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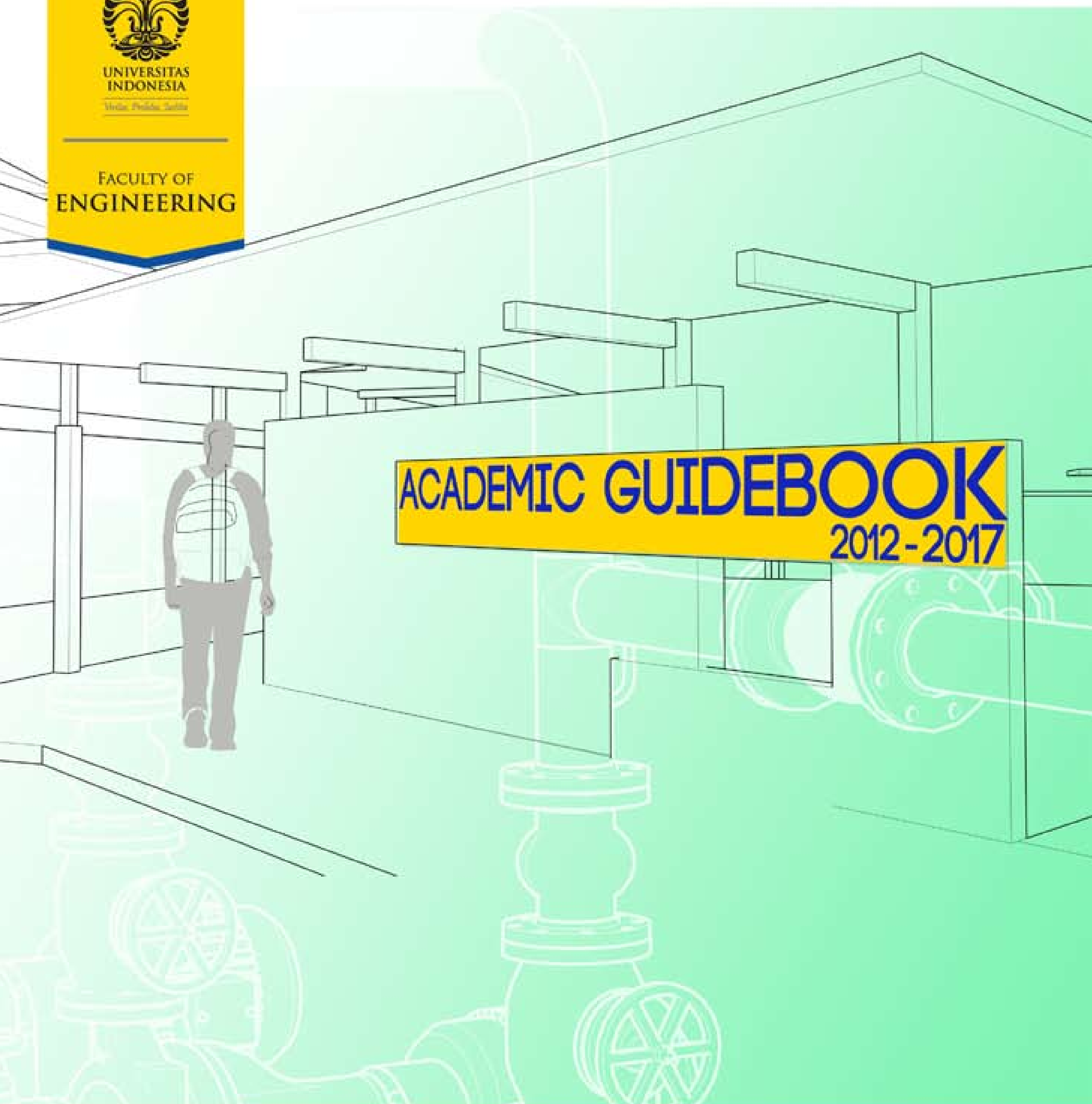

ACADEMIC GUIDEBOOK 2012 - 2017

2015 EDITION

ACADEMIC GUIDEBOOK

FACULTY OF ENGINEERING UNIVERSITAS INDONESIA

2012 - 2017

2015

Faculty of Engineering
Universitas Indonesia

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Welcome to FTUI

Welcome to FTUI !

On behalf of the Faculty of Engineering Universitas Indonesia, I would like to extend our warmest welcome to all students joining us this year. Our faculty is one of the largest faculties in the Universitas Indonesia and is proud to call our self as one of the leading education and research institution in Indonesia. With the support of our faculty members, we provide great learning and research environment for our students.

This 2015 Academic Guidebook is intended for all students of the Undergraduate Program (Regular, Parallel, International), Master Program and Doctor Program, to be used during their study at the Faculty of Engineering Universitas Indonesia. Curriculum, syllabus and academic staff are listed, as well as all support provided for you. The information contained within this book is also useful for those considering of continuing their study in engineering field at the Universitas Indonesia. Within the 2015 edition, we have made and included some corrections such as: the syllabus or subject description, updated list of teaching staff, updated information of reference books.

Within this guidebook, you will also find general information on FTUI and all of our Departments/ Study Programs, education system as well as the curriculum and syllabus of subjects taught at all of our Undergraduate, Master and Doctor Programs in our seven departments: Department of Civil Engineering, Department of Mechanical Engineering, Department of Electrical Engineering, Department of Metallurgy & Material Engineering, Department of Architecture, Department of Chemical Engineering, and Department of Industrial Engineering.

Lastly, I would like to convey my gratitude and appreciation to all faculty members which have helped with the compilation of this guidebook, especially the Vice Dean for Education, Research and Student Affairs; Vice Dean for Resources, Venture and Public Administration; Associate Dean for Education and Head of Faculty Adminstrative Center; Associate Dean for General Affairs and Facilities; Heads and Vice Heads of Departments; the committee and all informants. Let us move forward towards making Faculty of Engineering Universitas Indonesia as a leading engineering education institution which produces graduates with the competencies and attributes that are sufficient to be able to compete in the international community.

Depok, July 2015

Faculty of Engineering Universitas Indonesia
Dean,

Prof. Dr. Ir. Dedi Priadi, DEA

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CHAPTER 1

PROFILE OF FT UI AND DEPARTMENTS

1. PROFILE OF FTUI AND DEPARTMENTS

1.1. HISTORY OF FTUI

The history of the Faculty of Engineering, Universitas Indonesia (FTUI) began with an offer made from young engineers belonging to the Society of Engineers Indonesia (PII), to the first President of the Republic Indonesia, Bung Karno, for the renovations of the heavily damaged main streets of Jakarta. At that time Jakarta was preparing for the International Sports Event, the GANEFO. This bid was welcomed by President Soekarno. The young engineers were granted permission to start the renovations under the condition that all work must be completed within two weeks period. Headed by Ir. Bratanata, Ir. Roosseno, Ir. Sutami, and Ir. A.R. Soehoed, the project was completed on time.

After successful accomplishment of the street renovation project, these young engineers with their iron will felt that there was more that they could do to serve our country. But what? Then they thought of a brilliant idea: “Why not establish an engineering faculty in Jakarta as an alternative to the one in Bandung? This way those residing in the country’s capital would not need to travel far to Bandung for an engineering education”.

During the ceremonial event of Lenso dancing at the Pembangunan Building (formerly known as Pola Building) to welcome the GANEFO guests of honor, the young engineers brought their idea to President Soekarno to which he responded by inviting them to the Presidential Palace the next day. During the meeting in the Presidential Palace, the President wholeheartedly approved of the idea and even directly appointed Prof. Ir. Rooseno as the first Dean of the Faculty of Engineering. The President also instructed that the new Faculty of Engineering would be part of the University of Indonesia under the leadership of its Rector, dr. Syarief Thayeb.

The Establishment of Faculty of Engineering UI

Once dr. Syarief Thayeb served as the Minister of Higher Education and Science, he issued Decree No. 76 dated July 17, 1964 regarding the establishment of the Faculty of Engineering. Faculty of Engineering was officially established in Jakarta without any official ceremony or celebration, under the banner of the University of Indonesia as youngest faculty. And so the history of the Faculty of Engineering Universitas Indonesia began with the first three Study Programs with their respective Head of Study Programs: Ir. Sutami as Head of Civil Engineering Study Program, Ir. Ahmad Sayuti as Head of Mechanical Engineering Study Program and Ir. K. Hadinoto as Head of Electrical Engineering Study Program.

The Metallurgy and Architecture Study Programs were opened the following year with their respective Head of Study Programs: Dr.Ing. Purnomosidhi H. and Ir. Sunaryo S.. Ir. Roosseno as Dean was assisted by Ir. Sutami as Vice Dean for Academic Affairs, Ir. Slamet Bratanata as Vice Dean for Administration and Finance and Dr. Ing Purnomosidhi H. as Vice Dean for Student Affairs and Alumni. In its early acitivities in 1964, Faculty of Engineering UI was supported by 30 lecturers and 11 non-academic employees offering a 32 course subject curriculum. The first class of Faculty of Engineering UI consisted of 199 students. In five and a half years, 18 of them had successfully completed their study and graduated as certified Engineers.

In 1985, the study program Gas Engineering (originally under the Metallurgy Study Program) joined the study program Chemical Engineering (originally under the Mechanical Study Program) and formed the Gas and Petrochemical Engineering Study Program with its first Head of Study Program, Dr. Ir. H. Rachmantio. The Industrial Engineering Study Program, the youngest Study Program in Faculty of Engineering UI, was opened in 1999 with its first Head of Study Program, Ir. M. Dachyar, M.Sc. The term Study Program was later changed to Department and is still used today.

1.2. VISION AND MISSION OF FTUI

FTUI Vision

FTUI as a leading engineering education institution with the ability to compete in the international world.

FTUI Mission:

- Preparing its graduates to become lifelong learners, to be able to adapt to the working environment, and to acquire decent personalities and leadership qualities.
- To be center of excellence for education and research activities, to serve stakeholders' needs through facilitation of conducive academic environment.
- To be a leading institution with the initiatives that responds to local, national and global societal needs.

1.3. UI and FTUI Administration

UI

Rector:

Prof. Dr. Ir. Muhammad Anis. M. Met.

Deputy Rector for Academic and Student Affairs:

Prof. Dr. Bambang Wibawarta, S.S., M.A.

Deputy Rector for Finance, Logistic and Facilities:

Prof. Dr. Adi Zakaria Afiff

Deputy Rector for Research, and Innovation

Prof. Dr. rer. nat Rosari Saleh

Deputy Rector for for Human Resources, Development and Cooperation

Dr. Hamid Chalid, S.H., LL.M

FTUI

Dean of Engineering:

Prof. Dr. Ir. Dedi Priadi, DEA

Vice Dean I:

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Vice Dean II:

Dr. Ir. Hendri DS Budiono, M.Eng

Associate Dean for Academic and Head of Faculty Administration Center:

Dr. Ir. Wiwik Rahayu, DEA

Associate Dean for Research & Community Service

Prof. Dr. Ir. Akhmad Herman Yuwono, M.Phil.Eng

Associate Dean for Cooperation, Students Affairs, Alumni & Venture :

Prof. Dr. Heri Hermansyah, S.T., M.Eng.

Associate Dean for General Affairs & Facilities

Jos Istiyanto, S.T., M.T., Ph.D

Head of Academic Quality Assurance Unit

Prof. Ir. Mahmud Sudibandriyo, M.Sc., Ph.D

Head of Management System Assurance Development Unit

Dr. Ir. Rahmat Nurcahyo, M.Eng. Sc.

Departments

The following are list of Head of Department, and Vice Head of Department:

Civil Engineering:

Ir. Widjojo A. Prakoso, M.Sc., Ph.D

Mulia Orientilize, S.T., M.Eng

Mechanical Engineering:

Dr.-Ing. Ir. Nasruddin, M.Eng

Dr. Ario Sunar Baskoro, ST., MT., M.Eng

Electrical Engineering:

Ir. Gunawan Wibisono, M.Sc., Ph.D

Dr. Arief Udhiarto, S.T., M.T.

Metallurgy & Materials Engineering:

Dr. Ir. Sri Harjanto

Dr. Ir. Myrna Ariati Mochtar, M.S.

Architecture:

Prof. Yandi Andri Yatmo, S.T., M.Arch., Ph.D

Rini Suryantini, S.T., M.Sc

Chemical Engineering:

Prof. Ir. Sutrasno Kartohardjono, M.Sc., Ph.D

Dr. Ir. Nelson Saksono, M.T.

Industrial Engineering:

Dr. Akhmad Hidayatno, S.T., MBT.

Dr.-Ing. Amalia Suzianti, ST., M.Sc.

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Prof. Dr. Ir. Harry Sudibyo
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Prof. Dr. Ir. Rudy Setiabudy, DEA
Prof. Dr. Ir. Iwa Garniwa, MK., MT
Prof. Dr. Ir. Nji Raden Poespawati,MT
Prof. Dr. Ir. Riri Fitri Sari, M.Sc.MM
Prof. Dr. Benyamin Kusumoputro, M.Eng
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Prof. Dr.-Ing. Ir. Bambang Suharno
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Prof. Dr. Ir. Anondho W., M.Eng
Prof. Dr. Ir. Setijo Bismo, DEA
Prof. Dr. Ir. Slamet, M.T
Prof. Dr. Ir. T. Yuri M. Zagloel, M.Eng.Sc
Prof. Ir. Sutrasno Kartohardjono, M.Sc., Ph.D
Prof. Dr. Ir. Yusuf Latief, MT
Prof. Dr. Ir. Dedi Priadi, DEA
Prof. Dr. Ir. Harinaldi, M.Eng
Prof. Dr. Ir. Djoko M Hartono, SE., M.Eng
Prof. Dr. Ir. Muhammad Anis, M.Met
Prof. Ir. Isti Surjandari Prajitno, MT., MA., Ph.D
Prof. Dr. Ir. Danardono Agus S, DEA
Prof. Dr. Heri Hermansyah, S.T., M.Eng.
Prof. Dr. Ing. Ir. Misri Gozan, M.Tech.
Prof. Ir. Mahmud Sudibandriyo, M.Sc., Ph.D
Prof. Dr. Ir. Sigit P. Hadiwardoyo, DEA
Prof. Dr. Ir. Muhammad Idrus Alhamid
Prof. Dr. Ir. A. Herman Yuwono, M.Phil.Eng
Prof. Yandi A. Yatmo, S.T., M.Arch., Ph.D
Prof. Dr. Kemas Ridwan Kurniawan, ST., M.Sc
Prof. Dr. Ir Adi Surjosatyo, M.Eng

INTERNATIONAL ADJUNCT PROFESSOR

Prof. Dr. James-Holm Kennedy,University of Hawaii, USA.

Prof. Dr.-Ing. Axel Hunger, University of Duisburg, Germany.

Prof. Josaphat Tetuko Sri Sumantyo, PhD, Chiba University, Japan, Remote Sensing

Prof. Dr. Fumihiko Nishio, Chiba University, Japan, ICT

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Prof. L. P. Lighart (Emeritus), Delft University of Technology, Dutch

Prof. Dr. Koichi Ito (Printed Antenna, Small Antenna, Medical Application of Antenna, Evaluation of Mutual Influence between Human Body and Electromagnetic Radiations), Chiba University, Japan.

Prof. Dr. Uwe Lahl

Prof. Tae-Jo. Ko.

Prof. Michiharu Tabe, Research Institute of Electronics, Shizuoka University

Prof. Masaki Nagatsu, Shizuoka University

Prof. Hidenori Mimura, Shizuoka University

1.4. ACADEMIC PROGRAMS AT FTUI

FTUI consists of seven Departments and **twelve Undergraduate Study Programs**: (1) Civil Engineering, (2) Environmental Engineering, (3) Mechanical Engineering, (4) Marine Engineering, (5) Electrical Engineering, (6) Computer Engineering, (7) Metallurgy & Materials Engineering, (8) Architecture, (9) Interior Architecture, (10) Chemical Engineering, (11) Bioprocess Engineering, (12) Industrial Engineering; **seven Master Programs**: (1) Civil Engineering, (2) Mechanical Engineering, (3) Electrical Engineering, (4) Metallurgy and Material Engineering, (5) Architecture, (6) Chemical Engineering, (7) Industrial Engineering; and **seven Doctoral Programs**: (1) Civil Engineering, (2) Mechanical Engineering, (3) Electrical Engineering, (4) Metallurgy and Material Engineering, (5) Architecture, (6) Chemical Engineering, (7) Industrial Engineering; and **one Professional Program for Architect**

Accreditation of FTUI Academic Programs

The National Board of Accreditation for Higher Education (BAN-PT) has awarded the following accreditation level for all study program in the Faculty of Engineering: for Bachelor Programs: Civil Engineering (A), Mechanical Engineering (A), Electrical Engineering (A), Metallurgy & Material Engineering (A), Architecture (A), Chemical Engineering (A), Industrial Engineering (A), Naval Architecture & Marine Engineering (A), Computer Engineering (B), Environmental Engineering (B), Architecure Interior (A), Bioprocess Engineering (A).

Accreditation for Master Program is as follows: Civil Engineering (A), Mechanical Engineering (A), Electrical Engineering (A), Metallurgy and Materials Engineering (A), Architecture (A), Chemical Engineering (A) and Industrial Engineering (B).

Accreditation for Doctoral Program is as follows: Civil Engineering (A), Electrical Engineering (A), Metallurgy and Materials Engineering (A), Chemical Engineering (A), Mechanical Engineering is (A), while Architecture (B).

In 2008 & 2010, the Departments of Mechanical Engineering, Civil Engineering, Electrical Engineering, Metallurgy and Materials Engineering, Architecture and Chemical Engineering have been accredited by the Asean University Network (AUN); and also In 2013 Departments of Industrial Engineering have been accredited by the ASEAN University Network (AUN).

International Undergraduate Program (Double-Degree & Single Degree)

Since 1999, Faculty of Engineering has established an international undergraduate program in engineering (double-degree program) with the following renowned Australian higher education institutions: Queensland University of Technology (QUT), Monash University, Curtin University of Technology, The University of Queensland and The University of Sydney. Graduates from this international undergraduate program will be awarded a Bachelor of Engineering degree from our Australian University partner and a Sarjana Teknik degree from Faculty of Engineering UI when they return to FTUI and fulfill certain requirements. The double degree cooperation with QUT involves the study programs Civil Engineering, Mechanical Engineering, Electrical Engineering and Architecture. The double degree cooperation with Monash University involves the study programs Metallurgy & Material Engineering and Chemical Engineering. The double degree cooperation with Curtin University involves the study programs Chemical Engineering, Architecture, Metallurgy & Material Engineering and Electrical Engineering, with other study programs to follow. The double degree cooperation with the University of Queensland involves the study programs Mechanical Engineering, Electrical Engineering, Chemical Engineering and Metallurgy & Material Engineering. This international undergraduate program provides high quality engineering education in the international level. Since 2011, students will also have a choice to continue their final two years at FTUI as part of the newly opened Single Degree International Program.

1.5.1. DEPARTMENT OF CIVIL ENGINEERING

GENERAL

Civil engineering is the oldest engineering discipline and encompasses many specialties. Civil engineering can be described as the application of engineering to civil society. Civil engineers apply the principles of engineering to meeting society's fundamental needs for housing, transportation, sanitation, and the other necessities of a modern society. Civil engineers deal with the design, construction, and maintenance of the physical and naturally built environment, including works like roads, bridges, canals, dams, and buildings, as well as other challenges such as deteriorating infrastructures, complex environmental issues, outdated transportation systems, and natural disasters.

Civil engineering education is to prepare students to be master planners, designers, constructors, and managers of various civil engineering works. The graduates can work in all levels: in the public sector from municipal through to national governments, and in the private sector from individual homeowners through to international companies.

In the initial stage of development, Civil Engineering Department – FTUI offered one study program, Civil Engineering, with two majors, which are structural engineering and water resources engineering. Following the demand and development of science and technology, it was then expanded with four additional majors, i.e. transportation engineering, geotechnical engineering, sanitary engineering and construction management. With the improvement of human resources and facilities, Postgraduate Program for master degree (S2) and doctoral Degree (S3) were open in 1992 and 2001, respectively. In 2006, the Department added more specialized by opening undergraduate program of Environmental Engineering. Previously, Environmental Engineering is one of the majors in Civil Engineering. There are eight specializations for Master and Doctoral Program in Civil Engineering, they are: structural engineering, geotechnical engineering, water resources management, transportation engineering, construction management, environmental engineering, project management and infrastructure management.

The Environmental Engineering study program provide graduates with professional & competence in planning designing, constructing and managing environmental infrastructure for: drinking water treatment, liquid and solid waste management, drainage, environmental sanitation, water resources, air pollution, pollution prevention & environmental impact assesment.

The under graduate program of Civil Engineering was accredited internationally in 2001 by The Joint Board of Moderators of the Engineering Council consist of Institution of Structural Engineers (ISE), Institution of Civil Engineers (ICE), and Chartered Institution of Building Service Engineers of the United Kingdom. However, due to changes in their policy, re-accreditation could not be proceed. However, the Program is regularly accredited by national accreditation board, BAN-PT (Badan Akreditasi Nasional Pendidikan Tinggi) with score A. Both postgraduate program, Master and Doctor in Civil Engineering, also reach the same score. The undergraduate program of Environmental Engineering was nationally accredited in 2010. In 2008, undergraduate program of Civil Engineering was assessed by ASEAN University Network – Quality Assurance Program (AUN-QA). The Civil Engineering passed the assessment process.

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VISION , MISSIONS and OBJECTIVES OF CIVIL ENGINEERING DEPARTMENT - FTUI

VISION
To be a professional and globally recognized institution in civil engineering education and research, supported by a reliable management system.

MISSIONS

- To contribute to betterment of society through quality research and professional community services in civil engineering & environmental engineering with sustainability considerations.
- To ensure that the graduates have a mastery of fundamental knowledge, problem solving skills, engineering experimental abilities, and design capabilities in civil engineering and environmental engineering with understanding of sustainability and global considerations.
- To prepare graduates for leadership roles, having effective communication skills and professional ethics.

OBJECTIVES

A. Objectives in education is along the lines of the objectives of study programs.

B. Objectives in research are:

1. to contribute to advancement of science and technology.
2. to improve the relevance of the learning process towards the development of current science.

C. Objectives in community service are :

1. to contribute to Indonesia national development.
2. to contribute to betterment of society through quality professional and community services.

STAFFS OF THE DEPARTMENT OF CIVIL ENGINEERING

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Vice Head of Department:
Mulia Orientilize, ST, MEng

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Head of Environmental Engineering Program:
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Head of Hydraulics, Hydrology and River Laboratory:
Ir. Siti Murniningsih, MS

Head of Transportation Laboratory:
Dr. Ir. Tri Tjahjono

Head of Mapping and Surveying Laboratory:
Ir. Alan Marino, MSc

Head of Sanitation & Environment Laboratory:
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1.5.2. DEPARTMENT OF MECHANICAL ENGINEERING

GENERAL

The Department of Mechanical Engineering, previously known as Mechanical Engineering Study Program. The department was established together with the launch of the faculty of engineering Universitas Indonesia in November 27, 1964 at Salemba, Jakarta. Nowadays there are 2 study programs within the department, which are: Mechanical Engineering Study Program and Marine Engineering Study Program. The mechanical engineering study program provides the knowledge which focused into Energy Conversion, Product Design, Manufacturing Process and also the basic of Industrial operational and managerial. The Marine Engineering study program provide the education which focused into Ship design, Ship manufacturing process, ship maintenance, ship machinery installation and also the rules and laws of marine. The graduates of the mechanical engineering have worked in several areas such as automotive industry, oil and gas industry, heavy duty engine, educational institution, research institution and other industries. The department of mechanical engineering organized several programs, which are: Bachelor Degree (Regular, Parallel, and International class) Master Degree and Doctoral Degree. Since August 2007, the department of mechanical engineering received the ISO 9001: 2000 for quality management system in Mechanical Engineering Study Program. In 2011, The Department of Mechanical Engineering once again received the ISO 9001: 1008 for quality management system. Certification by international agencies is one of management's commitments in quality management, to ensure and enhance academic quality and stakeholder satisfaction. The mechanical engineering study program also received the highest academic accreditation point according to the National Accreditation Board in 2005. In 2008, the Department of Mechanical Engineering has also gained international recognition in the form of accreditation of the ASEAN University Network (AUN). This again shows the commitment the Department of Mechanical Engineering to develop international education and excel in their fields, as stated by the firm through the vision, mission and goals.

Developing nations are very dependent of human resource development. Resource is people who set the direction, goals, implement and develop the nation's life. With good human resources are expected to achieve the life of prosperous and affluent nations. Therefore, the developments of human resources become the key of national development. Higher education in Indonesia is part of the National Education System which aims to develop the intellectual life of the nation through the development of human resources to carry out three main activities of the so-called "Tridharma Universities", namely :

1. Hold a higher level education
2. Conduct the scientific research
3. Perform the Community service

In order to develop human resources for the life of the nation, the Department of Mechanical Engineering has set a goal of three main activities is to be a reference to any academic activity. In education, has a goal to produce graduates who are able to analyze and synthesize the characteristics of mechanical systems, designing and planning systems and mechanical equipment as well as managing the production installation, and be able to analyze and solve any scientific problem, work together in teams, and develop themselves and their knowledge, with a lofty intellectual attitude, pattern of systematic thinking, logical and integrated. In the field of research, Department of Mechanical Engineering has a goal to contribute and play a role in the development of mechanical science and technology and a continuous intake of the educational process. While the field of devotion and service to the community, aims to provide ideas and direct involvement in quality improvement and enhancement of community and industry.

To answer the demand of graduate academic programs that have the character of leadership and excellence in academic and professionalism in the field of Mechanical Engineering, both at the level of Bachelor, Master, or PhD, the Department of Mechanical Engineering, developed the design of competency-based academic curriculum is implemented through the student centered teaching activity(student centered learning). According to the degree, in the curriculum design the research activity become the major aspect in the Doctoral Degree.

In the 2012 curriculum design, the integration of the design between bachelor degree, master degree and doctoral degree curriculum has been pursued, so it is possible for a student with an excellent academic record to take courses from a higher degree (Master and Doctoral) by using the credit transfer regulation through the Fast Track Program.

A more detailed explanation of each of the courses organized by The Mechanical Engineering and Marine Engineering Study Program, the description of the main academic competence, and other supporters of the graduates of each program of study, are given in the following section.

Contact

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VISION AND MISSION OF THE DEPARTMENT OF MECHANICAL ENGINEERING

Vision

"Become the center of the excellent research and education service in Mechanical Engineering"

Mission

Conduct research and research-based education for the development of science and technology in the field of mechanical engineering, and conducts research and education efforts and its use to improve the quality of life and humanity.

Head of Department :
Dr.-Ing. Ir. Nasruddin, M.Eng
Vice Head of Department:
Dr. Ario Sunar Baskoro, ST., MT., M.Eng

Head of Laboratory
Head of Mechanical and Biomechanic Design Laboratory :
Dr. Ir. Wahyu Nirbito, MSME.
Head of Mechanical Technology Laboratory
Prof. Dr. Ir. Danardono A.S., DEA, PE
Head of Thermodynamics Laboratory:
Prof. Dr. Ir. Yulianto S. Nugroho, MSc, PhD.
Head of Heat Transfer Laboratory :
Dr. Ir. Engkos A. Kosasih, MT
Head of Fluid Mechanics Laboratory :
Dr. Ir. Warjito, M.Eng.
Head of Manufacture and Otomatization Laboratory:
Dr. Ario Sunar Baskoro, ST., MT., M.Eng
Head of Air-conditioning Engineering Laboratory:
Prof. Dr. Ir. M. Idrus Alhamid
Head of Ship Design Laboratory:
Prof. Dr. Ir. Yanuar, M.Eng. MSc.
Head of Science Group- Kelompok Ilmu (KI)
Head of KI. Energy Conversion :
Prof. Dr. Ir. M. Idrus Alhamid
Head of KI. Design, Macufacture and Otomatization:
Dr. Ir. Gandjar Kiswanto, MEng.

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PART-TIME FACULTY

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1.5.2. DEPARTMENT OF ELECTRICAL ENGINEERING

GENERAL

The Department of Electrical Engineering, Faculty of Engineering, Universitas Indonesia was established at the same time with the establishment of Faculty of Engineering on July 17th, 1964. Eventhough the classes had been started since October 17th, 1964. At the beginning of the establishment, the Department of Electrical Engineering was named as “Jurusan Listrik” consisted of two fields of studies: Electrical Power and Electronics & Telecommunication. Since 1984, “Jurusan Listrik” has been changed to “Jurusan Elektro”, which has been named again as The Department of Electrical Engineering in 2004. There are five streams available in this department, namely: (1) Electrical Power Engineering, (2) Control Engineering, (3) Computer Engineering, (4) Electronics Engineering, (5) Telecommunication Engineering. Since 2006, computer engineering stream became a new study program: Computer Engineering Study Program (CESP) in the Department.

THE OBJECTIVE OF EDUCATION

The objective of the Electrical Engineering bachelor education in this globalization area is to be able to analyze engineering problems, propose a logical engineering solution, both systematically and practically, supported by the right and proper method. The students are also required to have capabilities in designing and developing software and hardware, and always improved to new technology in electrical engineering.

VISION AND MISSION

The department has the vision to become a high standard of excellence in education and research in the field of electrical engineering. In order to achieve such vision, the department has defined its mission to produce Electrical Engineering graduates who are able to compete beyond the national labor market. The graduates will be capable to respond to the vast growing engineering technology development though the support of excellent educational process, excellent management and organization, international standard of competence of the teaching staff and international reputation in specific research activities.

THE TARGETS

To achieve high quality and internationally standardized education and research, with:

1. Providing education and research collaboration with other universities, research agencies, and institutions, either local or overseas.
2. Providing high quality and accountability in management and organization.
3. Providing funding resources, which are sufficient to achieve the targets in points 1) and 2) above, by conducting researches, consultations, trainings and other business activities.

THE GOALS

The undergraduate program of the Department of Electrical Engineering is aimed to achieve graduates capable of designing in the field of electrical engineering based on professional ethics according to advancement of technology.

ELECTRICAL ENGINEERING STAFFS

Head of Department:

Ir. Gunawan Wibisono, M.Sc., Ph.D

Vice Head of Department:

Dr. Eng. Arief Udhiarto, ST., MT

Head of High Voltage and Electrical Measurement Laboratory:

Ir. Amien Rahardjo, MT.

Head of Electrical Power Conversion Laboratory:

Ir. I Made Ardita, MT.

Head of Electrical Power System Laboratory:

Prof. Dr. Ir. Rudy Setiabudy

Head of Electronics Laboratory:

Dr. Agus Santoso Tamsir, MT

Head of Control Laboratory:

Dr. Ir. Feri Yusivar, M.Eng.

Head of Digital Laboratory:

Prima Dewi Purnamasari, ST., MT., M.Sc.

Head of Telecommunication Laboratory:

Dr. Fitri Yuli Zulkifli, M.Sc

Head of Optoelectronics Laboratory:

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Prof. Dr.-Ing. Axel Hunger, axel.hunger@uni-due.de (Adaptive e-Learning, adaptive instructional systems, e-course and its applications, pedagogical analyses of on-line course), University of Duisburg Essen, Germany.

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1.5.4. DEPARTMENT OF METALLURGY AND MATERIALS ENGINEERING

GENERAL

Department of Metallurgy was originally established as a study program under Faculty of Engineering, Universitas Indonesia in 1965. Due to the lack of qualified lecturers and infrastructure, the first academic activity was only attended by 25 students. For almost 6 years since 1969, the department had stopped accepting new students and focusing the activity to the existing students. In 1975, the department began to accept students again, and in the same year produced the first 7 graduates. Ever since, the department kept continuing and developing its academic activities.

As the science and technology progresses, especially for the engineering materials-based industries, also considering the availability of resources within the department, Department of Metallurgy consolidated its resources and studied the need to add “materials” to the name. Following the idea, on November 5th 2002, Rector of Universitas Indonesia then decreed Department of Metallurgy and Materials Engineering as one of the departments within the Faculty of Engineering.

The curriculum in Metallurgy and Materials Engineering is structured to address problems associated with the metallurgy and design of materials and materials processing to meet the specific needs for a variety of industries. Emphasis is on the basic sciences and principles of engineering with applications of these principles to metallurgy and materials behaviors. The students must obtain a broad foundation in chemistry, physics, and mathematics, which is applied in engineering courses. Within metallurgy and materials engineering courses, students obtain a foundation in the major areas of metallurgy and materials science and to the major classes of engineering materials, which is applied in courses in materials properties and selection, computational methods and in capstone design course. Students gain in-depth experience in another engineering discipline through coordinated technical elective sequences.

In 2011, the department has totally graduated almost 2000 graduates with a degree in bachelor of engineering, 81 graduates with a degree in master of engineering, and 11 graduates with a doctoral degree. At the beginning of first semester of 2011/2012, the department has actively 426 undergraduate students, 71 master students, and 24 doctoral students. Considering the high demand to produce qualified graduates and following current trends toward the global competition, Department of Metallurgy and Materials Engineering is committed to continuously improve its academic activities including teaching and learning process as well as research activities. As a part of national education system, which has the objective to develop the intellectual life of the nation through human resources development by conducting three main activities known as tridharma ("three duties"), the department is also committed to carry out higher level educations, to conduct scientific research, and to provide community services.

During its development stage, the Department of Metallurgy and Materials Engineering has achieved several milestones, such as:

- Grade A Accreditation for Undergraduate Program from National Accreditation Board, Ministry of National Education (Year 2013 and 2018).
- Establishment of master (1995) and doctoral (2008) programs.
- Grade B Accreditation for Master Program from National Accreditation Board, Ministry of National Education (up to 2013)
- Grade A Accreditation for Doctoral Program from National Accreditation Board, Ministry of National Education (Year 2012 - 2017)
- Establishment of "Dual-degree" International Program with Monash University (2003).
- Grant awards from the Government of Republic Indonesia for:
    - o Internal Improvement for non-metallic field competence - PHK-A4 (2004)
    - o Improvement for external and regional competence – PHK-A2 (2004-2006)
    - o Internationalization of academic and research activities in information technology, energy and nonmaterial – PHKI (2010-2013)
- Establishment of Center for Materials Processings and Failure Analysis (CMPFA), a venture unit to support the materials engineering community and industry (2001).
- Intensive academic and research collaborations with international institutions, such as Monash University (Australia), Kagoshima University (Japan), Nanyang Technological University (Singapore), Yeungnam University and KITECH (Korea) (since 2006).
- Materials Testing Laboratory was accredited ISO 17025 (2011)

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VISION AND MISSION OF THE DEPARTMENT OF METALLURGY & MATERIALS ENGINEERING

Vision

In line with the vision and mission of Universitas Indonesia and Faculty of Engineering, the vision of the Department of Metallurgy and Materials Engineering is *to become a metallurgy and materials engineering center of excellence in education, research, and community service.*

Mission

To achieve such a vision, Department of Metallurgy and Materials Engineering put its mission: *to produce high quality graduates with strong academic basis and a comprehensive ability in metallurgy and materials engineering and technological processes and are capable of playing an active and dynamic roles in national, regional, and international community.*

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Dr. Ir. Sri Harjanto

Vice Head of Department

Dr. Ir. Myrna Ariati, MS

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Dr. Ir. Rini Riastuti, M.Sc.

Head of Physical Metallurgy Laboratory:
Dr. Ir. Winarto, M.Sc (Eng)

Head of Mechanical Metallurgy Laboratory:
Ir. Bambang Priyono, MT

Head of Processing Metallurgy Laboratory:
Ir. Dwi Marta Nurjaya, MT

Head of Metallography & Heat Treatment Laboratory:
Dr. Ir. Yunita Sadeli, M.Sc

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STUDY PROGRAM

Department of Metallurgy & Materials Engineering manages the course program as follows:

- Under-graduate Program (S1 Program) of Metallurgy & Materials Engineering.
- Magister Program (S2 Program) of Metallurgy & Materials Engineering
- Doctoral Program (S3 Program) of Metallurgy & Materials Engineering

1.5.5. DEPARTMENT OF ARCHITECTURE

GENERAL

Department of Architecture Universitas Indonesia (formerly known as the Architectural Engineering Major) was established in Jakarta in 1965 as part of the Faculty of Engineering Universitas Indonesia (FTUI). A year after this FTUI was founded by Presidential Decree No. 76 on July 17, 1964. Since its inception, Architectural Education at FTUI was conducted as a full professional education degree program for a duration of 5-7 years. The average completion time was 7 years for an Engineering (Ir.) degree. In 1978, the Ministry of Education introduced Credit Semester Units (CSU, widely known as Sistem Kredit Semester or SKS) and the Engineering (Ir.) degree, including the one for the Architecture Major requires 160 CSUs. The average duration of the study was for five years, and the title was Engineer (Professional Degree). Since 1996, the four-year bachelor program was implemented which requires 144 CSUs to complete, with the degree of Bachelor of Engineering (Sarjana Teknik). In the same year, after 31 years of existence, the Architecture Program

of Study at UI received its decree from the Directorate General for Higher Education No. 215/DIKTI/KEP/1996 dated July 11, 1996.
In 2000, the Department of Architecture streamlined the curriculum by implementing the 2000 Curriculum (a streamlined version of the 1996 Curriculum) along with the application of Problem-based Learning Method (PBL), Collaborative and Student-Centered Learning (SCL). The 2000 Curriculum established more clearly that the direction for our program is pre-professional, and not a professional one.
The Department of Architecture opened the Masters of Architecture program in 2001 with 2 specializations in the fields of Architectural Design and Urban Design. Over the years, the Masters program added 4 more specializations: Urban Housing and Settlements, Real Estate, History and Theories of Architecture and Urbanism, and Building Technology. At this time, through the new curriculum (2012 Curriculum), the six specializations were grouped into three which are:

- Creative Process: Architectural Design, Urban Design, Property
- Humanities : History and Theories of Architecture, Urban Housing and Settlements
- Technology and Sustainability : Building Technology

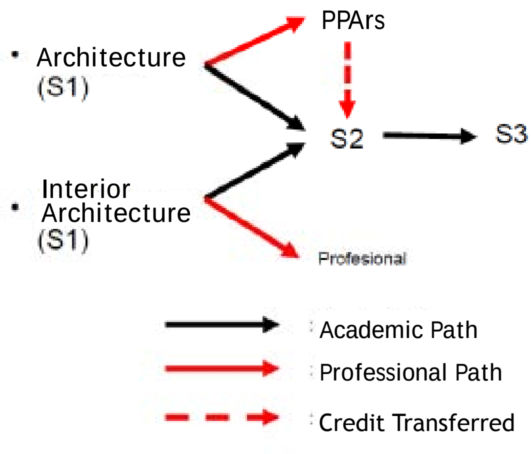
In 2004, the name of the Architecture Major changed to the Department of Architecture. The degree for its graduates was also changed from Sarjana Teknik (ST) to Sarjana Arsitektur (S.Ars) for the Bachelor and Masters of Architecture (M.Ars) for the Masters program.

Over the last 12 years, the Architecture Department at FTUI has always reviewed and improved its curricula. The 2012 Curriculum focuses on four main points:

1. Refers to the Competence Based National Education System (KBK/Kurikulum Berbasis Kompetensi);
2. Flexibility to correspond with the advancement of science and technology;
3. A curriculum structure that is market-oriented to fulfill the demands of professionals within the national and also at the international level;
4. The core material of the curriculum refers to the development of curriculum in Indonesia towards the Professional Program (in collaboration with Indonesian Institute of Architects (IAI) and the international standards of the Union Internationale des Architectes (UIA).

In 2008 the Department of Architecture established the Undergraduate Program in Interior Architecture. The program emphasizes interiority in architecture.

In 2009, the Department of Architecture opened a Ph.D program and a one-year Architectural Professional Program (Program Pendidikan Profesi Arsitek/PPArs). The Ph.D program is intended to strengthen the Department of Architecture as one of the leading architectural research-based institutions. Ph.D students' research are focused in two areas: (1) Major research areas (research based on architectural issues) and (2) Minor research areas (related to a specialized area of study). In the minor research areas, Ph.D students have the opportunity to take courses outside the discipline of Architecture, to gain knowledge, thoughts, and methods, in order to support their research in an Architectural major.
One year PPArs produce graduates who are ready to enter the world of professional practice in architecture. Graduates of PPArs could apply for credit transfers when pursuing a Masters degree at UI.



Department of Architecture also has an International Program (KKI): (1) Single degree undergraduate (8 semesters at UI), or in the form of double degree (4 semesters at UI + 4 semesters abroad) in collaboration with leading universities abroad. In addition, S1 students who have superior academic achievement are able to get into a three-year Fast-Track pro-

gram (Bachelor) + 2 years (Masters), a total of 5 years, to get a Masters of Architecture at UI or partner universities abroad.
The Undergraduate and Masters programs in the Department of Architecture UI have received accreditation from the Higher Education BAN with a score of A (Very Good). In addition, the Bachelor Department of Architecture program has received its 'Assessment' from the ASEAN University Network (AUN) in 2010. More profiles of FTUI Department of Architecture can be viewed virtually at the website: http://architecture.ui.ac.id.

VISION AND MISION OF DEPARTMENT OF ARCHITECTURE - FTUI

VISION
To become an excellent educational institution in architecture and interior architecture in the region

MISSION
Establishing education in architecture and interior architecture in order to develop an excellent quality of architectural knowledge and beneficial expertise for society.

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(ST, Architecture Universitas Indonesia; MA, London Metropolitan University, UK). Interior Design

Widyarko
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1.5.6. DEPARTMENT OF CHEMICAL ENGINEERING

GENERAL

The main mission of the Chemical Engineering Department is to provide the highest quality education so that graduates have the necessary knowledge, skills, and experience conducting research with current topics in the field of chemical engineering and biochemical engineering. Starting from the opening of the Gas Engineering Program and Chemical Engineering Program in 1981, Chemical Engineering Department at UI is now one of the leading chemical engineering departments in Indonesia having excellent accreditation from National Accreditation Board of Indonesia (BAN) and the ASEAN University Network (AUN). Chemical Engineering Department has two study programs, Chemical Engineering (PSTK) and Bioprocess Technology (PSTB), 30 permanent academic staff and about 800 undergraduate and graduate students. In order to enhance the role of the department in the era of biotechnology and life sciences, PSTB was opened in 2008.

Chemical engineering department offers five academic programs: undergraduate program (regular, parallel, international), master program (regular and gas management at Salemba campus), and doctoral program. The chemical engineering department has been adhering to competency-based principles starting in curriculum 2000 up to the recently updated curriculum 2012. The present graduate competencies are based on those recommended by ABET and the Bologna Process and on feedbacks from graduates and industry representatives, aiming at producing graduates who are educated and able to contribute effectively to their communities wherever they choose to live and work. The chemical engineering department is conducting international classes in collaboration with three Australian universities: Monash University, Curtin University and University of Queensland. Students in this international class spend their first four semesters at UI, and spend the subsequent four semesters in Australia. At the end of their study, students will get a Sarjana Teknik degree from UI and a Bachelor of Engineering degree from the partner university. Since 2011, international program students may choose to enroll in a single-degree program at UI following a curriculum that is equivalent to the regular undergraduate curriculum. The department also has established double degree master programs with National Taiwan University of Science and Technology (NTUST) and Curtin University. In this double degree programs, students spend their first year at UI and the second year at NTUST or Curtin University. At the completion of their studies, students will be awarded a Master of Engineering degree from NTUST or Curtin University.

The updated curriculum is now more streamlined and integrated allowing students to take elective courses previously only available in a study program (PSTK or PSTB) or available for a certain level (undergraduate or graduate). It means that students could choose courses that are more suitable to their interest. For those who qualify, there is a fast-track program that allows undergraduate students to obtain both bachelor and master degrees in ten semesters instead of in twelve semesters. Chemical engineering master's program has also prepared a special curriculum for those without an educational background not in chemical engineering. By adopting this special curriculum, applicants with a non-chemical engineering degree are recommended to take the chemical engineering undergraduate core courses to master the fundamentals of chemical engineering before taking more advanced core graduate courses. Graduates of doctoral programs are expected to contribute to the development of science by conducting independent research, usually under supervision of a qualified professor.

Chemical engineering department as one of the departments in the Faculty of Engineering, University of Indonesia has taken part in a research effort with the theme "Sustainable chemical and bioengineering for energy and product development". This research theme is supported by four research groups: chemical and natural product design, sustainable energy, industrial bioprocess technology, and process intensification. Research activities conducted at the Chemical engineering department has received a lot of government funding to support the research activities of students.

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VISION, MISION AND OBJECTIVES OF CHEMICAL ENGINEERING DEPARTMENT - FTUI

Vision

"*To become a world class Chemical Engineering Department as center of excellence for education and research in chemical engineering.* "

Mision

The Department seeks to provide the best quality of undergraduate and postgraduate education. The Department will provide a broad-based education and design experience, enabling students to address chemical engineering problems. Furthermore, the Department will provide students with fundamental elements to develop in the profession in response to rapidly changing technology and societal needs and expectations, and, will also develop important soft skills such as problem solving, communication, and group skills.

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Vice Head of Department
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Head of Bioprocess Engineering Study Program
Dr. Dianursanti, ST., MT

Head of Laboratory

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Prof. Dr. Ir. Mohammad Nasikin, M.Eng

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Prof. Dr. Ir. Setijo Bismo, DEA

Head of Sustainable Energy Laboratory
Dr. Ir. Asep Handaya Saputra, M.Eng

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Ir. Rita Arbianti, M.Si

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PART-TIME FACULTY

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1.5.7. DEPARTMENT OF INDUSTRIAL ENGINEERING

GENERAL

Industrial Engineering Education is an answer to a growing need of industrial engineers who have the capabilities of managing production or operations process efficiently and effectively to achieve excellence. Industrial Engineers should be one of the backbones for transforming our national industry to be more competitive and contribute to our nation's welfare. The scope of the term industry is for both service and manufacturing industry.

Industrial Engineering Program was actually formed in the mid 1970s as a part of Mechanical Engineering Department, due to the market needs for a specialized mechanical engineers which defines the current definition of industrial engineers. In 1998, based on Decree by Higher Education Director No 207/DIKTI/Kep/1998 dated June 30 1998, the Industrial Engineering Department was born. With the new status as department, the program had more autonomy and opportunity to enhance the Industrial Engineering Discipline in Indonesia.

After 10 years as an independent Department, Industrial Engineering has been recognized by the national public and industry as one of the forefronts industrial engineering education in Indonesia. This is shown by the high demand and acceptability of our graduates. Today, our graduates have been accepted not only in the manufacturing industry but also service industry such as governments, hospital, financial service, consulting, information technology and many others. In the manufacturing area, we have graduates in charge of production or operations management, human resource development, maintenance, inventory and logistics, and many more.

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VISION AND MISSION OF THE DEPARTMENT OF INDUSTRIAL ENGINEERING

Vision

" To be a premier industrial engineering higher education institution with good national and international reputation in providing high quality graduates and researches."

Mission

- Establishing education to provide high quality graduates accepted by national and international industry
- Fostering researches to answer the needs of national industry
- Harnessing the knowledge of industrial engineering for the welfare of the society

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Head of Laboratory

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Head of Human Factors Laboratory:
Ir. Boy Nurtjahyo, MSIE

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CHAPTER 2
ACADEMIC SYSTEM AND REGULATION

2. ACADEMIC SYSTEM AND REGULATION

The educational system in the Faculty of Engineering, Universitas Indonesia refers to the prevailing system of education at Universitas Indonesia.

2.1. GENERAL

Teaching and Learning Activities

One semester is the time of the activity consisting of 16-18 weeks of lectures or other scheduled activities, including various additional activities such 2-3 week assessment activities. These teaching and learning activities are in form of lecture, lab, studio, exams, quizzes, assignments, presentations, seminars, research, practical work, industrial visits, and a thesis.

Semester Credits Units (SKS)

Education in the Faculty of Engineering, Universitas Indonesia is held in a variety of ways such as lectures, assignments (ex: calculation tasks, planning, design), practical work, seminars, lab, studio, and research for thesis writing. All educational activities that must be undertaken by each student to earn a bachelor's degree are contained within the academic loads and measured in units of semester credit (SKS).

One SKS of an academic activity in the form of lectures or seminars is equivalent to student's effort in a minimum of three hours a week for one semester, consisting of 50 minutes scheduled academic interaction, 1-2 hours of structured activities such as responsiveness or problem solving, and 1-2 hours of independent activities such as reading reference books. Activities for one semester consist of 16-18 weeks of lectures or other scheduled activities and its additional activities. Also included in the schedule are two weeks of midterm examination and another two weeks for final examination.

All educational activities must be performed by each student to earn a bachelor's degree is an academic load of 144-145 credits divided into 8 (eight) semesters. Undergraduate students with an average study load of about 18-20 credits per semester are expected to undergo a week of minimal 18 -20 hours of scheduled interaction with a lecturer, 18-20 hours of structured activities, and 18-20 hours of independent learning activities.

Subjects

Subjects in the FTUI's undergraduate curriculum are grouped into University General Subjects (12,5%), Basic Engineering Subjects (15-20%), Basic Skills Subjects (30-35%), Core Subjects (35-40%). Subjects can be categorized as compulsory subjects and electives. They can be taken across departments or across faculties.

Grade Point Average

Grade Point Average or GPA is used to evaluate students' performance either for a particular semester in term of Indeks Prestasi Semester (IPS) or Semester Performance Index, or, cumulatively for all of the semester up to the most recent one in term of Indeks Prestasi Kumulatif (IPK) or GPA. The formula used to calculate either IPS or IPK is as follows:

$$\textbf{GPA} = \left(\frac{\sum_{\text{courses}} \text{(Grade Point Value x Semester Credit Unit)}}{\sum_{\text{courses}} \text{Semester Credit Unit}} \right)$$

with the summation applied to all subjects which are taken by students.

Semester Performance Index / Indeks Prestasi Semester (IPS)

Achievement Index that takes into account all of the subjects for a certain semester is called the Semester Performance Index (IPS) and used to determine the maximum academic load that the student may take in the upcoming semesters.

Grade Point Average (GPA/IPK)

If the calculation involves the entire grade point value of subjects taken during the educational program period, the result of the summation is a Grade Point Average (GPA) that is used as a basis for study evaluation. Courses taken into account are the ones listed in the Study Plan Form (FRS). GPA is obtained from the summation of all subjects having a grade of C or higher.

Academic Performance Evaluation

Assessment of academic ability is performed on an ongoing basis by assigning tasks, homework, quizzes, or exams which are given throughout the semester. For each subject, there are at least two components of assessment which may include a midterm exam (UTS) and a final exam (UAS). A student will be assessed on his academic ability if he meets the following requirements:

- The courses taken have been registered and verified by Academic Advisor during the academic registration period.
- The student has fulfilled all of the administrative and academic requirements for the ongoing semester.
- The student has completed all of the required academic assignments.

Grades

At the end of each semester, students may download Semester Grade Record as a report on their academic performance from SIAK NG. Assessment of study efficacy is carried out using letters and academic load in accordance with Table 2.1.

Table 2.1. Grade Value and Points

Grade Value	Marks	Grade Point
A	85 - 100	4,00
A-	80 - < 85	3,70
B+	75 - < 80	3,30
B	70 - < 75	3,00
B-	65 - < 70	2,70
C+	60 - < 65	2,30
C	55 - < 60	2,00
D	40 - < 55	1,00
E	0 - < 40	0,00

The highest grade is A with grade point of 4.00 and the minimum passing grade of a course is C with grade point of 2.00. The instructor may assign the 'Incomplete' (I) grade if the student has not made a reasonable attempt to complete major session assignments, laboratory projects and the lecturer has made a reasonable effort to inform the student as early as possible that an important part of session work is incomplete. The 'I" mark should be changed to other grade within 1 month, otherwise, it will be automatically changed to 'E' grade. The "T" mark is given for no attendance in exam. The "BS" mark is given for Special Lecture (such as Internship, Seminar & Final Project) that has not been completed. These BS courses are not taken into account in the calculation of Semester Study Unit, IPS and GPA.

Length of Study and Academic Load

Undergraduate Program

The academic load a student can take is determined by the Academic Counselor based on the previous Semester Performance Index (IPS) as stated in the Study Plan Form (FRS). Students must take the entire allocated credits of the entire courses in the first semester. As for the second semester, these following rules apply:

1. For students obtaining an IPS of 2.00 or less, they must take all credits load allocated for the second semester according to the structure of the applicable curriculum.
2. For students obtaining an IPS of 2.00 or more, the maximum credits that can be taken follow that of the provisions in the Maximum Credit Load Table.

From the third semester onwards, the maximum credit loads that may be taken is determined by IPS of the previous semester and follow provisions in Maximum Credit Load as shown in Table 2.2 with respect to course prerequisites (if any). If necessary, Academic Counselor (PA) can add a maximum of 2 credits more than the provision in the Table through the approval of the Vice Dean.

Table 2.2. Maximum study load in a semester for undergraduate program

IPS	Maximum SKS
< 2,00	12
2,00 – 2,49	15
2,50 – 2,99	18
3,00 – 3,49	21
3,50 - 4,00	24

Master Program

Academic load in the FTUI's Master Program curriculum is 40-44 credits after finishing the undergraduate program. The scheduled length of study is four semesters and in the implementation, the Master program can be completed in at least two semesters and a maximum of six semesters. Academic Load for each semester is set by the Academic counselor (PA) based on the IPS of the last semester as stated in the Semester Grade list (DNS). Provisions on the academic load are as follows:

- A semester's academic load is registered by a student as he carries out online registration according to the pre-determined schedule. Students are required to take all subjects as allocated in the first semester curriculum.
- For students with less than a 2,5 IPS, a provision stating that the number of credits taken for the following semester does not exceed 9 is applicable.
- The maximum number of credits that can be taken on Master Program is 18 credits per semester
- Exemption from the provisions of academic load should be with the permission of the Vice Dean.

Doctoral Program

Academic load in the FTUI's Doctoral Program curriculum is 48-52 credits after finishing the Master Program, including 40 credits of research activities. A semester's academic load is registered by the student through online academic registration during a pre-determined schedule. New students are required to take all subjects as allocated in the curriculum for the first and second semesters. Students must re-take research courses with a BS grade from previous semesters. Student's Academic Load for each semester is established by the Academic Advisor (PA) or the doctorate Promoter based on a discussion with the student from the doctoral program.

The length of doctoral program for all scheduled courses is 6 (six) semesters and in its implementation can be completed in at least five semesters and maximum of 10 (ten) semesters.

Seminar

Seminar for Undergraduate Program

Seminar is a scientific meeting to discuss an issue under supervision of a supervisor. Students are expected to systematically communicate their scientific papers both orally and in writing. Evaluation and assessment are carried out by the end of the activity. Students should follow the regulation for seminar set up by each department.

Seminar for Master Program

The seminar is the result of early research activities as a student's thesis pre-proposal. Students are allowed to start the Seminar if:

- The seminar has been Registered in Study Plan Form [FRS] in every semester
- The student have fulfilled the requirements to take the seminar courses as stated by the Department.
- The Head of the Department has determined a lecturer to act as the student's seminar counselor

Completed seminar assignment that has met the academic requirements will be submitted to be examined in a seminar examination session in front of a committee appointed by the Head of the Department. The committee consists of the Committee Chairman of the seminar with a minimum of three examiners and a maximum of five examiners including the supervisor. The person responsible for the Implementation of the Seminar is the Seminar Coordinator in each department.

Undergraduate Thesis / Final Project

Undergraduate Thesis is mandatory course for undergraduate students of Faculty of Engineering UI. The course is the application of science that has been obtained in accordance with the basic scientific disciplines that the student has studied, in the form of scientific paper, engineering design, assembly or models and accessories. Undergraduate thesis is mandatory to complete the requirements in order to earn a degree in the field of engineering. Undergraduate Thesis status is equivalent to other skill courses is tailored in accordance with the scope of each study program. Undergraduate Thesis must meet certain requirements, both academic and administrative requirements. Students are allowed to start composing undergraduate thesis if:

- The Undergraduate Thesis has been registered in the Study Plan Form [FRS]
- Students have obtained a minimum of 120 credits with a minimum of grade of C and have passed all mandatory courses both in the faculty and university level.
- Students have fulfilled all prerequisites set by the Study Program.

Undergraduate Thesis can be taken in both odd and even semester in the running academic year. On SIAK NG system, student must fill out the name of his thesis supervisor and the title of thesis which will be verified by the Vice Head of the Department. At the end of the semester, the Undergraduate Thesis supervisor will submit the student's thesis's grade to SIAK NG and change the title of undergraduated thesis (if necessary). The completed undergraduated thesis must be submitted in the form of hard-covered book and CD within the pre-determined time limit. The undergraduate thesis must first be assessed in an undergraduated thesis examination by the supervisor and examiners assigned by the Head of the Department.

Thesis (Master Program)

Thesis is a report of the results of research activities in the form of scientific writing. The thesis topic should be a summary of the subject matter that can be scientifically studied on the basis of the theory and use of certain methods. Thesis should be written in Bahasa with an English abstract. For Master program students who are given the opportunity to conduct research and thesis preparation abroad, they are allowed to write thesis in English with abstracts in the Bahasa, while still following the appropriate format stated in the Final Project Writing Guideline of Universitas Indonesia. Exemption of this rule applies only to study programs that hold a joint collaboration with university's abroad as stated in the charter of cooperation. Requirements to start making Thesis are:

- Thesis has been registered in Study Plan Form [FRS] in every semester
- Students have passed courses with a load of 20 credits with a GPA≥ 2.75
- Head of the study program has set lecturer's name as a thesis supervisor.

Students are responsible for all thesis research costs. Students can actively meet with any of their lecturers as a potential supervisor, to request a thesis topic. In addition, in middle of the second semester, Head of the Study Program can start announcing thesis topics from which the students of the Master program could chose from to prepare the thesis proposal in the form of seminars. The Head of the Study Program announces a list of thesis supervisor who are assigned to guide the students in writing and finishing the approved topic. Thesis examination committee consists of Head of the committee, a minimum 3 or a maximum 5 examiners including the thesis supervisor. Responsible for the implementation of the thesis is the thesis coordinator in each department. Thesis counseling should be carried out with maximum of two people, Supervisor I and Supervisor II. Supervisor I should have a PhD or Master degree with a minimum of 5 years teaching experience and have expertise relevant to the student's thesis. Supervisor II should at least have a minimal master degree & have expertise relevant to the student's thesis. Thesis can be submitted for a thesis examination when the thesis has met the following academic requirements:

- Thesis has been registered in Study Plan Form [FRS] in said semester
- The thesis has been declared eligible for examination by the Thesis Advisor
- Students have passed seminar examination and have met the requirements for thesis examination set by the study program.

The thesis has been declared eligible for examination must be submitted to the Department to be listed in the examination schedule determined by the Head of the Study Program.

Uploading of Summary of Undergraduate Thesis/ Thesis/Dissertation

Internship

Internship is an out-of-campus activity to apply the scientific knowledge in a real work situation. Requirements for Internship is set up by each department and is part of the total 144-145 SKS. Students must find the place to carry out their internship themselves and departments will help by issuing a formal letter requesting the on-the-job training position.

For the undergraduate double degree program, students are required to complete internship when they are in the partner universities. For example in Australia internship is one of the requirements set by the Institute of Engineers Australia (IEAust) to obtain accredited B.E.

(Bachelor of Engineering) degree. Internship is a good opportunity for students to apply their skills and build networks in the industry. It is strongly suggested that students should do their Internship in partner universities. However, if they cannot do so it in partner universities, they are allowed to do it in Indonesia with prior permission from partner university.

Credit Transfer
Students who have registered and study at an undergraduate study program or other equivalent education programs, both within the Universitas Indonesia or in any other universities, may apply for a Credit transfer, provided that: (i) the transferred credits contain the same material with the courses listed in the curriculum for undergraduate program in FTUI, (ii) the academic record must be dated not more than a maximum of 5 years from the credit transfer application date, (iii) if the academic record are obtained from other universities outside of the Universitas Indonesia, the university should have at least a "B" accreditation from the National Accreditation Board for Higher Education or other international accrediting agencies. The courses transferred will be indicated with "TK" mark in the academic transcript.

Credit Transfer procedure are as follows: (i) Student submit a letter requesting Credit Transfer to the Head of the designated department, (ii) The Head of the Department will form a team to recommend which courses the student has previously taken can be transferred, (iii) Recommendation will be sent to the Dean of FTUI, (iv) FTUI Dean issues the Credit Transfer Decree, (v) The Faculty's Center of Administration assigned "TK" marks for all relevant courses in the student's SIAK NG account.

Credit Transfer for Parallel Class Students of Diploma Graduates
Starting in 2011, all extension programs in FTUI were merged into Parallel Classes in the Undergraduate Program. Diploma graduates who are registered as a student in these parallel classes, credits obtained from the previous diploma program will be transferred in blocks of 38 credits. Students begin their study in the third semester by taking all academic load according to package provided for the third semester. Afterward, they can take credits in accordance with their IPS in the following semester.

Study Abroad
There are many opportunities available for undergraduate students, both from Regular and Parallel programs to participate in Student Exchange program abroad, such as in Japan, Korea, Taiwan, Singapore, and many other countries. Student exchange programs generally last for 1-2 semesters and is supported with a full scholarship. Information on Student Exchange program can be obtained from the Universitas Indonesia's International Office, PAU Building 1st floor. Courses taken during the study exchange program are transferrable when they return to Universitas Indonesia. Thus, students are still able to graduate on time.

In addition, Undergraduate students can participate in Double Degree 2 +2 International Undergraduate program with FTUI's partner universities. Students participating in this program will spend the last two years studying at the partner university abroad and he will earn two degrees once he graduates. However, this Double Degree program offers no scholarships. Thus, participating students should ensure their availability of funds. Before leaving to continue their study overseas, students must ensure that their status in SIAK NG has been change to "overseas", and the student will be obliged to pay 10% of their tuition fee per semester for the Student Exchange program. Period of study abroad, either on the Student Exchange program and the Double Degree, is counted as part of the whole study period.

Fast Track
FT UI students with brilliant academic achievements can participate in the Fast Track program. In this program, FTUI's undergraduate students in semesters 7 & 8 are allowed to take several Master program courses. Courses that can be taken and other requirements are specified by the Study Program in a way that the students can directly pursue Master program in FTUI and complete the program in 1 year. Thus, the total time needed to complete both undergraduate and master programs is 5 years.

Requirements and Procedure for Fast Track Registration

Undergraduate students who are interested in participating in the Fast Track Program must fulfill the following requirements:
1. Having a minimum GPA of 3.00
2. Having a minimum Institutional TOEFL/EPT

score of 475 (students may use the score from the EPT test they took as new student in FTUI)
3. Having a high motivation for research

Procedure for Fast Track Program:

1. Fast Track Program is open for all FTUI undergraduate study programs which have the same specialization with the Master programs (for undergraduate study programs that have specialization).
2. Students who are interested in participating in the Fast Track Program are required to fill out the Registration Form downloadable through the http://www.eng.ui.ac.id/index.php/ft/downloadindeks (titled: (Formulir Pendaftaran Fast Track Magister FTUI).
3. Students registering for the Beasiswa Unggulan from the Ministry of Education and Culture selection are required to fill out the Beasiswa Unggulan registration form downloadable from the same web page.
4. The Fast Track Registration Forms will be evaluated by a team headed by the Head of Department.
5. If the student's application to participate in the Fast Track scheme is approved, they are required to counsel with his/her academic advisor for the finalization of his/her Undergraduate (S1) and Master (S2) Study Plan. The student's study plan for semester 7 and 8, especially for the undergraduate Elective Course selection must be in accordance with the Compulsory and Elective Courses in their respective Master study program in line with their specialization.
6. Undergraduate thesis and thesis of the student are expected to be of continuous research to maximize knowledge, experience and quality research result.

Registration Form for the Fast Track Program for each running Academic Year may be submitted to each Department Secretariat on March each year at the latest.

2.2. ADMINISTRATIVE AND ACADEMIC REGISTRATION

Academic Calendar

Administrative and academic schedules in FTUI are set in accordance with the administrative and academic schedules in Universitas Indonesia as follows:

Term 1 2015/2016 *)

Administrative and Academic registration in Universitas Indonesia
21 July – 25 August 2015

Course period
31 August 2015 – 19 December 2015

Mid-semester examination
19 - 23 October 2015

End of Semester Examination
7 - 18 December 2015

Deadline for grade assignment in SIAK-NG
6 January 2015

Departmental Judicium
1st, 26 October 2015
2nd, 12 January 2016

Faculty Yudicium
1st, 28 October 2015
2nd, 14 January 2016

Graduation
6 February 2016

Term 2 *)

Administrative and Academic registration in FTUI
January - February 2016

Course Period and examination
February - June 2016

Mid-semester examination
April 2016

End of Semester Examination
June 2016

Graduation
August 2016

Short Semester *)

Administrative and Academic registration
May - June 2016

Course period
June - August 2016

Mid-semester Examination
July 2016

End of Semester Examination
August 2016

Note:
*) Schedules are subject to change

Note:
- Short Semester course period is held for 8 weeks, including mid-semester and final semester examinations.
- 2 credit courses consist of twice 2-hour contact per week, 3 credit courses consist of three times 2-hour contact per week, 4 credit subject consist of four times 2-hour contact per week.
- For regular undergraduate program: Faculty Basic Courses (Physics, Mathematics and Chemistry) are only available for students who wish to retake the course and have attended required lab activities.
- A student can take up to a maximum of 12 credits during the short semester.
- Courses offered are determined by the Department.
- If the number of students registered for a certain course in the Short Semester does not meet the minimum requirement, then the course will be canceled.
- Short Semester's tuition fee is not included in the normal tuition fee (BOP) and is calculated by the number of credits taken during the short term. Tuition fee for each credit is determined by FTUI.
- Payment for short semester courses must be made before the payment period is closed. Otherwise, the student's name will be automatically removed and the student is no longer considered as a participant in the short semester.

Registration and Course Guidelines

Before administrative registration takes place, FTUI publishes an academic calendar for one semester listing schedules for courses, mid-term, final-term examinations and other academic activities. The academic calendar and course schedule could be accessed at http://www.eng.ui.ac.id, and SIAK NG.

Administrative Registration

Administrative Registration includes payments of tuition fee and admission fee. Students are responsible for paying fees by the payment deadline. Students who do not complete the registration process by the payment deadline will not be registered at that particular semester will be included toward student's allowed length of study.

Academic Registration

Students should do online academic registration; consult with his/her Academic Advisor for approval and signing the Course Plan Form or Formulir Rencana Studi (FRS) during the academic registration period. The main duties of Academic Advisor are:

- Helping and directing students in their study plan particularly in selecting courses and in solving their academic problems
- Monitoring and evaluating student's academic performance during their period of study.

Students should logon to https://academic.ui.ac.id using username and password provided by the Office of Pengembangan Pelayanan Sistem Informasi (PPSI) UI. Students could get their username and password at PPMT (Pusat Pelayanan Mahasiswa Terpadu) building. Students could also download course schedules and academic calendar from the website.

After completing the online FRS, students should print the form (3 copies) and meet their PA to discuss, verify and validate the courses taken. Students have to check their FRS after registration period to ensure that the courses taken are correct. Fines will be levied to students for late administrative and academic registration, as per the university or the faculty regulation.

Sanctions

1. Students who do not carry out the administrative registration will receive inactive status as a student in the current semester, which is included as their length of study.
2. Students who do not carry out academic registration cannot follow the academic activities in the current semester, which is included as their length of study.
3. Students who are not active as referred to in points (1) are not charged with tuition payments.
4. Students who do not carry out the registration and administration of academic registration 2 (two) consecutive semesters, expressed as a university student resigned without notice from the university.
5. Active students who do not complete the payment in accordance with the agreement until the end of the semester goes imposed the fine of 50% of the unpaid amount.

6. Payment of fines referred to in points (5) shall be paid at the following semester Academic Registration

Exception Administrative Registration

When non-active students, with all reason intend to maintain their status as active students, they have to follow the procedure of administrative registration:

- Obtain the approval from FTUI by filling out a form available at PAF (Pusat Administrasi Fakultas/Faculty Administrative Center).
- The students must come to the Directorate of Finance UI to obtain the approval for paying the tuition fee after paying the penalty 50% from the tuition fee on the current semester.
- The approval will be used by the students for paying the tuition fee manually.
- Students must give the copy of the payment record to the Directorate of Finance UI for verification.

Prerequisite Courses

These courses can only be taken if a student is currently taking or has previously taken and passed the prerequisite course with sufficient grade [not T].

Requirements for Transfer to Partner Universities in Australia for Double Degree Program

Minimum requirement of GPA and English before transferring to Partner University is listed in Table 2.3. Eligible students can continue their study to partner universities in Australia if they fulfill the following requirements:

1. Achieve minimum GPA as required at the end fourth semester for the 2+2 program;
2. Passed all required subjects with minimum C.
3. Achieve minimum IELTS or TOEFL scores as required.
4. If GPA less than required, the students must stay at UI and repeat some subjects to improve their GPA, while administratively and academically registered at FTUI.
5. If GPA meets minimum requirement, but IELTS or TOEFL scores less than minimum requirement, they are suggested to improve their IELTS or TOEFL score in Indonesia and maintain administrative registration at FTUI. Other choice is to take English for Academic Purposes (EAP) at the partner university. Information on duration and schedule of EAP can be found at the partner university's website.

Table 2.3. Minimum requirement of GPA and IELTS or TOEFL for transfer to the Partner Universities

Partner University	Minimum GPA	Minimum IELTS / TOEFL
QUT	3.0	IELTS min. 6.5 with no band lower than 6 IbT min 90 with no band lower than 22
Curtin		
UQ		
Uni Sydney		
Monash		

2.3. GRADUATE PREDICATE

Students are considered to have passed the undergraduate program and earned a Bachelor Degree (S.T or S.Ars) if they have passed all the mandatory courses and acquired a minimum of 144-145 credits in accordance with the applicable curriculum with "C" as the lowest grade and completed all 8 semesters scheduled academic load within 8-12 semesters. Honor predicate for graduates are determined by the student's final GPA as follow: Cum Laude (3.51 – 4.00), Very Satisfactory (2.76 – 3.50), and Satisfactory (2.00 – 2.75). For an undergraduate student to earn the Cum Laude degree, he must finished his study within 8 (eight) semesters time without retaking any courses.

Students are considered to have passed the Master program and earned a Master of Engineering or Master of Architecture Degree if they have passed all the required 40 – 42 credits, a ≥ 2.75 GPA with "C" as the lowest grade and do not exceed study period and have met all administrative requirements. Honor predicate for graduates are determined by the student's final GPA as follow: Cum Laude (3.71 – 4.00), Very Satisfactory (3.41 – 3.70), and Satisfactory (2.75 – 3.40). For a Master program student to earn the Cum Laude degree, his length of study must not exceed 4 (four) semesters time without retaking any courses.

Students are considered to have passed the Doctoral program and earned a Doctor Degree if they have passed all the required 48 – 50 credits, a minimum GPA of 3.00 with a minimum "C" for in-class courses and a minimum "B" for research courses, do not exceed study period and have met all administrative requirements. Honor predicate for graduates are determined by the student's final GPA as follow: Cum Laude (3.71 – 4.00), Very Satisfactory (3.41 – 3.70), and Satisfactory (3.00 - 3.40). For a Doctoral program student to earn the Cum Laude degree, his length of study must not exceed 6 (six) semesters time without retaking any courses. The mark "BS" is not counted as course repetition. If a student's final GPA is within the 3.71 – 4.00 range but he fail to meet the other requirements, he will be awarded the "Very Satisfactory" predicate.

2.4. ACADEMIC PERFORMANCE EVALUATION AND DROPOUT CRITERIA

Undergraduate Program

The university also requires that students maintain satisfactory academic performance during their study at FTUI and meet the following evaluation criteria to be able to continue their studies:

- Attain at least 24 SKS of minimum C and obtain IPK not less than 2.00 at the end of their second semester;
- Attain at least 48 SKS of minimum C and obtain IPK not less than 2.00 at the end of their fourth semester;
- Attain at least 72 SKS of minimum C and obtain IPK not less than 2.00 at the end of their sixth semester;
- Attain at least 96 SKS of minimum C and obtain IPK not less than 2.00 at the end of their eight semester;
- Attain all required SKS of minimum C & obtain IPK not less than 2.00 at the end of their twelfth semester;

Or:

- Fail to carry-out administrative and academic registration for two consecutive semesters;
- Proven to be in violation of rules or regulations that caused the student to lose his right as FTUI students.

Student who still maintain satisfactory academic performance and meet the evaluation criteria to continue his study but would like to resign on his own free will may submit a written application to the Dean with a copy to the Head of the Department.

Master Program

The Maximum length of study to earn a Master Degree in FTUI is at the latest 6 (six) semesters, starting from registration time to graduation. This provision also applies to students who enroll in the FTUI Master program with a "probation" status. Students will lose their right to continue the study (dropping out) if:

- The maximum length of study is exceeded.
- Students who do not register academically and administratively for two consecutive semesters will be automatically considered to have resigned from UI.
- Students fail to achieve a 3.00 GPA of at least 14-18 credits with a value of C at the end of the second semesters.
- In the end of the study period at the sixth semester, students fail to obtain a minimum GPA of 3.00 for all required academic load with at least C for all prerequisite academic load of the curriculum.
- Proven to be in violation of rules or regulations that caused the student to lose his right as FTUI students

Student who still maintain satisfactory academic performance and meet the evaluation criteria to continue his study but would like to resign on his own free will may submit a written application to the Dean with a copy to the Head of the Department.

Doctoral Program

The Maximum length of study earn a Doctoral degree in FTUI is 10 (ten) semesters, starting from registration time to graduation. Students will lose their right to continue to study (dropping out) if:

- Students who do not register academically and administratively for two consecutive semesters will be automatically considered to have resigned from UI

- Students fail to pass qualification exam and receive less than B mark for their dissertation research proposal for the first 4 (four) semesters evaluation.
- Student fail to receive a minimum GPA of 3.00 for the prerequisite courses for the first 6 (six) semesters evaluation.
- Student fail to receive a minimum GPA of 3.00 for the prerequisite courses for the first 6 (six) semesters evaluation.
- Students fail to meet all requirements to participate in and pass the doctoral promotional examination by the end of study duration (semester 10);
- Proven to be in violation of rules or regulations that caused the student to lose his right as FTUI students
- Exceeded the maximum length of study (10 semesters).

Student who still maintain satisfactory academic performance and meet the evaluation criteria to continue his study but would like to resign on his own may submit a written application to the Dean with a copy to the Head of the Department.

2.5. ACADEMIC LEAVE

Student who wishes to be away from his/her academic endeavors at FTUI for one to two semesters, but intend to return to FTUI are eligible for academic leave of absence. Leave of absence could be only given to student who has studied at least two semesters at FTUI, unless with specific circumtances.

Procedures of Academic Leave

1. To obtain academic leave, a student must write a letter requesting for academic leave to the Head of Department before the beginning of the administrative registration period of semester.
2. The Head of Department will forward the letter to the Associate Dean for Students and Alumni.
3. If the academic leave is approved, PAF will change the status of the student as academic leave and the amount of tuition fee will automatically be changed.
4. The student must pay 25 % of tuition fee during the period of administrative registration of the intended semester.
5. If the students fail to pay during the prescribed period of administrative registration, Exceptional Administrative Registration will apply.
6. If the Academic Leave is proposed not accordance with point (1) above, or is proposed after the semester is on, the student should pay full amount (100 %) of tuition fee.

2.6. FACULTY and DEPARTMENT JUDISIUMS

Judisium is a meeting held at both the Faculty and the Department level to decide whether a student has fulfill all academic requirements and may graduate and earn a degree in engineering based on the Department / Faculty Evaluation.

2.7. SEMESTER GRADE TRANSCRIPT, DIPLOMA and ACADEMIC TRANSCRIPTS

FTUI Central Administration Office is responsible for issuing Semester Grade Transcript, Diploma and Academic Transcript for all FTUI's graduates. Student Academic History is issued based on student's request while the diploma and academic transcripts are issued only once at the time of the student's graduation. Contained within the Student Academic History and Academic Transcript are name, course code and grades of all courses that the students took during their study period. Also included is the student's Grade Point Average (GPA) which is calculated based on all courses' grades. Diplomas and Academic Transcripts will be handed to all graduates no later than 2 (two) months from the date of graduation.

2.8 OFFENSES AND SANCTIONS

In any particular courses, no students shall engage in any form of unethical or improper conduct, such as but not limited to examination offenses:

- Utilizing unauthorized materials/notes to enhance performance during on examination.
- Attempting to observe the work of another student.
- Taking an examination for another per-

son, or permitting someone else to do so.

- Collaborating improperly by joint effort on discussion in anyway expressly prohibited by lecturer.

When incidents, as enumerated above occurs, the following sanctions may be imposed (as per FTUI regulation):

- The student may be assigned E for the subject in question
- The student may be suspended for one semester
- The student may be dismissed or expelled by FTUI

If necessary, a meeting of Panitia Penyelesaian Pelanggaran Tata Tertib (Offence Settlement Committee) (PT32) may be held.

2.9. ACADEMIC REGULATION OF THE UNIVERSITAS INDONESIA

List of Academic Regulations at Universitas Indonesia can be accessed via http://resipotory.ui.ac.id.

Below is a list of Decrees that functioned as reference for education program at Universitas Indonesia

GENERAL:

Decree of the Board of Trustees Universitas Indonesia Number: 008/SK/MWA-UI/2004 on the Amendment of Board of Trustees' Decree Number: 005/SK/MWA-UI/2004 on the Code of conduct on Campus Life in Universitas Indonesia

REGISTRATION:

Decree of the Rector of Universitas Indonesia Number: 450A/SK/R/UI/2006 on Universitas Indonesia Students' Registration

Decree of the Rector of Universitas Indonesia Number: 450B/SK/R/UI/2006 on Prohibition on Registering in More Than One Undergraduate Study Program at Universitas Indonesia

Decree of the Rector of Universitas Indonesia Number: 472/SK/R/UI/2006 on Universitas Indonesia's Student's Academic Leave

Decree of the Rector of Universitas Indonesia Number: 482/SK/R/UI/2006 on Universitas Indonesia Student ID card.

EDUCATION:

Decree of the Rector Universitas Indonesia Number: 285/SK/R/UI/2003 on the Implementation Guidelines for Cross-Faculty Lectures in Universitas Indonesia

Decree of the Board of Trustees Universitas Indonesia Number: 006 / MWA-UI/2004 on the Universitas Indonesia's Academic Curriculum

Decree of Rector of Universitas Indonesia Number: 478/SK/R/UI/2004 on the Student Academic Achievement Evaluation in Universitas Indonesia.

Decree of the Rector of Universitas Indonesia Number: 491/SK/R/UI/2004 on Universitas Indonesia Education Activities Conclusion Regulations

Decree of the Board of Trustees Universitas Indonesia Number: 001 / TAP/MWA-UI/2005 on the Establishment of Academic Degrees in the Universitas Indonesia.

Decree of the Board of Trustees Universitas Indonesia Number 003 / TAP/MWA-UI/2005 on General Guidelines for Implementation on Universitas Indonesia's Professional Programs

Regulation of the Board of Trustees Universitas Indonesia Number: 006 / Peraturan/MWA-UI/2005 on Student Learning Outcomes Evaluation at Universitas Indonesia

Regulation of the Board of Trustees Universitas IndonesiaNumber: 007 / Peraturan/MWA-UI/2005 on Academic Education Implementation Norms in Universitas Indonesia

Regulation of the Board of Trustees Universitas Indonesia Number: 008 / Peraturan/MWA-UI/2005 on Professional Education Curriculum Norms in Universitas Indonesia

Decree of Rector of Universitas Indonesia Number: 546/SK/R/UI/2005 on Doctoral Promotion Examination.

Decree of Rector of Universitas Indonesia Number: 547/SK/R/UI/2005 on the Implementation Guidelines of the International Class Program Universitas Indonesia

Decree of the Rector of Universitas Indonesia Number: 013/SK/R/UI/2006 on the Implementation of Extension Programs in Universitas Indonesia

Decree of the Rector of Universitas Indonesia Number: 838/SK/R/UI/2006 on Administration of Universitas Indonesia Student's Learning Outcomes

Decree of the Rector of Universitas Indonesia Number: 012/SK/R/UI/2007 on Implementation of the of Students Learning Activity in Universitas Indonesia

Decree of the Rector of Universitas Indonesia Number: 005/SK/R/UI/2008 on the Implementation of Short Semester in Universitas Indonesia

Decree of the Rector of Universitas Indonesia Number: 008/SK/R/UI/2008 on the Implementation of Matriculation for Master and Doctoral Program at the Universitas Indonesia

Decree of the Rector of Universitas Indonesia Number: 450/SK/R/UI/2008 on the Implementation of E-Learning in the University Indonesia

Decree of the Rector of Universitas Indonesia Number: 865/SK/R/UI/2008 on Credit Transfer and Courses Exemption in Universitas Indonesia

Decree of the Rector of Universitas Indonesia Number: 2198/SK/R/UI/2013 on the Implementation of Undergraduate Program in Universitas Indonesia.

Decree of the Rector of Universitas Indonesia Number: 2199/SK/R/UI/2013 on the Implementation of Master Program in Universitas Indonesia

Decree of the Rector of Universitas Indonesia Number: 2200/SK/R/UI/2013 on the Implementation of Doctoral Program in Universitas Indonesia

RESEARCH

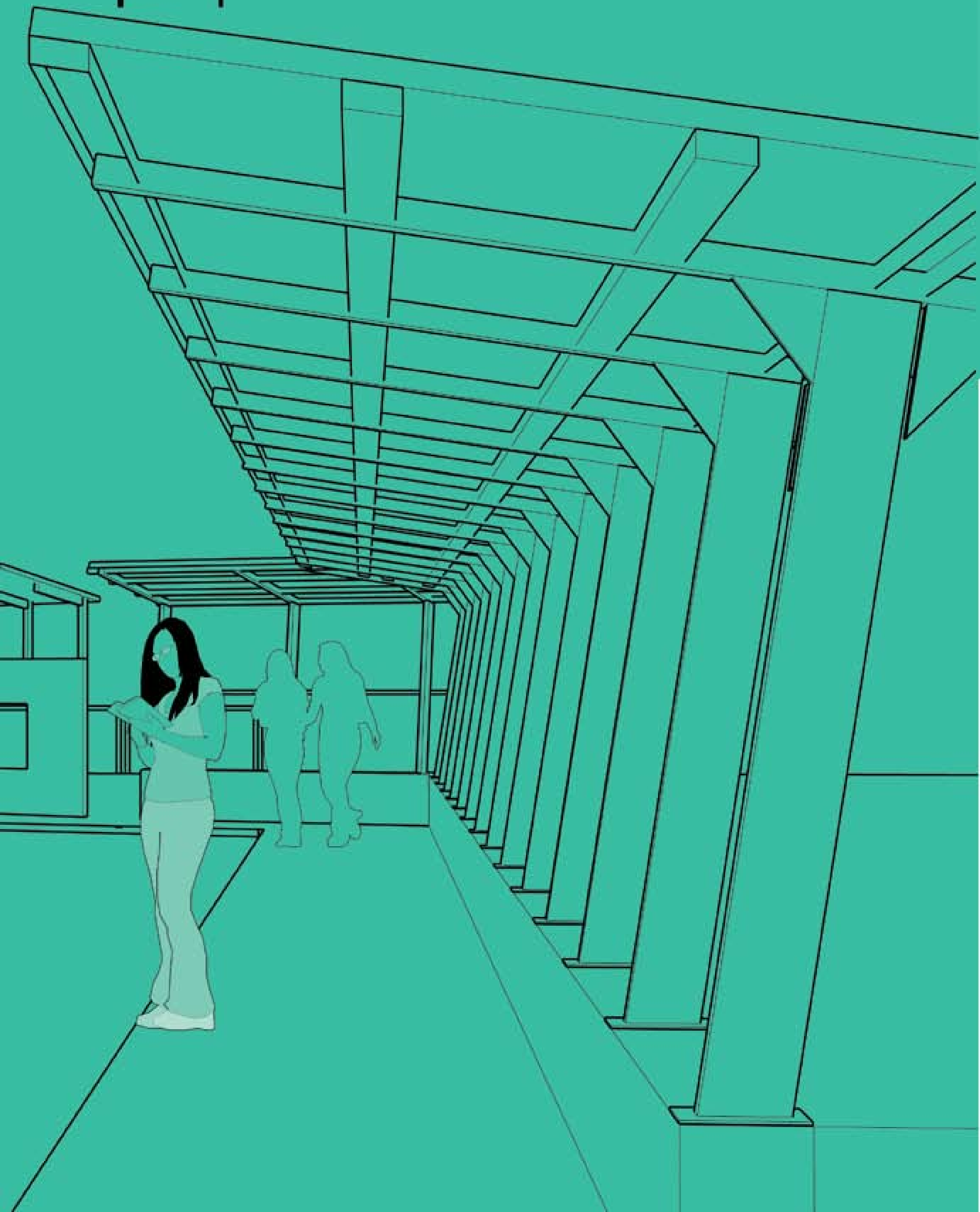
Decree of the Board of Trustees Universitas Indonesia Number 002/SK/MWA-UI/2008 on University's Research Norms

Decree of the Board of Trustees Universitas Indonesia Number 003/SK/MWA-UI/2008 on Research Policy at Universitas Indonesia

Decree of the Board of Trustees Universitas Indonesia Number 009/SK/MWA-UI/2008 on amendment of the Decree of the Board of Trustees of Universitas Indonesia Number 003/MWA-UI/2008 on Research Policy in Universitas Indonesia


ENGINEERING CENTER

CHAPTER 3
FACILITIES AND CAMPUS LIFE



3. FACILITIES AND CAMPUS LIFE

3.1. INTEGRATED STUDENTS SERVICE BUILDING (PPMT)

This building is located at the left of the Rector building with the one door policy in serving the registration process of all Universitas Indonesia students, whether they are vocational, undergraduate, undergraduate extension, master, doctoral, specialist, and professional students. This building consists of three divisions: PPSI division, Student Affairs division, and Academic division.

3.2. FACULTY ADMINISTRATION CENTER (PAF)

Academic administrative services for all academic programs in FTUI are managed by PAF. The services provided for students include academic records, change of grades from lecturers, testamur and academic transcripts, registration, absence of leave, enrollments and letter of reference letter. The working hour is at 08.00 to 16.00 from Monday to Friday, at PAF building.

3.3. UNIVERSITY CENTRAL LIBRARY

Location : Kampus UI Depok
Service hours of UI Central Library

Monday - Friday	08.30 - 19.00 WIB
Saturday & Sunday	08.30 - 15.00 WIB
Holly Month of Ramadhan	08.30 - 15.00 WIB

Membership:

Students, lecturers, researchers and employee of the Universitas Indonesia are entitled for membership of the central library with the following requirements:

1. Provide the latest semester payment proof or the latest study card (IRS) or certification letter from any faculty, unit or department within the Universitas Indonesia.
2. Provide a 2x3 photo (one)
3. Provide a cover letter from the faculty (for lecturers)

Lending Procedures:

- General text books can be borrowed for two weeks (max. 3 books) by showing your Student Card. Borrowed books need to be stamped.
- Reference books, magazines, newspaper and thesis can only be read on the spot or photocopied.
- Dissertation and thesis can only be photocopied as many as 10 pages.

UI Central Library Services

Reference Service

This service is provided to help the UI civitas academica in searching information, especially for students who are working on their final assignment or research. Information search request may be submitted in person or via email (reflib@ui.ac.id).

Information Package

Information package is a form of service in the form of certain topics of information packages. Each package consists of several articles and their annotation in accordance to the selected topic. Each article can be obtained by contacting the reference division first (reflib@ui.ac.id) or by direct phone request (+6221-7270751).

Information Search Training

The information search training consists of several packages. They are: basic and advance package. This training is provided to help improve the information skill of library visitors and members. This service is available to all university members, especially new students and students who are in their final year. Request for training can be submitted directly or through the email perpusui@ui.ac.id

Circulation (Borrowing Books)

The circulation services are located in level 1 The library's collection of reference books, thesis, dissertation, research reports and UI-ana can only be read on the spot at the UI Central Library.

UI Central Library Facilities

OPAC (Online Public Access Catalog)

OPAC is a tool to search the information regarding the available collection of the library by using a terminal computer. OPAC computers are available on every floor of the library.

Internet Access
Internet access connection at the UI central library uses the integrated network (JUITA – Jaringan Terpadu) and can also be accessed by using the UI Hotspot. Internet service is also available at the first floor of the central library. Also available are computers with internet access for the usage of library visitors and members.

Computer, Scanner and Data Backup
Students are allowed to use the provided computers to work on their assignments, picture/ photo scanning and to burn the result of their information search to a CD.

Photocopy
A photocopy machine is available at the UI Central Library

Discussion, Class and Seminar Rooms
Discussion, Class and Seminar rooms are available for students' needs and for classes.

Special Study Rooms
Special study rooms are available and can be used by all university members. These rooms are equipped with a desk, filing cabinet and internet access.

Locker
250 lockers are available for UI Central Library Members.

3.4. COMPUTER SCIENCES & NETWORK

Directorate of Information System Development and Service (PPSI) are responsible for the programmed computer network system designed to help fulfill the students and lecturers needs in computer usage (from academic activities such as programming to internet usage) through the Integrated UI network (JUITA).

Requirements for using the JUITA:
- Registered as a UI student
- Fill out registration form with a reference from the Associate Dean for Students Affairs/ Head of Study Program/Academic Counselor of the student.

Place of Registration:
- Depok (Integrated Student Service Center Building)
- Salemba (PUSILKOM Building)

Hotline Service
Users who are experiencing problems in the use of this facility can report or request the help of the Computer Technical Unit through the following PPSI hotline service:
Phone : +6221-7863419
Email : support@ui.ac.id
Web Site : http/cso.ui.ac.id
Office Hours : Monday – Friday (09.00 - 16.00)

Puskom Services at FTUI

Puskom (Pusat Komputer) provides services related to education and information technology development for students and academic/non-academic staff. The office is located at 2nd floor of GK Building at FTUI, Depok Campus. Main duties of Puskom is to provide education facilities for students, learning and research facilities for lecturers, and services for education administration, students and personnel. Puskom also provides connection services to internet and local area network at the Faculty and the University. Internet can be accessed at all area of FTUI. This facility can be used by students as well as faculties. All computer networks have been connected by fiber optic cables for inter-building and copper cable in the buildings with capacity of 100 Mbps. Besides providing local networks, Puskom also controls 7 computer servers with redundancy backup to minimize troubles in academic and research services. Computers are also available for students at various locations at FTUI i.e. computer laboratory at 2nd floor of GK Building, as well as at FTUI building at Salemba Campus. The service hour is 09.00 to 16.00 from Monday to Friday. For further information please contact Puskom at GK Building, 2nd floor, tel. 021-7863508, 021-2720011 ext. 64, or send email to puskom@eng.ui.ac.id.

3.5. STUDENT WELFARE

3.5.1. UNIVERSITAS INDONESIA MOSQUES

- The Ukhuwah Islamiyah (UI) Mosque Depok located in the UI Depok Campus. Established on 28 January 1987 for the Friday prayer with Prof. H. Moh. Daud Ali, SH as khatib (preacher). This mosque was named Ukhuwah Islamiyah for within this mosque is fostered the Islamic brotherhood within the campus as well as the unity and brotherhood of Moslem from within and outside of campus area.

- The Arif Rahman Hakim (ARH) Mosque Salemba is located in the UI Salemba Campus. Established on 10 November 1967, 27 Rajab 1387 H. Based on the UI Rector Decree dated 16 August 1966, a development committee was established and consist of students. The vision of this mosque is to be the center of Islam education in the campus and produces modern Moslems (equipped with faith and knowledge) that can implement the teachings of Islam and help solve religious problems.

3.5.2. TEKSAS BRIDGE

The Teksas Bridge is a linkage bridge between two faculties in the UI Depok campus, the Faculty of Engineering and the Faculty of Humanities. These two faculties are separated by an 80 meters lake. The Teksas Bridge is hoped to serve as:

- As a connection bridge and "Landmark"
- As a research object for steel application product
- As a promotional tool on "Aesthetics Steel"

The concept of this bridge aims towards two approach:

- The side of the bridge on the Faculty of Engineering UI reflects a powerful and masculine character symbolized with a "Sail" shaped Pylon Bridge soaring to the sky as a symbol of "LINGGA".
- The side of the bridge on the Faculty of Humanities UI reflects a flexible and feminine character symbolized with a "Hole Gate" shaped Pylon Bridge as a symbol of "YONI".

3.5.3. CAMPUS BUS

To serve the transportation needs of students within the campus, Universitas Indonesia provides 20 campus busses. These busses will serve inside campus routes from these times: 07.00-21.00 (Monday-Friday) and 07.00-14.00 (Saturday). These yellow campus busses have two different routes:

- Blue: UI Dormitory, Gerbatama, UI Train Station, Faculty of Psychology, Faculty of Social and Political Science, Faculty of Humanities, Faculty of Economics, Faculty of Engineering, KuKel, Student Center Building, Faculty of Mathematic and Natural Sciences, Faculty of Public Health, Balairung, UI Mosque, and Faculty of Law.
- Red : UI Dormitory, Gerbatama, UI Trains Station, Faculty of Law, UI Mosque, Balairung, Faculty of Public Health, Faculty of Mathematic and Natural Sciences, Student Center Building, KuKel, Faculty of Engineering, Faculty of Economics, Faculty of Humanities, Faculty of Social and Political Science, and Faculty of Psychology.

Executive Bus

In order to provide transportation service, especially outside campus transportation, Universitas Indonesia provides Air Conditioned and Non-Air Conditioned busses for rent. These busses are available for various types of activity, such as: UI student organization activities, academic support activities, and many more.

Rental Procedures:

- Written rental request is submitted to:
  Directorate of Student Affairs
  Integrated Student Service Center
  Building, Kampus UI Depok
  Phone : +6221-7867222 (Operator)
  Fax : +6221-7863453
- Payment should be made, at the very latest, one week before the date of use via BNI Bank, Kampus UI Depok Branch, and Account Number: 1273000024 under the name of Universitas Indonesia.
- Proof of payment must be submitted to the Directorate of Student Affairs. Cancellation done 3 (three) days before the date of use will be charge a 10% cancellation fee from the paid rent. Cancellation on the date of use will be charge a 30% cancellation fee from the paid rent.

3.5.4. STUDENT WELFARE AND FACILITY BUILDING (GKFM) / University Health Center

Address : Kampus UI Depok
Phone : +6221-78881019

This building is located in front of the Faculty of Engineering in UI Campus Depok. GKFM / University Health Center Building was built to better serve several important needs of the students, such as:

Polyclinic Unit

Provide a free health service to all students of the Universitas Indonesia. Students only need to provide their Student ID card to process

their membership card for future medical record to receive this service. There are several services available:
a. Public Health Service
b. Dental Health Service

Service Hours:
Monday – Thursday : 08.00 - 12.30
and 14.00 - 19.00
Friday : 08.00 - 11.00
and 14.00 - 19.00
Saturday : 08.00 - 12.00

Note:
Aside from the above mentioned facilities for students which are funded by the Students Welfare and Facility Fund, GKFM in UI Depok Campus also provide facilities for blood chemistry examinations, x-ray, and cardiac examination for university members with affordable prices.

Pharmacy
The pharmacy provides free medicine for 3 (three) days for UI students who seek treatments in the Polyclinic unit. The pharmacy also provides various other medicines for first aid needs for general public purchase.

UI Student Counseling and Guidance (BKM)
In providing service in the mental welfare of the UI students, the Student Counseling and Guidance is a place where UI students can receive psychological help in dealing with academic, personal or family problems. These psychological help are given in the form of counseling and guidance. Guidance service is the provision of information (to an individual or group) with the purpose of making sure that students are able to learn and build an optimal social relationship. Counseling service is the process of giving help to students and support student in finding a way to solve his problem. Here, a counselor functions as a facilitator.

Services in the UI Student Counseling and Guidance
The routine services provided by the BKM UI are counseling and guidance services daily which are done at:
Service Time : Monday – Friday
Service Hours : 09.00 – 15.00
Place : Student Welfare Center 2nd floor, Student Welfare & Facility Center Building UI Campus Depok
Phone : +6221-96384797

BKM UI staff of counselors consists of psychologies, psychiatrists, and academic counselors.

Problems handled by BKM UI
Generally, the problems handled by the BKM UI consist of academic, personal, family, and social problems.

BKM UI's other services:
- Online counseling
- Peer counseling training
- Counseling training for counselor lecturers and BKM management in the faculty level.
- Coordinate meeting between BKM in the university and faculty level.
- Personality development training
- Group therapy

UI Salemba Polyclinic
For students in the UI Salemba Campus, the university also provides similar health service in the polyclinic for public health service.

Service time : Monday – Friday: 08.00 – 12.00
and 14.00 – 18.00

3.5.5. UI STUDENT DORMITORY
Location : UI Campus, Depok
Phone/Fax : +6221- 7874414 / +6221-7874271
Capacity : 594 rooms for male students housing, 656 rooms for female students housing (including the VIP – AC rooms)
Facility : TV, cafetaria, public pay phone, public internet shops, computer rental

UI Wismarini Student Dormitory
Location : Jl. Otto Iskandar Dinata No. 38, East Jakarta, Indonesia
Phone/Fax : +6221-8195058
Capacity : 72 rooms for male students housing, 111 rooms for female students housing
Facility : Badminton court, TV, cafeteria, Table Tennis

The UI Wismarini student dormitory is provided to students from the Salemba Campus (Faculty of Medicine & Faculty of Dentistry).

Facility

- Standard housing facility
  Bed, table, chair, wardrobe, shoe rack, lamp, bathroom, wash basin.
- Technology facility
  Public pay phone shops, public internet shop, photocopy
- Public facility
  Cafeteria, praying room, laundry service, sport facility, car/motorcycle parking areas, minimart, dormitory market

Room Specification

- Standard room
  Standard bed, table, chair, bookcase, wardrobe, shoe rack, lamp, outdoor bathroom, non AC.
- Standard plus room
  Standard bed, table, chair, book case, wardrobe, shoe rack, lamp, outdoor bathroom, air conditioned.
- Bungur and Melati room
  Spring bed mattress, table, chair, indoor bathroom, wash basin, small kitchen, living room, air conditioned.
- VIP room
  Spring bed mattress, table, chair, indoor bathroom, wash basin, small kitchen, living room, air conditioned.

Other information

- UI Depok dormitory has their own set of rules and regulations which must be obeyed by all dormitory residents as an attempt to create conducive environment for dormitory residents and as an attempt to maintain harmony among the various elements of the UI Depok dormitory residents.
- Each undergraduate student residents of the UI Depok dormitory are entitled to live in the dormitory for one year (semesters 1 and 2).
- Residents will be charged for every electronic device which they brought to their dormitory rooms.
- For further information, please contact UI Dormitory secretariat at +6221-78744144 or by clicking http://asrama.ui.edu.

Registration Process Flow Chart for UI Dormitory

Step 1: Joint Academic Registration where students will receive their student ID number (NPM). Students will then be asked to fill out registration form and enclose: (1) a copy of ID card (2) a copy of academic registration proof (3) a copy of acceptance letter (4) 3x4 photographs (5) a letter of statement on impoverished condition (6) not a smoker statement

↓

Step 2: acquire a recommendation from the Faculty's Associate Dean for Students Affair --> submit the form package + recommendation --> considered entitled to a room in the dormitory: No --> STOP; Yes --> continue to the next step

↓

Step 3: Make a registration at the UI Depok dormitory by submitting the form package + recommendation, pay the first month rent + security deposit at the dormitory counter.

↓

Step 4: Accepted as dormitory resident for two semesters. Submit proof of payment and receive the room key.

3.5.6. WISMA MAKARA

Phone : +6221-78883670, 78883671
Reservation : +6221-78883672
E-mail : info@makara.cso.ui.ac.id
Website : http://www.wismamakara.com

Wisma Makara, located within the UI Depok campus, is a choice of accommodation for the Southern Jakarta and Depok area. This hotel is very suitable for seminar, training, workshop activities. Surrounded by rubber trees and a lake; the hotel's cool, calm, and beautiful atmosphere provides the perfect background for your various activities. The hotel's tranquility also makes it very suitable for those of you who need tranquility to work and rest.

Available facilities:

- 70 fully furnished rooms
  (AC, TV, refrigerator)
- Restaurant
- Swimming Pool
- Coffee Shop
- Meeting room (up to 100 person capacity)
- Pay phone shop and internet shop
- Photocopy
- Ballroom (with 800 person capacity)
- Parking area

3.5.7. UI STUDENT ACTIVITY CENTER (PUSGIWA)

Location : UI Campus Depok
Phone : +6221-7270201

Pusgiwa UI is a place for various student activities in Universitas Indonesia. Here we can find secretariat offices of various UI student organizations. Pusgiwa also provides many facilities for students' acitivites such as an 300-400 person auditorium.

3.5.8. UI STUDENTS HALL

Location : UI Salemba Campus
Capacity : 300 People
Phone : +6221-31901355/56

The UI Salemba Student Hall is one of the facilities in UI under the management of Directorate of Student Affairs and Alumni Relation. This hall is often used for various activities such as meetings, seminars, workshops, and many more. The hall is available for use by the university members and public.

3.5.9. SPORT FACILITIES

A. Stadium
- Football field
- Triple Jump Field
- Athletic Field

B. In Door (Gymnasium)
- Badminton court
- Volleyball court
- Basketball court

C. Out Door
- Hockey field
- Basketball court (3 lines)
- Badminton court (1 line)

Permit form or letter for the use of UI Student Activity Center (Pusgiwa), UI Student Hall, and Sport Facilities must be submitted to the Directorate of Student Affairs and Alumni Relation UI located at the Student Activity Center Building, UI Campus Depok.
Phone : +6221-7866403, 7863453
Fax : +6221-7863453

at FTUI, several sport facilities are available: basket ball court, futsal court and climbing wall.

3.5.10. BIKE TO CAMPUS

As a proof to Universitas Indonesia's commitment in implementing the “Go Green” program, UI has provided free bicycles as a mean of transportation within the campus area. Started in 2008, this program establishes collaboration with the Bike to Work and Polygon, making UI the first campus in Indonesia with their own Bike to Campus program.

These bicycles, which colors and and form are specially design for UI, are single seat bicycles. By July 2009, there are around 300 units of bicycle available for use and will continue to be added in accordance with the campus development or demand.

How to Borrow:
1. Students simply showed their student ID card (KTM) to officer in charge of each bike shelter.
2. Campus bicycle can only be use on the available bicycle track. It is forbidden to ride them outside of the available track or to take them outside of campus area.
3. Each bicycle is equipped with a trunk with a maximum capacity of 10 kg and is not to be use as a passenger space.
4. Borrowed bicycle is the responsibility of each student until it is returned to the officer in charge of each bike shelter.
5. Students may return the borrowed bicycle at the nearest bike shelter by showing their student ID card (KTM) to the officer of said shelter.

Service time for Bike to Campus is Monday to Friday, 08.00 – 17.00. For usage outside of service day and time, interested party must coordinate in accordance to the existing regulation.

A few points worth noting in cycling:
Once you've received your borrowed bicycle from the shelter officer, please do the following:
1. Make sure that your bicycle are in good order and function well.
2. Make sure that you have both hand on the bicycle handle, put your books/bags on the provided space.
3. Arrange your seat in accordance to your height, the height of your seat determines your comfort in cycling.
4. Each bicycle has three shifter levels, use them in accordance.
5. Ride the bicycle on the provided track, stay at the left side of the track when passing other bicycle.
6. Pay special care to motorcycles at each crossing.
7. Pay special attention to cycling safety.

3.6. STUDENT ORGANIZATION

Students are a nation's agent of change in making changes towards a fair and prosper independent society. Their power in fighting and struggling toward that goal must always be balanced with moral power as future asset in their fight in realizing the country's objectives. Thus, students need a vessel where all of their independent, family oriented, scientific, society oriented, and open activities can be accommodated. In Universitas Indonesia, this vessel is called Universitas Indonesia Student Society Association (Ikatan Keluarga Mahasiswa Universitas Indonesia – IKM UI).

IKM UI is a formal and legal organization which is the parent organization for all student activities in Universitas Indonesia. IKM UI adopts constitutional values adapted with the need of student lives. Sovereignty of IKM UI lies in the hand of the students and is fully implemented according to Laws and Constitution of IKM UI. The members of IKM UI are registered students in the Universitas Indonesia, consisting of active and regular members. Active members are IKM UI members that have followed active member admission procedures and received recommendation from the faculty. Regular members are IKM UI members that are not registered within the active membership of IKM UI. The symbol of the Universitas Indonesia Student Society Association (IKM UI) is the Makara of Universitas Indonesia with the wording IKATAN KELUARGA MAHASISWA UNIVERSITAS INDONESIA in black.

Student organizations that are incorporated within the IKM UI are:

1. Students Forum
2. Students Representative Council
3. Student Executive Body
4. Financial Audit Agency
5. Student Court
6. Student Element of the Board of Trustees
7. Autonomous Body of the Student Activity Unit
8. Semi Autonomous Body of the Student Activity Unit

Students Representative Council (Dewan Perwakilan Mahasiswa - DPM)

Students Representative Council is the high level body within the Universitas Indonesia Student Society Association (IKM UI) which possesses a legislative power. Members of the DPM UI consist of independent members from each faculties and representatives of legislative bodies of each faculty. Independent members are voted through a general election, while there can only be one representative from each faculty's legislative body. Membership of DPM UI is inaugurated by a student forum decree. Term of office for members of the DPM UI is one year and ended simultaneously with the inauguration of the new members of the DPM. The requirements for becoming a member of the DPM UI are regulated within the IKM UI laws. DPM UI has the authority in term of legislative, supervision, and assessment of Students Representative Council's (BEM UI) Work Accountability Report, jurisdiction, facility, and designing the admission mechanism and follow up on financial budget plan of each student organizations within the Universitas Indonesia for each period of management. Members of the DPM UI are entitled to interpellation right, voting right, and the right to convey suggestion and express their opinions.

Secretariat : Student Activity Center Building (Pusgiwa), 2nd floor
Phone :+6221-94629107, +6285717884964

Students Representative Council (Badan Eksekutif Mahasiswa - BEM)

Universitas Indonesia Students Representative Council is a student organization within the university level with the executive power. Term of office for UI Students Representative Council is one year, from January to December each year. Chairman and Vice Chairman of BEM UI are elected as a couple directly by members of the IKM UI in a Universitas Indonesia General Election. The elected Chairman and Vice Chairman of BEM UI are later officially inaugurated with a Student Forum Decree. Function and authority of BEM UI are, among other: advocate students in issues relating to funds and facilities at the university level; addressing the external politic policy of IKM UI; serve and coordinate with the Universitas Indonesia Autonomy Body of UKM UI, faculty's executive body, and student element of the Board of Trustees. BEM UI Board of Administrators is elected based on open and close recruitment mechanism.

Student Activity Unit
(Unit Kegiatan Mahasiswa - UKM)
Student Activity Unit of Universitas Indonesia (UKM-UI) is a place of student activities and creations in the Universitas Indonesia in one area of specialization, talent and religious services at the university level. The Student Activity Unit consists of the Autonomy and Semi Autonomy Bodies. Universitas Indonesia UKM Autonomy Body is a UKM in the university level which is deemed qualified and valid by the decree of the Student Forum into an autonomic UKM UI Autonomy Body. While the Universitas Indonesia UKM Semi Autonomy Body is a place of student activities and creations in the Universitas Indonesia in one area of specialization, talent and religious services at the university level under the coordination of the Students Representative Council.

a. Art
1. Krida Budaya Dance League
2. Madah Bahana Marching Band
3. Mahawarditra Philharmonic
4. Paragita Choir
5. Student Theater

b. Sport
1. Badminton
2. Hockey
3. Tennis
4. Soccer
5. Basket Ball
6. Swimming
7. Volley Ball
8. Soft Ball
9. Bridge
10. Futsal
11. Dance Sport
12. Cricket
13. Table Tennis

c. Martial Art
1. Taekwondo
2. Merpati Putih
3. Aikido
4. Wushu

d. Religious Groups
1. Moslem Student Society (Nuansa Islam Mahasiswa - SALAM)
2. Catholic Student Society (Keluarga Mahasiswa Katolik - KMK)
3. Oikumene Civitas Academica Society (Persekutuan Oikumene Sivitas Akademika - POSA)
4. Buddhist Student Society (Keluarga Mahasiswa Budhis)
5. Hindu Student Society (Keluarga Mahasiswa Hindu)

e. Academic Group
1. Eka Prasetya Student Study Group (KSM EP)
2. English Debating Society (EDS)

f. Entrepreneurship
1. Student Voice
2. CEDS
3. Student Radio (RTC UI FM) 107,9

g. Others
1. Wira Makara (Student Regiment)
2. Students' Mountaineering Club (Mapala)

3.7. CAREER DEVELOPMENT CENTER (CDC)

Career Development Center is a center with the aim of preparing UI graduates to have more skill and higher level of competitiveness and at the same time channeled UI graduates to the working world. CDC is located in the Student Center Building.
Phone/Fax : +6221-70880577/78881021
Email : cdc-ui@ui.ac.id
FTUI also has a CDC, located at 3rd floor of Engineering Center (EC) Building.
Phone : +6221-78880766

3.8. NATIONAL STUDENT SCIENCE WEEK

The National Student Science Week (Pekan Ilmiah Mahasiswa Nasional - PIMNAS) is a prestigious event for all Universities in Indonesia organized by the Directorate General of Higher Education (DIKTI). The Adikarta Kertawidaya trophy is the award contested at the PIMNAS. PIMNAS is an opportunity to channel the creativity, education and community service of the society in a Student Activities Program. Below is some of the Student Activities Program being contested within the National Student Science Week.

Student Creativity Program – Research (PKM-P)
This program is a research program that aimed to identify the determinants of the quality of the product, find a causal relationship between two or more factors, experimented with a form or equipment, to establish the

method of learning, conduct an inventory of resources,
modifying existing products, identify the chemical compounds in the plants, testing the efficacy of plant extracts, formulate marketing techniques, a health survey of street children, teaching methods Balinese script in elementary school students, the rate of economic growth in the craft center of Kasongan, superstition factor that characterizes the behavior of the Javanese community and other activities that have such a purpose.

Student Creativity Program - Technology Application (PKM-T)
This program is a technology assistance program (quality of raw materials, prototypes, models, equipment or production processes, waste management, and quality assurance systems and many other) or other micro-or small-scale industries (home industries, small traders or cooperation) as needed by the potential partners in the program. PKMT require students to exchange ideas with their partner in the program first, because the product is a solution of a problem which the PKMT partner prioritizes. Thus, in the proposed program, the student must attach a Statement of Willingness to Work Together with Partner on a paper with Rp. 6000, - seal.

Student Creativity Program – Entrepreneurship (PKM-K)
This program is the where students develop their skills in entrepreneurship and is a profit oriented program. Business commodities produced can be in the form of goods or services which in turn are one of the basic capital students will need in entrepreneurship and to enter the market.

Student Creativity Program – Community Service (PKM-M)
This program is an assistance program in science, technology, and arts in an effort to increase performance, build business skills, structuring and improving the environment, strengthening community institutions, the socialization of rational drug use, exposure to and understanding aspects of customary law, relief efforts on illiterates in the society and other community programs both for formal and non-formal societies.

Student Creativity Program - Writing Scientific Articles (PKM - AI)
This program is a program of writing a scientific article which originated from student activities in education, research, or community service which the student has done himself (case studies, field practice, community development work, student creativity program, internships, and many other).

Student Creativity Program – Written Concept (PKM - GT)
This program is a program of writing a scientific article that originated from ideas or concepts from a group of students. This written idea refers to an actual problem that can be found in the community and require a smart and realistic solution. In each area these programs are subdivided into seven groups of fields of science, namely:

1. Health field, including: Pharmacy, Nutrition, Obstetrics, Medicine, Dentistry, Nursing, Public Health, and Psychology.
2. Agricultural field, include: Veterinary Medicine, Forestry, Maritime, Fisheries, Agriculture, Animal Husbandry, and Agricultural Technology.
3. Mathematic and Natural Sciences field, including: Astronomy, Biology, Geography, Physics, Chemistry, and Mathematics.
4. Technology and Engineering field, including: Information Technology, Engineering, and Agricultural Technology.
5. Social Economy field, including: Agribusiness (Agriculture), Economic, Social and Political Sciences.
6. Humanities field, including: Religion, Language, Philosophy, Literature, and Art.
7. Education field, including: Education Sciences study program under the Faculty of Education.

Submission deadline for PKM-K, PKM-M, and PKM-P proposals are in October of each year, while deadline proposals for PKM-GT and PKM-AI are in March of each year. Almost all of these areas can be followed by students in 12 faculties at UI. PIMNAS is a means to prove the existence of UI as a research university in Indonesia. Win the Adikarta Kertawidya trophy and show the existence of UI as the Research Campus.
For further information :
http://bem.ui.ac.id/
http://mahasiswa.ui.ac.id/info-pkm-2010.html

3.9. SCHOLARSHIP

Universitas Indonesia currently manages approximately 71 scholarships both from the government and the private sector. Information about scholarships can be obtained at the Student Affairs Division of each faculty or through the website of the Directorate of Student Affairs at www.mahasiswa.ui.ac.id.

There are two types of scholarship in UI:
• UI Scholarship
• Donor/Sponsor Scholarship

General requirement procedure for scholarship application from Donor/Sponsor:
- Submit application through the Faculty Head with a recommendation from the Associate Dean of Student Affairs.
- Submit a photocopy of academic transcript stating a GPA corresponding with the requirement given by the donor/sponsor.
- Not a smoker.
- Is not a receiver of similar other scholarship.
- Other requirements as stated by the Donor/Sponsor.

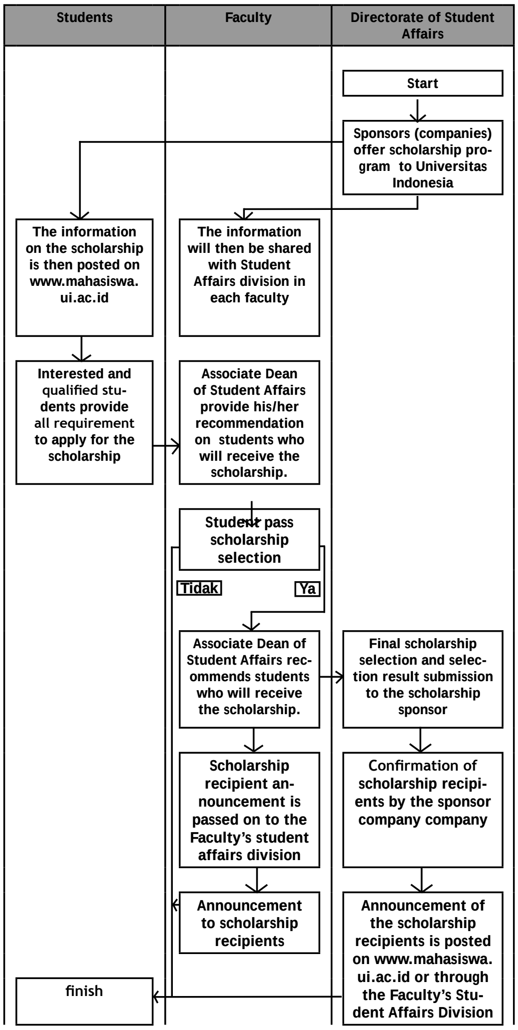
LIST OF NAME OF SCHOLARSHIP DONOR/ SPONSOR FOR UNIVERSITAS INDONESIA STUDENTS

1. Bank BNI 46
2. Bank Central Asia
3. Bank Indonesia
4. Bank KEB Indonesia
5. Bank Lippo
6. Bank Mandiri
   - Bank Mandiri
   - Bank Mandiri Prestasi
7. Bank Mayapada
8. Bank Niaga
9. Bank Permata
10. Bank Tabungan Negara
11. Student Special Aid
   - Special Aid for Undergraduate Program Student
   - Special Aid for Vocational Program Student
12. BAZNAS
13. West Java Scholarship
14. BMU Scholarship
15. CIMB Niaga Excellent Scholarship
16. DKI Jakarta Scholarship
   - Jakarta Achievement Scholarship
   - Jakarta Thesis Scholarship
17. BPMIGAS
18. BRI
19. BUMN
20. DIKNAS
   - Diknas (Excellent Activist Scholarship)
   - Diknas (Excellent Master Scholarship)
   - Diknas (Super Excellent Scholarship)
21. Diknas 1 (BBM)
22. Diknas 2 (PPA)
23. Eka 2007 - 2008
24. Eka 2008 - 2009
25. Eka CIpta (Uang Buku)
26. Exxon MOBIL (For Students from Aceh)
27. Exxon MOBIL (For Students from Aceh)

   Thesis
28. Indosat
29. Karya Salemba 4 (KS 4)
30. KORINDO
31. LGE
32. MARUBENI
33. MC.DERMONT
34. Part TIme Job
35. Posco (Thesis Aid)
36. PPA/BBM Angkatan 2009
   - PPA/BBM DIII
   - PPA/BBM S1
37. PPE
38. PT. BUMA Apparel Industry
39. PT. Coca Cola
40. PT. Indocement
41. PT. Accenture
42. PT. Sun Life Indonesia
43. PT. Thiess
44. Qatar Charity
45. Recapital
46. Rotary Club Jakarta Sudirman
47. Salim
48. Sariboga
49. Shell (Extention Scheme)
50. Shell (New Scheme)
51. Sime Darby
52. Sumitomo Bank (Supportive Scholarship)
53. Sumitomo Bank (Full Scholarship)
54. Sumitomo Corporation Scholarship
55. Supersemar
56. Tanoto
57. Tanoto S2
58. Total E & P
59. TPSDP (DIKTI)
60. UFJ Foundation / Mitsubishi
61. Unilever
62. Y. Asahi Glass (YAGI)
63. Y. Toyota (REGULER)
64. Yayasan IJARI
65. Yayasan Goodwill Internasional
66. YAYASAN TIFICO

67. YKPP - Pertamina
  - YKPP - Pertamina (Living Allowance)
  - YKPP - Pertamina (Tuition Fee)

Flowchart of Scholarship Application



3.10. INSURANCE

Each student enrolled in Universitas Indonesia for each running semester (participate in academic activities) will also be registered as an insurance member of PT. Asuransi Jasa Raharja.

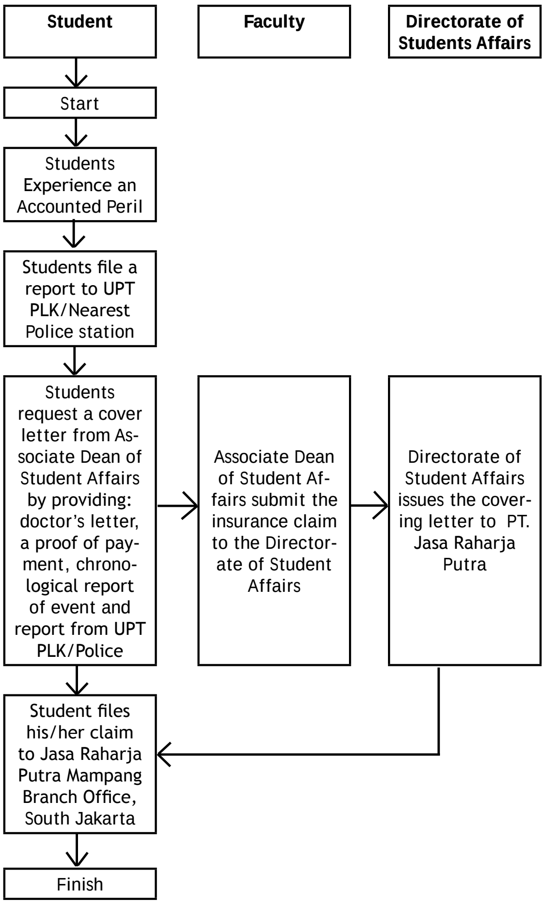
For these insured students, they are allowed to submit an insurance claim in accordance with the following provisions:

- Accidents included within the insurance claim are accidents which occurred during the student's journey from home to UI campus to participate in academic and extracurricular activities whether it is within or outside of Campus area and with the UI/Faculty's Management's knowledge and permission.
- Compensation on claim regarding students' accident is only applicable to those who have paid the DKFM fee for the semester.
- In the event of an accident, student must report the accident no later than 3x24 hours to the office of the Universitas Indonesia Directorate of Student Affairs Sub Directorate of Student Welfare Services or the nearest PT Jasa Raharja Office Branch.
- If after 180 (one hundred and eighty) days, the accident is not reported, insurance compensation shall be canceled.
- Compensation claim (for victims suffering from injuries) must be submitted by attaching the original and valid receipt from doctor/hospital/clinic that treated the student's injuries.
- Non-medical care or treatment is not compensable.
- Students may send their inquiries regarding any matter that are not listed here directly to the Universitas Indonesia Head of Student Welfare Sub Directorate at the Central Administration Building, Universitas Indonesia Campus, Depok.

Compensation Receivable from the Insurance Claim *)
Death due to an accident :
Rp. 5.000.000, -
Permanent disability due to accident :
Rp. 10.000.000, -
Care / medical Treatment due to accident (maximum payment) :
Rp. 3.500.000, -

*) Subject about to change without notice

Insurance Claims Process



Cause	Condition	Required Document
Train Accident	Injured	1. A notification letter from the Faculty's Associate Dean of Student Affairs to the Directorate of Students Affairs.
		2. Accident Report issued by the police
		3. Treatment report from the attending doctor
		4. Original receipt from the hospital or the attending physician
	Death	1. A notification letter from the Faculty's Associate Dean of Student Affairs to the Directorate of Students Affairs.
		2. Accident Report issued by the police
		3. Accident Report from Polsuska (PT. KAI)
		4. Autopsy report from the hospital
		5. Death Certificate
		6. A copy of the victim's birth certificate
		7. A copy of Family Card
		8. Heir certificate letter from the local district office.
Road Accident	Injured	1. A notification letter from the Faculty's Associate Dean of Student Affairs to the Directorate of Students Affairs.
		2. Accident Report issued by the police
		3. Treatment report from the attending doctor
		4. Original receipt from the hospital or the attending physician and the pharmacy
	Death	1. A notification letter from the Faculty's Associate Dean of Student Affairs to the Directorate of Students Affairs.
		2. Accident Report issued by the police
		3. Accident Report from Transportation Agency
		4. Autopsy report from the hospital
		5. Death Certificate
		6. A copy of the victim's birth certificate
		7. A copy of Family Card
		8. Heir certificate letter from the local district office.

3.11. GENERAL INFORMATION

Post Office, Depok Campus

The Depok Campus Post Office offers postage stamp sales, special delivery mail delivery, registered mail, parcel post, money orders, checks and postal giro and savings services such as Batara.
Address: Ground Floor Integrated Student Services Center (PPMT) Building, UI ,Depok Campus, 16424

Important Phone Numbers

UI Campus Salemba
Phone : +6221-330343, 3303455
Fax : +6221-330343

UI Campus Depok

Phone : +6221-7270020, 7270021, 7270022, 7270023, 7863460

Firefighters : 116
SAR : 55 021

Ambulance

RSCM : 118
Accidents : 119, 334 130
Police (on duty) : 525011

Police station

Central Jakarta : 3909922
North Jakarta : 491 017
South Jakarta : 7206011
West Jakarta : 5482371
East Jakarta : 8191478
Depok : 7520014

3.12. INTERNATIONAL JOURNAL OF TECHNOLOGY

International Journal of Technology (IJTech) is bi-annual international referred journal with the objectives to explore, develop, and elucidate the knowledge of engineering design and technology, to keep practitioners and researchers informed on current issues and best practices, as well as serving as a platform for the exchange of ideas, knowledge, and expertise among technology researchers and practitioners.

International Journal of Technology provides an opportunity to share detailed insights from different understandings and practices associated with technology. It provides an international forum for cross-disciplinary exchange of insights and ideas regarding value and practices for dissemination. International Journal of Technology will publish your work to international society of practitioners and researchers with interest in technology design and development from a wide variety of sectors.

Website: www.ijtech.eng.ui.ac.id

3.13. QUALITY IN RESEARCH (QiR) CONFERENCE

QiR Conference is a bi-annual international conference organized by FTUI since 1998. The 13th QiR was held in Yogyakarta from 25 – 28 June 2013. It was attended by over 400 participants from 16 different countries in the world. This conference provide a chance for students, be it undergraduate, master or doctoral program students, to present their research findings in front of an international audience. The 14th QiR will be held in August 2015. For more detail information on Qir, please visit: http://qir.eng.ui.ac.id.

3.14. INTERNATIONAL OFFICE

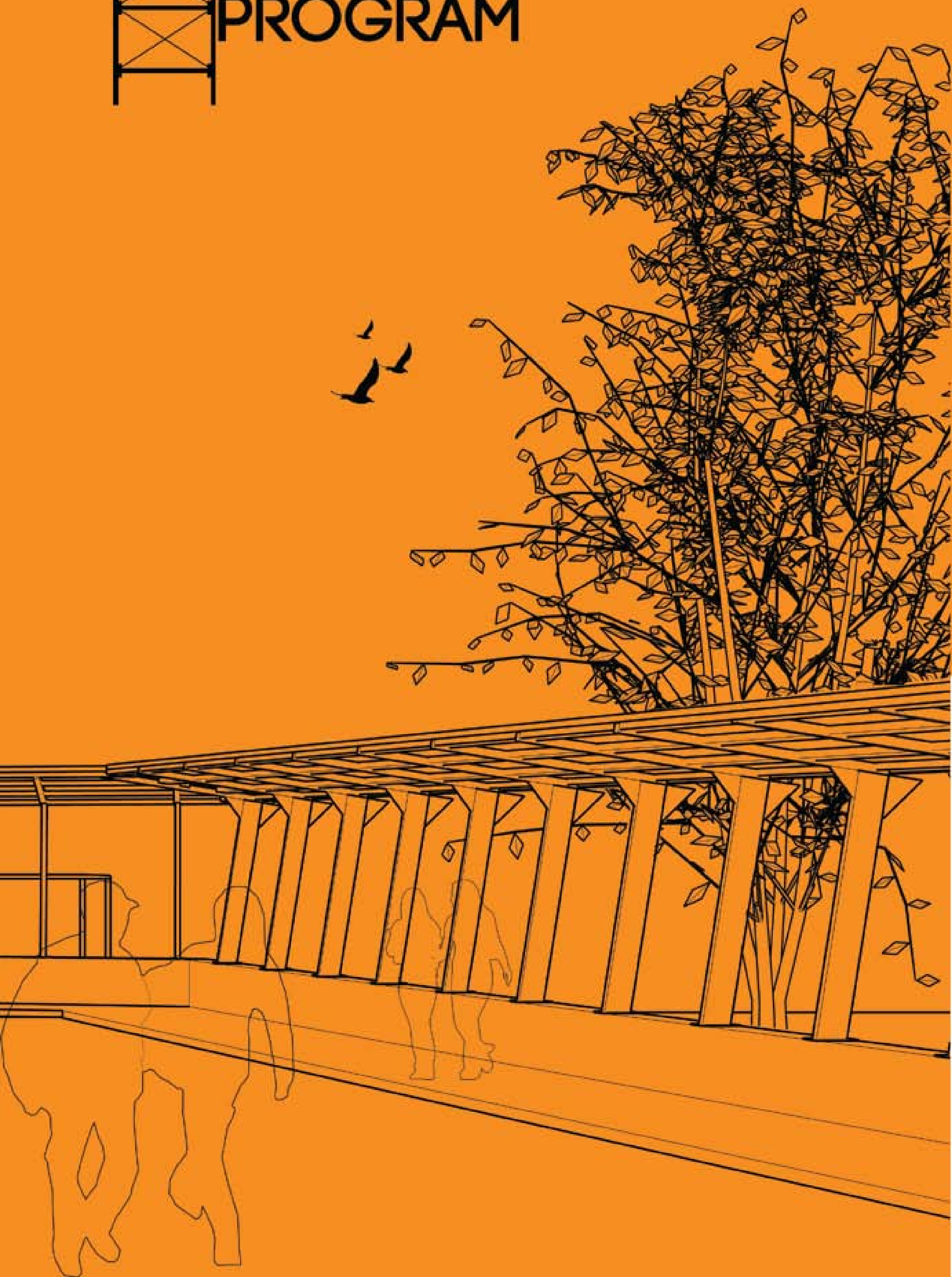
International Office is the university division dedicated to support the internationalization goals of the university and to handle international mobility involving the university and the international civitas academica. Their goal is to assist the international students and scholars handle their academic-related matters at Universitas Indonesia and to bridge Universitas Indonesia's civitas academica with overseas universities. Universitas Indonesia has a worldwide cooperation with various universities all over the world. These cooperations include not only academic but also research collaborations, giving the international access and exposure to its entire proud member.

The International Office of Universitas Indonesia provides various services such as: Bilateral Cooperation (University to University Cooperation), Regional Cooperation (International Associations & International Forums), Government to Government Cooperation (G to G), International Learning and Teaching, Student Exchange, Double Degree, Sandwich Program, Visiting Scholars, Study abroad, Scholarship Opportunities, International Research and Research Training, International Knowledge Transfer; are some of the services provided by the International Office. These opportunities are open for all university members from lecturers to students, be it in their Bachelor, Master or Ph.D program. Students can benefit from these programs in experiencing a once in a life time chance to study and understand different academic cultures in the world.

For further information, please contact:
Central Administration Building
1st Floor, Universitas Indonesia
Kampus Depok, Jawa Barat 16424
Phone/fax : +62 21 – 7888 0139
Email : intofui@yahoo.com, io-ui@ui.ac.id
Milist : internationaloffice@yahoogroups.com
Twitter : @intofui


FACULTY OF ENGINEERING

CHAPTER 4
UNDERGRADUATE PROGRAM



4. UNDERGRADUATE PROGRAM (REGULAR/PARALLEL/INTERNATIONAL)

4.1. UNDERGRADUATE PROGRAM IN CIVIL ENGINEERING

Program Specification

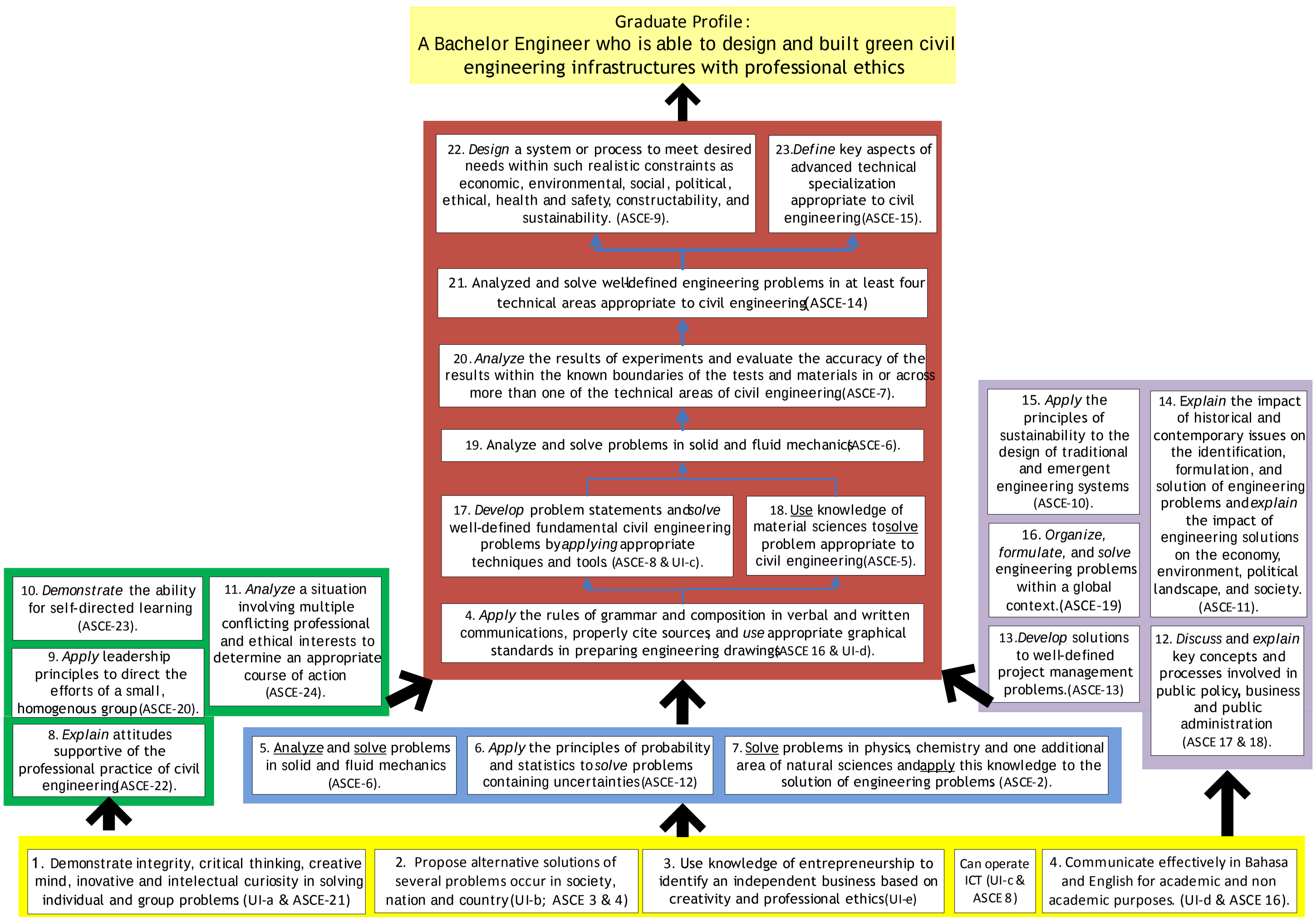
1.	**Awarding Institution**	Universitas Indonesia Double Degree: Universitas Indonesia and partner university	
2.	**Teaching Institution**	Universitas Indonesia Double Degree: Universitas Indonesia and partner university	
3.	**Programme Tittle**	Undergraduate Program in Civil Engineering	
4.	**Class**	Regular, Parallel, and International	
5.	**Final Award**	Sarjana Teknik (S.T) Double Degree: Sarjana Teknik (S.T) and Bachelor of Engineering (B.Eng)	
6.	**Accreditation / Recognition**	BAN-PT: A - Accredited, AUN-QA	
7.	**Language(s) of Instruction**	Bahasa Indonesia and English	
8.	**Study Scheme (Full Time / Part Time)**	Full Time	
9.	**Entry Requirements**	High school /equivalent, or D3 / Polytechnique / equivalent, AND pass the entrance exam.	
10.	**Study Duration**	Designed for 4 years	
	Type of Semester	Number of Semester	Number of weeks / semester
	Regular	8	17
	Short (optional)	3	8
11.	**Graduate Profiles:** A Bachelor Engineer who is able to design and built green civil engineering infrastructures with professional ethics		
12.	**Expected Learning Outcomes:** 1. Solve problems in mathematics and apply this knowledge to the solution of engineering problems. (ASCE 1) 2. Solve problems in physics, chemistry and one additional area of natural sciences and apply this knowledge to the solution of engineering problems. (ASCE 2) 3. Use knowledge of material sciences to solve problem appropriate to civil engineering (ASCE 5) 4. Analyze and solve problems in solid and fluid mechanics (ASCE 6) 5. Analyze the results of experiments and evaluate the accuracy of the results within the known boundaries of the tests and materials in or across more than one of the technical areas of civil engineering. (ASCE 7) 6. Develop problem statements and solve well-defined fundamental civil engineering problems by applying appropriate techniques and tools. (ASCE 8) 7. Design a system or process to meet desired needs within such realistic constraints as economic, environmental, social, political, ethical, health and safety, constructability, and sustainability. (ASCE 9) 8. Apply the principles of sustainability to the design of traditional and emergent engineering systems. (ASCE 10) 9. Explain the impact of historical and contemporary issues on the identification, formulation, and solution of engineering problems and explain the impact of engineering solutions on the economy, environment, political landscape, and society. (ASCE 11) 10. Apply the principles of probability and statistics to solve problems containing uncertainties. (ASCE 12) 11. Develop solutions to well-defined project management problems. (ASCE 13) 12. Analyzed and solve well-defined engineering problems in at least four technical areas appropriate to civil engineering (ASCE 14)		

12.	13. Define key aspects of advanced technical specialization appropriate to civil engineering. (ASCE 15) 14. Apply the rules of grammar and composition in verbal and written communications, properly cite sources, and use appropriate graphical standards in preparing engineering drawings. (ASCE 16) 15. Discuss and explain key concepts and processes involved in public policy, business and public administration. (ASCE 17 and 18) 16. Organize, formulate, and solve engineering problems within a global context. (ASCE 19) 17. Apply leadership principles to direct the efforts of a small, homogenous group. (ASCE 20) 18. Explain attitudes supportive of the professional practice of civil engineering. (ASCE 22) 19. Demonstrate the ability for self-directed learning. (ASCE 23) 20. Analyze a situation involving multiple conflicting professional and ethical interests to determine an appropriate course of action. (ASCE 24) 21. Demonstrate integrity, critical thinking, creative mind, inovative and intelectual curiosity in solving individual and group problems. (UI-a) 22. Propose alternative solutions of several problems occur in society, nation and country (UI-b) 23. Use knowledge of entrepreneurship to identify an independent business based on creativity and professional ethics (UI-e)		
13	Classification of Subjects		
No.	**Classification**	**Credit Hours (SKS)**	**Percentage**
i	**University General Subjects**	**18**	**13 %**
ii	**Basic Engineering Subjects**	**25**	**17 %**
iii	**Core Subjects**	**70**	**48,6 % = 49 %**
iv	**Elective Subjects**	**20**	**14 %**
v	**Internship, Seminar, ndergraduate Thesis, Project**	**11**	**8 %**
	Total	**144**	**100 %**
14.	**Total Credit Hours to Graduate**		**144 SKS**

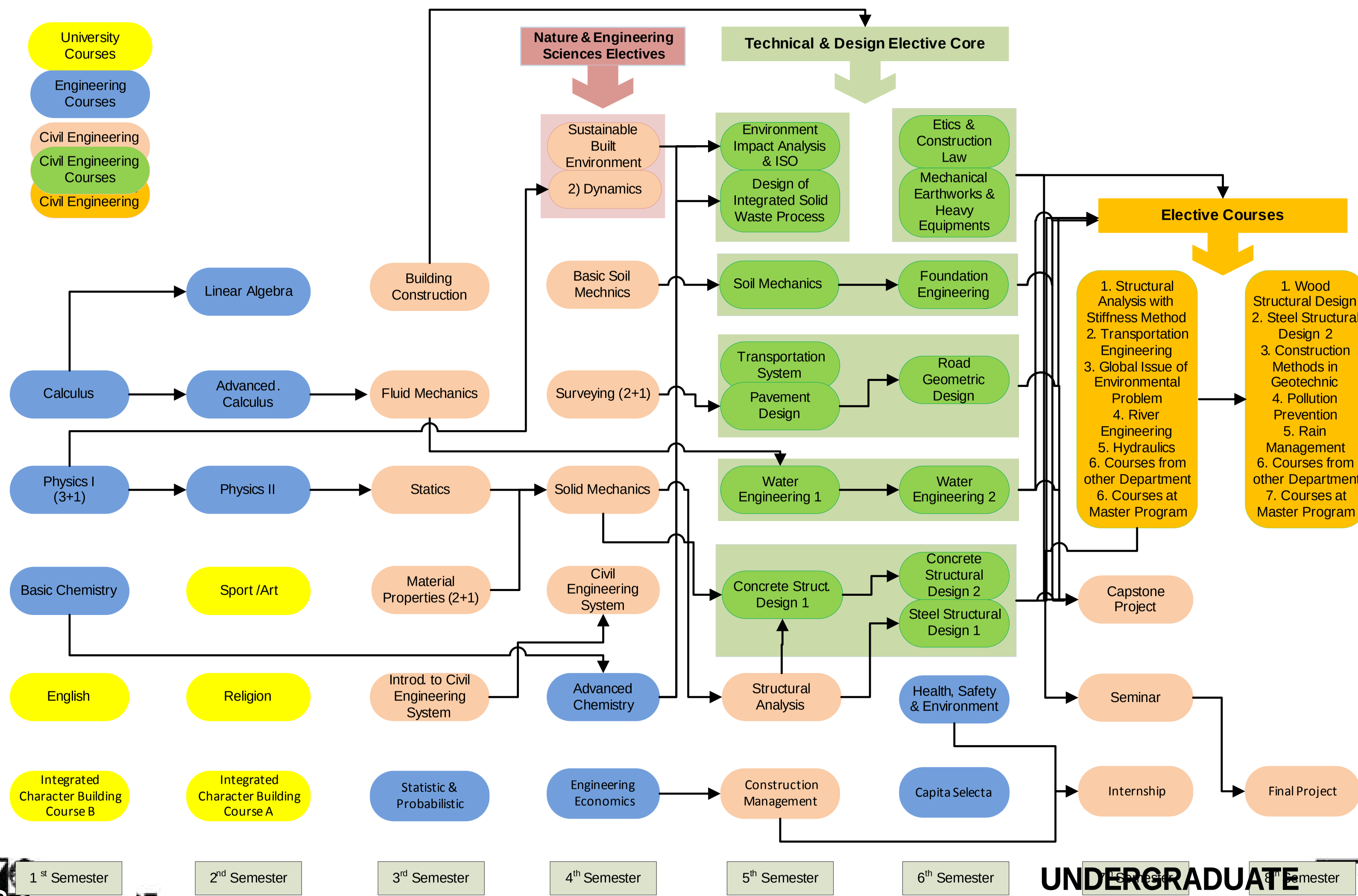
Career Prospect

- Builder
- Innovator
- Communicator
- Leader
- Environmental Stewards

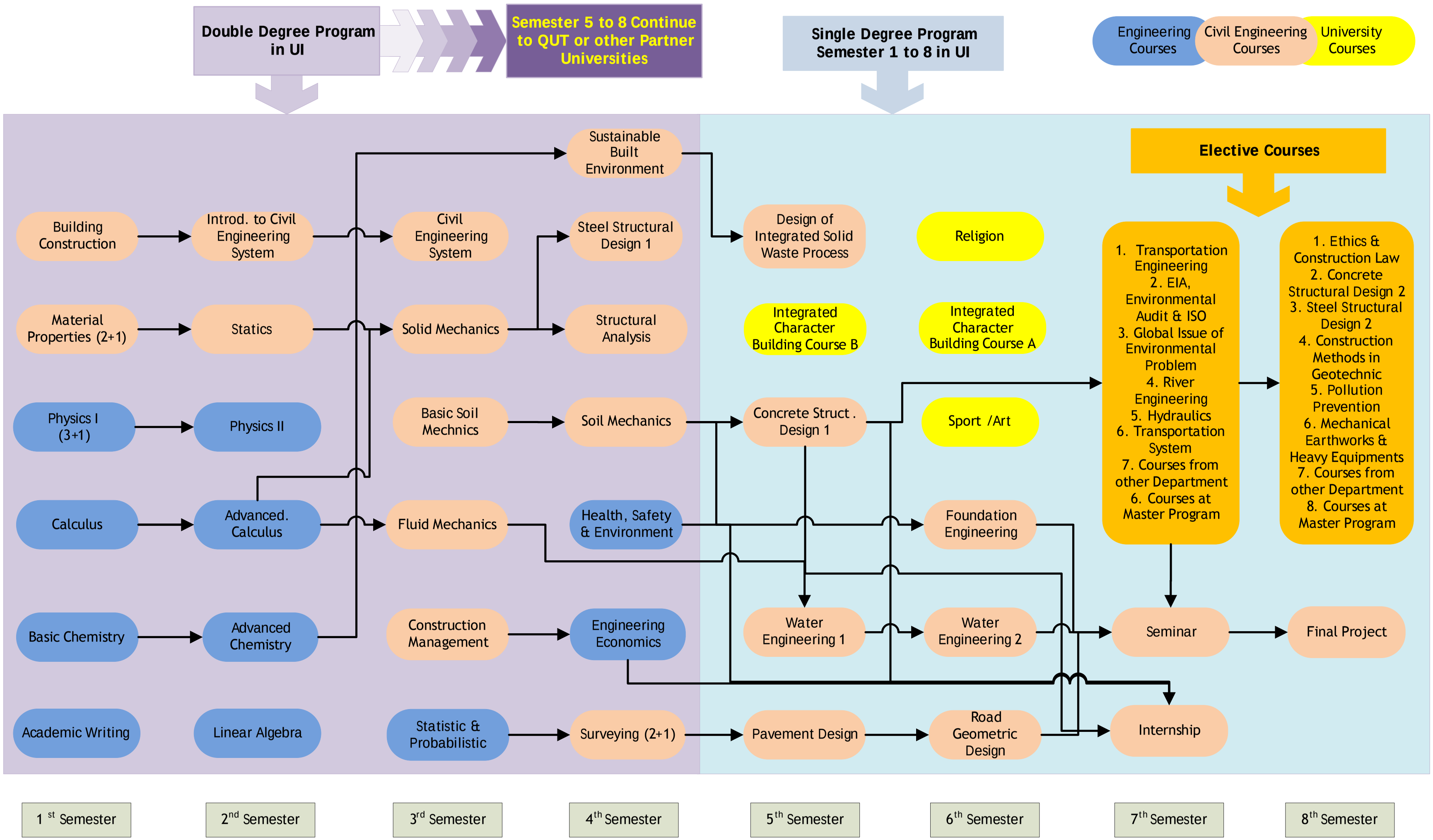
Learning Outcomes Flow Diagram



Flow Diagram of Subjects at Regular and Parallel Program



Flow Diagram of Subjects at International Program



Course Structure of Undergraduate Program in Civil Engineering (Regular/Parallel)

CODE	MATA AJARAN	SUBJECT	SKS
	Semester 1	**1st Semester**	
UIGE 6 0 0004	MPKT B	Integrated Character Building Subject B	6
UIGE 6 0 0002	Bahasa Inggris	English	3
ENGE 6 0 0003	Fisika Dasar 1	Physics 1	4
ENGE 6 0 0001	Kalkulus	Calculus	4
ENGE 6 0 0010	Kimia Dasar	Basic Chemistry	2
		Sub Total	**19**
	Semester 2	**2nd Semester**	
UIGE 6 0 0001	MPKT A	Integrated Character Building Subject A	6
UIGE 6 0 0003	Olah Raga/Seni	Sport/ Art	1
ENGE 6 0 0002	Aljabar Linear	Linear Algebra	4
ENGE 6 0 0004	Fisika Dasar 2	Physics 2	4
UIGE 6 0 0005-9	Agama	Religious Studies	2
ENGE 6 0 0006	Kalkulus Lanjut	Advanced Calculus	3
		Sub Total	**20**
	Semester 3	**3rd Semester**	
ENGE 6 0 0005	Statistik dan Probabilistik	Statistic and Probability	2
ENCV 6 0 0002	Pengantar Sistem Rekayasa Sipil	Introduction to Civil Engineering System	3
ENCV 6 0 0003	Statika	Statics	4
ENCV 6 0 0004	Mekanika Fluida	Fluid Mechanics	3
ENCV 6 0 0005	Properti Material (2+1)	Material Properties (2+1)	3
ENCV 6 0 0006	Konstruksi Bangunan	Building Construction	4
		Sub Total	**19**
	Semester 4	**4th Semester**	
ENGE 6 0 0007	Ekonomi Teknik	Engineering Economics	3
ENCV 6 0 0007	Ilmu Ukur Tanah (2+1)	Surveying (2+1)	3
ENCV 6 0 0008	Mekanika Benda Padat (3+1)	Solid Mechanics (3+1)	4
ENCV 6 0 0009	Mekanika Tanah Dasar (2+1)	Basic Soil Mechanics (2+1)	3
ENCV 6 0 0010	Sistem Rekayasa Sipil	Civil Engineering System	3
ENCV 6 0 0011	Kimia Lanjut	Advanced Chemistry	2
	Mata Ajaran Pilihan Alam dan Sains Salah Satu dari :	Nature and Engineering Sciences Electives Choose one out of:	
ENCV 6 0 0012	Lingkungan Berkelanjutan	Sustainable Built Environment	2
ENCV 6 0 0013	Dinamika	Dynamics	2
		Sub Total	**20**
	Semester 5	**5th Semester**	
ENCV 6 0 0014	Manajemen Konstruksi	Construction Management	3
ENCV 6 0 0015	Analisa Struktur (2+1)	Structural Analysis (2+1)	3
	Mata Kuliah Pilihan Teknik dan Perancangan Pada semester 5 & 6 mahasiswa wajib memilih <u>minimal</u> 24 SKS dari <u>minimal</u> 4 peminatan:	Technical & Design Elective Core In Semester 5 & 6 (Choose minimum of 24 credits offered by at least 4 specializations)	
	1. Struktur :	1. Structure :	
ENCV 6 0 0101	Perancangan Struktur Beton 1	Concrete Structural Design 1	3
	2. Geoteknik :	2. Geotechnics :	
ENCV 6 0 0201	Mekanika Tanah (2+1)	Soil Mechanics (2+1)	3
	3. Tranportasi :	3. Transportation :	
ENCV 6 0 0301	Perancangan Struktur Perkerasan (2+1)	Pavement Design (2+1)	3
ENCV 6 0 0302	Sistim Transportasi (2+1)	Transportation System (2+1)	3
	4. Manajemen Sumber Daya Air	4. Water Resources Mangement	
ENCV 6 0 0401	Perancangan Infrastruktur Keairan 1	Water Engineering 1	3
	6. Lingkungan	6. Enviroment	
ENEV 6 0 0009	Perancangan Pengolahan Limbah Padat Terpadu	Design of Integrated Solid Waste Management	3
ENEV 6 0 0011	Amdal, Audit Lingkungan dan ISO	Environment Impact Analysis and ISO	2
		Sub Total	**18**
	Semester 6	**6th Semester**	
ENGE 6 0 0008	K3LL	Health, Safety and Environmental Protection	2
ENCV 6 0 0016	Kapita Selekta	Capita Selecta	2

CODE	MATA AJARAN	SUBJECT	SKS
	Mata Kuliah Pilihan Teknik dan Perancangan Pada semester 5 & 6 mahasiswa wajib memilih minimal 24 SKS dari minimal 4 peminatan:	Technical & Design Elective Core (Choose minimum of 24 credits offered by at least 4 specializations)	
	1. Struktur :	1. Structure :	
ENCV 6 0 0102	Perancangan Struktur Baja 1	Steel Structural Design 1	3
ENCV 6 0 0103	Perancangan Struktur Beton 2	Concrete Structural Design 2	3
	2. Geoteknik :	2. Geotechnics :	
ENCV 6 0 0202	Rekayasa Pondasi	Foundation Engineering	3
	3. Tranportasi :	3. Transportation :	
ENCV 6 0 0303	Perancangan Geometrik Jalan	Road Geometric Design	3
	4. Manajemen Sumber Daya Air	4. Water Resources Mangement	
ENCV 6 0 0402	Perancangan Infrastruktur Keairan 2	Water Engineering 2	3
	5. Manajemen Konstruksi	5. Construction Management	
ENCV 6 0 0501	PTM dan Alat Berat	Mechanical Earthworks and Heavy Equipments	3
ENCV 6 0 0502	Etika dan Aspek Hukum Industri Konstruksi	Ethics and Construction Law	2
	Pilihan (*)	Electives (*)	3
		Sub Total	**17**
	Semester 7	**7th Semester**	
ENCV 6 0 0017	Kerja Praktek	Internship	3
ENCV 6 0 0019	Seminar	Seminar	1
ENCV 6 0 0018	Proyek	Capstone Project	3
	Pilihan (*)	Electives (*)	
		Sub Total	**16**
	Semester 8	**8th Semester**	
ENCV 6 0 0020	Skripsi	Final Project	4
	Pilihan (*)	Electives (*)	9
		Sub Total	**13**
Total			**144**

(*) Elective Courses :
Students may choose elective courses :

1. Offered by undergraduate program in Semester 7 and 8; or
2. Offered by Master Degree program with maximum credits of 18 or,
3. Offered by other Department with maximum of 3 courses or 9 credits
4. For students pursue to Master Degree Program through fast track mechanism; at semester 7th and 8th, choose maximum of 18 credits offered by one of specializations at master degree program.

Mata Ajar Pilihan

(*) Electives Courses of Undergradute Program

CODE	MATA AJARAN	SUBJECT	SKS
Semester Gasal			
	Kelebihan SKS Mata Kuliah Pilihan disain pada semester 5 dan 6 diperhitungkan sebagai mata kuliah pilihan	Technical & Design Elective Courses more than 24 credits at 5th & 6th semester are considered as elective courses	
ENCV 6 0 0104	Analisa Struktur dengan Metode Kekakuan	Structural Analysis with Stiffness Method	3
ENCV 6 0 0304	Teknik Transportasi	Transportation Engineering	3
ENEV 6 0 0010	Permasalahan Lingkungan dalam isu global	Environmental Global issues	2
ENCV 6 0 0403	Teknik Sungai	River Engineering	3
ENCV 6 0 0404	Hidrolika	Hydraulics	3
Semester Genap			
	Kelebihan SKS Mata Kuliah Pilihan disain pada semester 5 dan 6 diperhitungkan sebagai mata kuliah pilihan	Technical & Design Elective Courses more than 24 credits at 5 & 6 semester are considered as elective courses	
	Mata Kuliah Pilihan Lintas Departemen atau lintas Fakultas	Elective courses offered by other Departements or other Faculty	
ENCV 6 0 0105	Perancangan Struktur Kayu	Wood Structural Design	3
ENCV 6 0 0106	Perancangan Struktur Baja 2	Steel Structural Design 2	3
ENCV 6 0 0203	Metode Konstruksi Geoteknik	Construction Methods in Geotechnic	3
ENEV 6 0 0017	Pencegahan Pencemaran	Pollution Prevention	2
ENCV 6 0 0405	Pengelolaan Limpasan Hujan	Rain Management	3

(*) Electives Courses of Master Degree Program

Following are Compulsory / Electives Courses at Master Degree Program offered to Bachelor students as elective courses

CODE	MATA AJARAN	SUBJECT	SKS
Semester Gasal			
	Kekhususan Struktur	**Structure**	
ENCV 8 0 0101	Mekanika Material Lanjut	Advanced Mechanics of Material	3
ENCV 8 0 0102	Perancangan Struktur Beton Pratekan	Design of Prestressed Concrete	3
ENCV 8 0 0103	Dinamika Struktur	Dynamics of Structure	3
	Kekhususan Geoteknik	**Geotechnics**	
ENCV 8 0 0201	Mekanika Tanah Lanjut	Advanced Soil Mechanics	3
ENCV 8 0 0202	Investigasi Geoteknik Lanjut	Advanced Geotechnical Investigation	3
ENCV 8 0 0203	Stabilitas Lereng dan Perbaikan Tanah	Slope Stabilization and Soil Improvement	3
	Kekhususan Transportasi	**Transportation**	
ENCV 8 0 0301	Perancangan Geometrik Jalan Lanjut	Advanced Highway Geometric Design	3
ENCV 8 0 0302	Sistem Transportasi Lanjut	Advanced Transportation System	3
ENCV 8 0 0303	Rekayasa dan Kendali Lalu Lintas	Traffic Engineering and Control	3
ENCV 8 0 0304	Perencanaan dan Kebijakan Transportasi	Transport Planning and Policy	3
	Kekhususan MSDA	**Water Resources Management**	
ENCV 8 0 0401	Kimia Lingkungan	Enviromental Chemistry	3
ENCV 8 0 0402	Hidrologi Lanjut	Engineering Hydrology	3
ENCV 8 0 0001	Matematika Teknik	Engineering Mathematics	3
	Kekhususan Manajemen Konstruksi	**Construction Management**	
ENCV 8 0 0501	Manajemen Proyek Teknik	Engineering Project Management	3

ENCV 8 0 0502	Manajerial Ekonomi Teknik	Engineering Economics and Management	3
ENCV 8 0 0503	Manajemen Sistim Rekayasa dan Nilai	Systems Engineering and Value Management	3
ENCV 8 0 0601	Metode dan Peralatan Konstruksi	Construction Methods and Equipment	3
Semester Genap			
	Kekhususan Struktur	**Structure**	
ENCV 8 0 0105	Metode Elemen Hingga	Finite Element Method	3
ENCV 8 0 0106	Perancangan Struktur Bangunan Tahan Gempa	Design of Earthquake Resistance Building	3
ENCV 8 0 0107	Teknologi Beton dan Beton Bertulang Lanjut	Concrete Technology and Adv. Reinforced Concrete	3
	Kekhususan Geoteknik	**Geotechnics**	
ENCV 8 0 0204	Teknik Pondasi Lanjut dan Galian Dalam	Adv. Foundation Engineering and Deep Excavation	3
ENCV 8 0 0205	Metode Numerik Dalam Geoteknik	Numerical Methods in Geotechnical Engineer-ing	3
ENCV 8 0 0206	Geoteknik Lingkungan	Environmental Geotechnics	3
	Kekhususan Transportasi	**Transportation**	
ENCV 8 0 0305	Transportasi Barang	Freight Transportation	3
ENCV 8 0 0306	Analisa Jaringan Transportasi	Transport Network Analysis	3
ENCV 8 0 0307	Rekayasa Perkerasan Jalan Lanjut (***)	Advanced Highway Pavement Engineering (***)	3
ENCV 8 0 0308	Analisa Permintaan Transportasi (***)	Transport Demand Analysis (***)	3
ENCV 8 0 0309	Keselamatan Transportasi (***)	Transport Safety (***)	3
ENCV 8 0 0310	Ekonomi Transportasi (***)	Transport Economics (***)	3
ENCV 8 0 0311	Perencanaan dan Rekayasa Jalan Rel (***)	Railway Engineering and Planning (***)	3
ENCV 8 0 0312	Perencanaan dan Pengelolaan Pelabu-han (***)	Port Planning and Management (***)	3
ENCV 8 0 0313	Perencanaan dan Pengoperasian Ang-kutan Umum (***)	Public Transport Planning and Operation (***)	3
ENCV 8 0 0314	Topik Khusus Transportasi (***)	Selected Topics in Transportation (***)	3
	Kekhususan MSDA	**Water Resources Management**	
ENCV 8 0 0403	Manajemen Sumber Daya Air	Water Resources Management	3
ENCV 8 0 0404	Hidrologi Kualitas Air	Qualitative Hydrology	3
ENCV 8 0 0405	Pemodelan Kualitas Air Permukaan	Surface Water Quality Modeling	3
ENCV 8 0 0406	Pengelolaan Sumber Daya Air Tanah	Ground Water Resources Management	3
	Kekhususan Manajemen Konstruksi	**Construction Management**	
ENCV 8 0 0505	Manajemen Waktu dan Biaya	Time and Cost Management	3
ENCV 8 0 0506	Manajemen Kualitas dan Resiko	Quality and Risk Management	3
ENCV 8 0 0507	Manajemen Pengadaan, Administrasi Kontrak dan Klaim	Procurement Management, Contract and Claim Administration	3
ENCV 8 0 0602	Manajemen Sumber Daya dan komu-nikasi proyek	Human Resource and Project Communication Management	3

(***) Elective Course

Course Structure of Undergraduate International Program in Civil Engineering

CODE	SUBJECT	CP	CODE	SUBJECT	CP
	1st Semester			2nd Semester	
UIGE 6 1 0002	Academic Writing	3	ENGE610002	Linear Algebra	4
ENGE 6 1 0003	Physics 1	4	ENGE610004	Physics 2	4
ENGE 6 1 0001	Calculus	4	ENCV 6 1 0001	Advanced Calculus	3
ENGE 6 1 0010	Basic Chemistry	2	ENCV 6 1 0002	Introduction to Civil Engineering System	3
ENCV 6 1 0005	Material Properties (2+1)	3	ENCV 6 1 0003	Statics	4
ENCV 6 1 0006	Building Construction	4	ENCV 6 1 0011	Advanced Chemistry	2
	Sub Total	**20**		**Sub Total**	**20**
	3rd Semester			**4th Semester**	
ENCV 6 1 0004	Fluid Mechanics	3	ENGE610005	Statistic and Probability	2
ENCV 6 1 0007	Surveying (2+1)	3	ENGE610007	Engineering Economics	3
ENCV 6 1 0008	Solid Mechanics (3+1)	4	ENGE610008	Health, Safety and Environmental Protection	2
ENCV 6 1 0009	Basic Soil Mechanics (2+1)	3	ENCV 6 1 0012	Sustainable Built Environment	2
ENCV 6 1 0010	Civil Engineering System	3	ENCV 6 1 0015	Structural Analysis (2+1)	3
ENCV 6 1 0014	Construction Management	3	ENCV 6 1 0102	Steel Structural Design 1	3
	Sub Total	**19**	ENCV 6 1 0201	Soil Mechanics (2+1)	3
				Sub Total	**18**
	5th Semester			**6th Semester**	
UIGE 6 1 0004	Integrated Character Building Subject B	6	UIGE610001	Integrated Character Building Subject A	6
ENCV 6 1 0101	Concrete Structural Design 1	3	UIGE610003	Sport/ Art	1
ENCV 6 1 0301	Pavement Design	3	UIGE610005-9	Religious Studies	2
ENCV 6 1 0401	Water Engineering 1	3	ENCV 6 1 0202	Foundation Engineering	3
ENEV 6 1 0009	Design of Integrated Solid Waste Management	3	ENCV 6 1 0303	Road Geometric Design	3
	Sub Total	**18**	ENCV 6 1 0402	Water Engineering 2	3
				Sub Total	**18**
	7th Semester			**8th Semester**	
ENCV 6 1 0017	Internship	3	ENCV 6 1 0020	Final Project	4
ENCV 6 1 0019	Seminar	1		Electives (*)	10
	Electives (*)	13		**Sub Total**	**14**
	Sub Total	**17**			
				Total	**144**

(*) Elective Courses :

Students may choose elective courses :

1. Offered by undergraduate program in Semester 7 and 8; or
2. Offered by Master Degree program with maximum credits of 18 or,
3. Offered by other Department with maximum of 3 courses or 9 credits
4. For students pursue to Master Degree Program through fast track mechanism; choose maximum of 18 credits offered by one of specializations at master degree program. It should be noted that all courses are conducted in Bahasa.

(*) Electives Courses of International Undergradute Program

CODE	SUBJECT	CP	CODE	SUBJECT	CP
7th Semester			8th Semester		
ENCV 6 1 0302	Transportation System	3	ENCV 6 1 0103	Concrete Structural Design 2	3
ENCV 6 1 0304	Transportation Engineering	3	ENCV 6 1 0106	Steel Structural Design 2	3
ENCV 6 1 0403	River Engineering	3	ENCV 6 1 0203	Construction Methods in Geotechnic	3
ENCV 6 1 0404	Hydraulics	3	ENCV 6 1 0501	Mechanical Earthworks and Heavy Equipments	3
ENEV 6 1 0010	Environmental Global issues	2	ENCV 6 1 0502	Ethics and Construction Law	2
ENEV 6 1 0011	Environment Impact Analysis and ISO	2	ENEV 6 1 0017	Pollution Prevention	2

(*) Electives Courses of Master Degree Program

Following are Compulsory / Electives Courses at Master Degree Program offered to Bachelor students as elective courses

CODE	SUBJECT	CP	CODE	SUBJECT	CP
7th Semester			8th Semester		
	Structure			**Structure**	
ENCV 8 0 0101	Advanced Mechanics of Material	3	ENCV 8 0 0105	Finite Element Method	3
ENCV 8 0 0102	Design of Prestressed Con-crete	3	ENCV 8 0 0106	Design of Earthquake Resistance Building	3
ENCV 8 0 0103	Dynamics of Structure	3	ENCV 8 0 0107	Concrete Technology and Adv. Reinforced Concrete	3
	Geotechnics			**Geotechnics**	
ENCV 8 0 0201	Advanced Soil Mechanics	3	ENCV 8 0 0204	Adv. Foundation Engineer-ing and Deep Excavation	3
ENCV 8 0 0202	Advanced Geotechnical Investigation	3	ENCV 8 0 0205	Numerical Methods in Geotechnical Engineering	3
ENCV 8 0 0203	Slope Stabilization and Soil Improvement	3	ENCV 8 0 0206	Environmental Geotech-nics	3
	Transportation			**Transportation**	
ENCV 8 0 0301	Advanced Highway Geomet-ric Design	3	ENCV 8 0 0305	Freight Transportation	3
ENCV 8 0 0302	Advanced Transportation System	3	ENCV 8 0 0306	Transport Network Analysis	3
ENCV 8 0 0303	Traffic Engineering and Control	3	ENCV 8 0 0307	Advanced Highway Pave-ment Engineering (***)	3
ENCV 8 0 0304	Transport Planning and Policy	3	ENCV 8 0 0308	Transport Demand Analy-sis (***)	3
	Water Resources Management		ENCV 8 0 0309	Transport Safety (***)	3
ENCV 8 0 0401	Enviromental Chemistry	3	ENCV 8 0 0310	Transport Economics (***)	3
ENCV 8 0 0402	Engineering Hydrology	3	ENCV 8 0 0311	Railway Engineering and Planning (***)	3

ENCV 8 0 0001	Engineering Math	3
	Construction Management	
ENCV 8 0 0501	Engineering Project Management	3
ENCV 8 0 0502	Engineering Economics and Management	3
ENCV 8 0 0503	Systems Engineering and Value Management	3
ENCV 8 0 0601	Construction Methods and Equipment	3

ENCV 8 0 0312	Port Planning and Management (***)	3
ENCV 8 0 0313	Public Transport Planning and Operation (***)	3
ENCV 8 0 0314	Selected Topics in Transportation (***)	3
	Water Resources Management	
ENCV 8 0 0403	Water Resources Management	3
ENCV 8 0 0404	Qualitative Hydrology	3
ENCV 8 0 0405	Surface Water Quality Modeling	3
ENCV 8 0 0406	Ground Water Resources Management	3
	Construction Management	
ENCV 8 0 0505	Time and Cost Management	3
ENCV 8 0 0506	Quality and Risk Management	3
ENCV 8 0 0507	Procurement Management, Contract and Claim Administration	3
ENCV 8 0 0602	Human Resource and Project Communication Management	3

(***) Elective

Course Structure of Undergraduate Programme in Civil Engineering (International) at QUT

Year 3	Semester 5 (QUT) July	Credits
KODE	Course Title	
ENB276	Structural Engineering 1	12
ENB371	Geotechnical Engineering 2	12
ENB280	Hydraulic Engineering	12
MAB233	Engineering Mathematics 3	12
	subtotal	48

Year 3	Semester 6 (QUT) Feb	Credits
KODE	Course Title	
ENB275	Project Enginerring 1	12
ENB375	Structural Engineering 2	12
ENB376	Transport Engineering	12
ENB377	Water and Waste Water Treatment Engineering	12
	subtotal	48

Year 4	Semester 7 (QUT) July	Credits
KODE	Course Title	
ENB372	Design and Planning of Highways	12
ENB378	Water Engineering	12
	Electives/Minor	12
	subtotal	36

Year 4	Semester 8 (QUT) Feb	Credits
KODE	Course Title	
ENB471	Design of Concrete Structures and Foundations	12
ENB472	Project Engineering 2	12
	Electives/Minor	12
	Electives/Minor	12
	subtotal	48

Description of Subjects

UIGE600001
UIGE610001
MPKT A / INTEGRATED CHARACTER BUILDING A
6 SKS
General Intructional Objective: To develop student's participation in raising their awareness towards issues within the society, country, nation, and surrounding environment based on their faith, piety, manners, and academic ethics in order to develop Science and Technology.
Learning Objectives: Students are expected to capable of:
1. Understanding, explaining, and analyzing the philosophy and logical science, attitude, social and culture in Indonesia.
2. Understanding academic and nation values from social and cultural diversity in Indonesia.
3. Understanding the problems by applying step learning actively and using information technology.
4. Using Bahasa Indonesian in discussion and academic writing as well.

Syllabus: Topic which appropriate with target and method learning, problem based learning (PBL), Collaborative Learning (CL) and Computer mediated learning (CML)
Prerequisite: -
Handbook: Appropriated with topic

UIGE600004
UIGE610004
MPKT B / INTEGRATED CHARACTER BUILDING B
6 SKS
General Intructional Objective: Develop students paticipation to improve awareness of social issues, national state, and the environment that is based on faith and piety, manners, and ethics in the context of academis science and technology development.
Learning Objectives: Students are expected to capable of:
1. Understanding, explaining, and analyzing the philosophy and logical science, attitude, social and culture in Indonesia.
2. Understanding academic and nation values from social and cultural diversity in Indonesia.
3. Understanding the problems by applying step learning actively and using information technology.
4. Using Bahasa Indonesian in discussion and academic writing as well.

Syllabus: Topic which appropriate with target and method learning, problem based learning (PBL), Collaborative Learning (CL) and Computer mediated learning (CML)
Prerequisite: -
Handbook: Appropriated with topic

UIGE600002
ENGLISH
UIGE610002
ACADEMIC WRITING
3 SKS
Learning Objectives: After attending this subject, students are expected to capable of use English to support the study in university and improve language learning independently.
Syllabus: <u>Study Skills</u>: (Becoming an active learner, Vocabulary Building: word formation and using the dictionary Listening strategies Extensive reading) <u>Grammar:</u> (Revision of Basic grammar Types of sentences Adjective clauses, Adverb clauses Noun clauses, Reduced clauses) <u>Reading:</u> (Reading skills: skimming, scanning, main idea, supporting ideas, Note-taking Reading popular science article, Reading an academic text) <u>Listening:</u> (Listening to short conversations, Listening to a lecture and note-taking, Listening to a news broadcast, Listening to a short story) <u>Speaking:</u> (Participating in discussions and meetings, Giving a presentation) <u>Writing</u>: (Writing a summary of a short article Describing graphs and tables, Writing an academic paragraph, Writing a basic academic essay (5 paragraphs))
Prerequisite: -
Handbook: Poerwoto, C. et.al. Reading Comprehension for Engineering Students

ENGE600001
ENGE610001
CALCULUS
4 SKS
Learning Objectives: After attending this subject: students are capable of understanding calculus basic concepts and competent to solve applied calculus problems. Students are capable of understanding the basic concepts of two or more variables function with it's application. Capable of understanding the basic concepts of sequences and series as well as basic concepts of vectors and analytic geometry.
Syllabus: Real number system, non-equivalency, Cartesius Coordination System, mathematic induction, Function and Limit, Continous Function. Differential including chain's rule, implicite differential, and advanced differential function. Transendent and differential Function. Applied Differential. Integral, basic integral function, Integration technic. Integral

application on cartesius and polar coordinate, undefinite. Sequences and infinite series. Spare rows and rows of positive change sign, Taylor and McLaurin series. Function of many variables and its derivatives. Maximum and Minimum. Lagrange Methods. Integral folding and its application.
Prerequisite: -
Handbook:
1. D.E.Vanberg and E.J, Purcell, Calculus with Analytic Geometry, 7th ed., Aplleton-Cen-tury-Crofts, 1996.
2. D.E.Vanberg, E.J Purcell, A.J Tromba, Calcu-lus, 9th. Prentice-Hall, 2007.
3. G.B Thomas & R.L Finney, Calculus & Analytic Geometry 9th ed., 1996, Addison-Wesley

ENGE600010
ENGE610010
BASIC CHEMISTRY
2 SKS
Learning Objectives: After attending this subject, students are capable of:
Solving quantitative chemistry problems and identifying the reason clearly and able to integrate various ideas in problem solving.
Explaining and modelling chemical and physical processes in term of molecule to define macroscopic characteristics.
Classifying the element based on the condition and bond characteristic by using table periodic as a reference.
Applying the important theory such as molecular kinetics or thermochemistry in solving general chemistry problems.
Syllabus: Matter and measurement; Atom, Molecule, Ion, and Table Periodic; Stoichiometry: Calculation with Chemical; Chemical Reaction in Solution and Stoichiometry Solution; Thermochemistry;Chemical Equilibrium; Acid and Base; Electrochemistry; Chemical Kinetics; Applied Chemistry.
Prerequisite: -
Handbook:
1. Ralph H. Petrucci, General Chemistry: Principles and Modern Applications, 8th Ed. Prentice Hall Inc. New York, 2001.
2. John McMurry, Robert C. Fay, Chemistry (3rd Ed.), Prentice Hall, 2001.
3. Raymond Chang, Williams College, Chemistry (7th Ed.), McGraw-Hill, 2003.

ENGE600003
ENGE610003
BASIC PHYSICS 1
4 SKS
Learning Objectives: Students understand the concepts and basic laws of mechanic physics and applied in a systematic and scientifically problem solving that influenced by the force, both moving or not moving objects.
Syllabus: Scale, kinematics of point objects, mechanics of point objects, law of conservation of linear momentum and energy, harmonic motion, gravity, dynamics and kinematics of rigid objects, Introduction and basic concept (pressure, thermodynamic system, state of the system, temperature), expansion, equilibrium energy (thermal state equation), heat transfer, ideal gas, first law of thermodynamics, enthalpy and entropy, The first law of thermodynamics application for open and closed system, Second law of thermodynamics, kinetic theory of ideal gas. **Practical of Mechanics**: Measurement, Moment of inertia, Gravity acceleration, Fluid density, Scratch coefficient, Collision, Swing torque, Viscosity of water, Young's modulus, Viscosity of Newtonian fluid, Fluids surface tension, Oscillation, **Practical of Heat**: Coefficient of linear expansion, Heat conductivity, Thermocouple calibration, Calorimeter, Joule Constant, Laplace Constant, Heat Collector, Determining of air Cp/Cv, Expansion of fluids and water anomaly.
Prerequisite: -
Handbook:
1. Halliday.D, R Resnick, Physics I, 4th ed Wiley 1991.
2. Ganijanti AS, Mekanika, Penerbit Salemba Teknik, 2000.
3. Tipler PA, Fisika I, ed III, terjemahan Lea Prasetio, Penerbit Erlangga, 1998.
4. Giancoli D.C, General Physics, Prentice Hall Inc, 1984.
5. Sears-Salinger, Thermodynamics, Kinetic theory and statistical thermodynamics, Wesley, 1975.
6. Giancoli, D.C, Physics: principles with applications, Prentice Hall Inc, 2000

ENGE600002
ENGE610002
LINEAR ALGEBRA
4 SKS
Learning Objectives: Students can explain/understand/apply linear algebra and associate this subject with some other subjects.
Syllabus: Introduction of elementary linear algebra, Matrix, Determinant, Vectors in R2 and R3. Euclideas vector space, General vector space, Review of vector space, Product space, Value and diagonalization eigen vector, Linier Transformation, Application on the system

of differential equation, Application on the quadratic surface, Decomposition of LU, Least Squares.
Prerequisite: -
Handbook:
1. H. Anton, Elementary Linear Algebra, 9th ed, John Wiley& Sons, 2005.
2. G.Strang, Introduction to Linear Algebra, Wellesley-Cambridge Press, 2007.

UIGE600005
UIGE610005
ISLAMIC STUDY
2 SKS
General instructional objectives: The cultivation of students who have concern for social, national and country's issues based on Islamic values which is applied in the development of science through intellectual skills.
Learning Objectives: Course participants are expected to do the following when faced with a problem or issue which they must solve:
1. Analyze the problem based on the Islamic values they adopted
2. Analyze the problem by implementing active learning stages
3. Discuss and express their thoughts and ideas by using proper and correct Indonesian language in discussion and academic writing

Syllabus: Islam history: the meaning of Islam, the characteristic of Islam, the sources of Islamic teachings, Muhammad SAW as prophet and history figure, introduction of Islam in Indonesia, the teaching essence of Islam: the basic principle of Islam teachings, the unity of Allah, worship practice in live, eschatology and work ethics, human's basic rights and obligation, social structure in Islam: sakinah mawaddah and ramhah family, the social implication of family life, Mosque and the development of Islam, zakat and the economic empowerment of the people, Islam society, Science: reason and revelation in Islam, Islam's motivation in development of science, science characteristics, source of knowledge, IDI (each Faculty and Department/Study Program)
Prerequisite(s): MPKT
Textbooks: Adjusted to topics

UIGE600006
UIGE610006
CATHOLIC STUDY
2 SKS
General instructional objectives:
1. To help deliver students as intellectual capital in implementing lifelong learning process to become scientists with mature personality who uphold humanity and life.
2. Be scholars who believe in God according to the teachings of Jesus Christ by continuing to be responsible of his faith in life in church and society.

Syllabus: Almighty God and the God teachings; Man, Morals, science technology and art; harmony between religions; Society, Culture, Politics, Law: the substance of theses studies will be addressed by integrating the four dimensions of the teachings of the Catholic faith: the personal dimension, the dimension of Jesus Christ, the dimension of the Church, and Community dimension. Dimensions are implemented in the following themes: People, Religion, Jesus Christ, the Church, and Faith in the society.**Prerequisite(s):** MPKT
Textbooks: Adjusted to topics

UIGE600007
UIGE610007
CHRISTIAN STUDY
2 SKS
General instructional objectives: Cultivating students with comprehensive Christian knowledge and teaching in the midst of the struggle and the fight of the nation while also discussing the student's participation in line with the study to help improve and build our country.
Learning Objectives:Course participants are expected to do the following when faced with a problem or issue which they must solve:
1. Analyze the problem based on the Christian values
2. Analyze the problem by implementing active learning stages
3. Discuss the problem by using proper and correct Indonesian language

Syllabus: : History (Historical terms): Status of the Bible, the existence of God and Morality, Christ the Savior, the Holy Spirit as existence reformer and outlook on the world: Faith and Knowledge of Science, Church and service, Ecclesiology, Spiritual and enforcement of Christian Human Rights and the world of ethics: Christian Ethics, Christian and worship, Christianity and politics, Christian love and social reality: Christian Organizations, Students and Service, Christian and expectations.
Prerequisite(s): MPKT
Textbooks: Adjusted to topics

UIGE600008
UIGE610008
BUDHIST STUDY

2 SKS
Syllabus: Almighty God and the God Study (Faith and piety, Divine Philosophy / Theology), Human (Human Nature, Human Dignity, Human Responsibility), Moral (Implementation of Faith and Piety in everyday life), Science, Technology and Art (Faith, Science and Charity as a unity, the Obligation to study and practice what you are taught, Responsibility for nature and environment), harmony between religion (religion is a blessing for all mankind, the essence of the religious plurality and togetherness), community (the role of religious society in creating a prosperous independent society , the responsibility of religious society in the realization of human rights and democracy), Culture (the responsibility of religious society in the realization of critical thinking (academic), work hard and fair), Politics (Religion contribution in the political life of nation and country), Law (Raise awareness to obey and follow God's law, the role of religion in the formulation and enforcement of law, the function of religion in the legal profession)
Prerequisite(s): MPKT
Textbooks: Adjusted to topics

UIGE600009
UIGE610009
HINDU STUDY
2 SKS
Syllabus: Character, History (Character in Hindu religion, Hindu history), Source and scope of Hinduism (the Veda as the source of Hindu religion teachings, the scope of the teachings in Hindu religion), The concept of the God (Brahman) according to the Veda, the Path to Brahman (Catur Marga Yoga, Mantra and Japa), Human Nature (The purpose of human life, Human's duties, obligations, and responsibilities both individually or collectively), Ethics and morality (Principles teaching, self-control), in-depth understanding of the scripture (deep understanding of the Bhagawadgita, deep understanding of the Sarasamuschaya), The Role of Hinduism in science, technology, and art (Hinduism benefits in science and technology in accordance with each department, benefit / the role of Hinduism in the arts), Cohesion and community's prosperity /independence (Benefits of unity in the religious plurality, independent community (kerthajagathita) as a common goal, Tri Pitakarana), Culture as an expression of Hindu religious practice, Contribution to the Hindu religion teachings in the political life of nation and country, laws and the enforcement of justice, Awareness of and obeying the Rita / Dharma.
Prerequisite(s): MPKT
Textbooks: Adjusted to topics

ENGE600004
ENGE610004
BASIC PHYSICS 2
4 SKS
Learning Objectives: Students understand the concept and basic law of Magnet and Electricity physics and apply it systematically and scientifically in solving everyday magnet and electricity physics problem, can understand the concepts and basic law of Optical and Wave physics and apply systematic and scientific problem solving in a natural wave phenomenon or wave that arises due to technical, physical properties of light and geometric optics.
Syllabus: Electric charge and Coulomb law, Electric field, Static and Gauss law, Electric potential, Capacitor, Direct electric current and basic circuit analysis, Magnetic field, Induction and electromagnetic, Faraday law and inductance, Material magnetism properties, A series of transient, Alternating current, Waves, Sounds, Polarization, Interference, Diffraction, Optical geometry, Lighting and photometry. Practical of Electricity: Electrolysis, Wheatstone bridge, Kirchhoff law, Earth's magnetic field, Temperature coefficient, Characteristic of series RLC circuit, Ohm law, Transformer. Practical of Optics: Polarimeter, Lens, Photometry, Prisms bias index, Spectrometer, Diffraction grid, Newton's ring.
Prerequisite: -
Handbook:
1. Halliday, D, R. Resnick, Physics II, 5th ed, Wiley, 2001.
2. Ganijanti AS, Gelombang dan Optik, ed III, Jurusan Fisika FMIPA UI, 1981.
3. Tipler P.A, Fisika II, ed III terjemahan Bambang Sugiyono, Penerbit Erlangga, 2001.
4. D.C.Giancoli, General Physics, Prentice Hall

UIGE600003
UIGE610003
SPORTS / ARTS
1 SKS
The Art subject discuss on how to develop the student's participation and appreciation to fully understand, develop awareness, have aesthetic concerns, have imagination, have creativity to create work of art and culture in the form of art works such as: painting, batik, photography, calligraphy, comic or in the form of performance art such as: film appreciation, Bali dance and music, Javanese music, theatre

and traditional puppet performance. The Sport subject discuss the general knowledge of sport (history, rules of the games and how to lead a match) and sport skills (physical aspects of movement, technique, tactics and mentality)

ENGE600005
ENGE610005
STATISTICS AND PROBABILITY
2 SKS

Learning Objectives: Provide basic skills to students for being able to handle the data/. quantitative information, from descriptive phase, including collecting, organizing, and presenting, to the inductive phase including hypothesizing and making a conclusion based on existing data and variable connection.

Syllabus: Descriptive statistics, probability, probability distribution, random variable, descrete probability distribution, continous probability distribution, sampling distribution, estimation, one and two sample test of hypothesis, simple linear regression, applied statistics in engineering.

Prerequisite: -

Handbook:

1. Harinaldi, Prinsip-prinsip Statistik Untuk Teknik dan Sains, Erlangga, 2006.
2. Devore, J.L., Probability and Statistics for Engineering and The Sciences (5th Ed.), Duxbury, 2000
3. Barnes J.W, Statistical Analysis for Engineers and Scientists, a Computer- Based Approach, McGraw-Hill, 1994
4. Donald H.S, Statistics, A First Course (6thEd), McGraw-Hill, 2001
5. Walpole, Ronald E, Probability & Statistics for Engineers & Scientist, 8th Ed, Pearson Prentice Hall, 2007.

ENGE600007
ENGE610007
ENGINEERING ECONOMICS
3 SKS

Learning Objective(s): Course participants are able to use and implement cost concept and analysis when evaluating a proposed engineering solutions or projects.

Syllabus: Introduction to engineering economics, Equivalent, Net Present Value, Yearly Net Present Value, Return Analysis, Replacement Analysis, Cost Benefit Analysis, Payback Period, Depreciation, Tax,

Pre-requisite(s): Introduction to Economics

Text Book(s):

1. Blank, Tarquin, Engineering Economy, McGraw-Hill, 2011.

ENGE600008
ENGE610008

HEALTH, WORK SAFETY, AND ENVIROMENT
2 SKS

Learning Objectives: Able to identify various types of hazards, characterization, proposes a method which is suitable for risk reduction and mitigation and safety management system design. Able to increase awareness of health and safety industry, and understand the regulatory framework and standard of safety and enviromental programs.

Syllabus: Introduction to Regulation and Standards; Risk Perception, Assessment and Management; Machinery Hazards; Noise Hazards; Process Safety Hazard; Fire and Explosion Hazard; Electrical Hazard; Toxicology in The Workplace; Environmental Protection; Environmental Protection Control Processes; Hazard Communication to Employees; Personal Protective Equipment (PPE): Types of PPE and Selection of PPE; Safety Audits, Incident and Emergency Planning.

Prerequisite: -

Handbook:

1. Charles A. Wentz, Safety, Health and Environ-mental Protection, MGH, 1998.
2. Asfahl, C.R., Rieske, D.W., Industrial Safety and Health Management, 6th Ed., Pearson Education, Inc. 2010.
3. United Kingdom – Health and Safety Executive.
4. Undang-undang dan Peraturan Nasional terkait dengan Sistem Manajemen K3 dan Lingkungan.
5. Related Journal, standards and Publications.

ENCV600001
ENCV610001
ADVANCED CALCULUS
3 SKS

Learning Objectives: After following this subject, students will understand basic calculus concepts, ordinary differential equations and partial differential equations and skills to solve applied problems

Syllabus : Lines and Lanes, Vector Calculus,Ordinary Differential Equations, Lap;ace Transformation, Partial Differential Equations

Prerequisites :

Text Books:

1. D.E Vanderg and E.J Purcell, Calculus with Analytical Geometry, 9th ed., Addison Wesley, 1996
2. D.E.Vanderg and E.J. Purcell, Calculus, Prentice Hall, 1997
3. E. Kreyzig, Advanced Mathematical Engineering, Johnwiley & Son, 1997
4. Boyce Diprima, Element Ordinary Differential

Equations and Boundary Value Problems, Wiley, 1992
5. C. Ray & C.B. Loise, Advanced Mathematical Engineering, Mc Graw, 1998

ENCV 6 0 0002
ENCV 6 1 0002
INTRODUCTION TO CIVIL ENGINEERING SYSTEM
3 SKS

Learning Objectives: Provide understandings to students concerning civil engineering system (and the environment), and introduce to student concerning the process of engineering design, including communicating the results.

Syllabus: Engineering Analysis and Design, Design Process, Design Documentation, and construction technology by using the approach of Case Based Programs, in the form of the urban settlement environment (development of case examples of Eng. Drawing subjects). Content: civil infrastructure system; Transport, Drainage, Sanitation, Garbage, Clean Water, Energy & Telecommunications, Fasos-Fasum (constructions and relevant facilities, example: education, religious services, entertainment, government), Open green areas, Commercial.

Prerequisites: None

Text Books:
1. R.S. Narayanan, A.W. Beeby, *Introduction to Design for Civil Engineers*, Spon Press, 2000
2. Bughardt, *Introduction to Engineering Design and Problem Solving*, McGraw Hill, New Jersey, 1999
3. Mario Salvadori, *The Art of Construction: Projects and Principles for Beginning Engineers and Architects*, Independent Publishers Group, 1990
4. Augustine J. Fredrich, *Sons of Martha: Civil Engineering Readings in Modern Literature*, American Society of Civil Engineers (ASCE Press), 1989
5. Matthys Levy and Richard Panchyk, *Engineering the City*, Independent Publishers Group, 1990

ENCV 6 0 0003
ENCV 6 1 0003
STATICS
4 SKS

Learning Objectives:
1. Students are expected to be able to understand the basics of mechanics concerning force, action, reaction, and internal force in various statically determinate structures.
2. Able to calculate and construct internal force diagrams in various statically determinate structures and able to calculateand construct influential lines of statically determinate structures caused by moving loads upon them.

Syllabus : General knowledge of forces, force characteristics; calculating force resultants, composition of several forces, force analysis, force balance using analysis and graphics; Identification of various structure types; Definition of force in a structure plane, analyzing and calculating placement reactions and internal forces in statically determinate structures (simple beams, cantilever beams, beams with changeable positions, Gerber beams, beam with indirect loads, portals, three hinged portals, hanging structures and supports); Analyzing and calculating truss forces in beam structures and beam framework spaces. Description of influential lines for statically determinate structures; Analyzing and calculating influential line equations for placement reactions and internal forces in a statically determinate structure plane, as well as calculating maximum value of forces in a structure plane caused by moving loads acting upon them

Prerequisites: Physic, Advanced Kalkulus

Text Books :
1. Hibbeler, R.C., Engineering Mechanics Statics, Prentice Hall, 1998
2. Hibbeler, R.C., Structural Analysis, Prentice Hall, 1998

ENCV 6 0 0004
ENCV 6 1 0004
FLUIDS MECHANICS (2+1)
3 SKS

Learning Objectives:
1. Be able to analyze fluid pressure distribution at a given static situation to be applied for load calculation of structure stability of civil building
2. Be able to analyze fluid in motion to be applied for calculation of total flow and the induced dynamic forces

Syllabus : The most important basic science in civil engineering is mechanics knowledge. This knowledge can be separated into material mechanics and fluid mechanics. The mechanics of fluids lectures provide basic formulation of motion and body forces that cannot be perceived as a completely integrated fluid, such as wind and water. This knowledge is the basis for all off subjects in water resources engineering; e.g. advanced hydraulics, hydrology, Design of water infrastructure, ground water resources, water surface management and development, etc.

Up to midterm test, the material will include fluid statics covers definition of pressure, pressure distribution, as well as application of the fundamental equation to determine the force due to water pressure in various civil structure engineering. In the next half semester, the topics will discuss about fluids in motion, starting from

conceptualization of eulerian motion and the application in mass conservation law, momentum, and energy to calculate the magnitude of total flow and dynamic force. The total flow and force are the basic design for hydraulic structure or civil building structure.
Prerequisites : Physics, Calculus
Text Books :
1. Wiggert, D.C., Potter, M.C., "Mechanics of fluids", 2nd edition, (1997)
2. Bruce R. Munson, Donald F. Young, Theodore H. Okiishi, "Fundarmentals of Fluid Mechanics", 5th edition, (2005)

ENCV 6 0 0005
ENCV 6 1 0005
MATERIAL PROPERTIES (2+1)
3 SKS
Learning Objectives :
Provide understandings concerning important elementary and practical aspects of materials in the civil engineering field
Syllabus : Particulate Materials, Aggregates, Portland Cement and Portland Concrete Cement, Structural Steel, Asphalt Cement and concrete asphalt, wood, plastic and polymer, Concrete Fibers
Prerequisites :
Text Books :
1. S. Young, Sidney, The Science and Technology of Civil Engineering Materials, Prentice-Hall International Inc., 1998
2. Shan Somayaji, 2001, Civil Engineering Materials, Prentice Hall.
3. Robert D Kerbs, Richad D Walker, (1971) Highway Materials, Mc Graw-Hill

ENCV 6 0 0006
ENCV 6 1 0006
BUILDING CONSTRUCTION
4 SKS
Learning Objectives:
1. Students understand the symbols of engineering drawing in Civil Engineering, have ability to draw the civil structures such as simple buildings (up to 2 stories), waterworks, sewage treatment construction, geotechnical construction (foundation, retaining wall), roads, and bridges.
2. Students are able to calculate the building quantity, the unit prices and cost estimate.
3. Students are also able to present the image and design of these buildings, both orally and in writing

Syllabus : Introduction to SAP, Introduction to Engineering Drawing, Functions and usefulness of drawing in the design and production processes; The introduction of drawing tools, drawing paper format, standards, lettering, leader, and scale; Geometric Construction; Multi-View Drawings; Oblique projections; Section Views; Dimensioning and Tolerance; Wood Construction (Roof and Bridge Construction, etc..); Structural Steel Drafting (Construction Roofing, Bridge and Factory); Concrete Construction (example: Foundations, Building Construction, Rigid Pavement Road and Bridges, Dams, etc..) Electrical Installations; Welding; Piping and Plumbing Drawings; Topographic Mapping; Understand the scope of disciplines of Civil Engineering and introducing Civil Construction structures, understand and draw the structure of simple building (two stories), waterworks, sewage treatment building, ground, foundation, retaining wall, the structure of roads and bridges as well as calculating the cost of construction.
Prerequisites :
Text Books:
1. Neufret, Ernst, *Data Arsitek Jilid 1 dan 2*, Penerbit Erlangga, Jakarta, 1989
2. Subarkah, Imam, *Konstruksi Bangunan Gedung*, Penerbit Idea Dharma, Bandung, 1988
3. Sugiharjo, R., *Gambar-Gambar Dasar Ilmu Bangunan Jilid 1 dan 2*, Penerbit R. Sugihardjo B.A.E., Yogyakarta, 1975
4. Z., Zainal, *Membangun Rumah: Rencana dan Bahan-Bahan yang Dipakai*, Penerbit PT Gramedia, Jakarta, 1980
5. Frick, Heinz, *Ilmu Konstruksi Bangunan 1*, Penerbit Kanisius, Yogyakarta, 1980. ISBN 979-413-190-3
6. Frick, Heinz, *Ilmu Konstruksi Bangunan 2*, Penerbit Kanisius, Yogyakarta, 1980. ISBN 979-413-190-3
7. Soemadi, R., *Diktat Kuliah: Kontruksi Pembangunan Gedung-Gedung Jilid 2*, Penerbit R. Soemadi, Bandung, 1977
8. Subarkah, Imam, *Konstruksi Bangunan Gedung*, Penerbit Idea Dharma, Bandung, 1988
9. Supribadi, I Ketut, *Ilmu Bangunan Gedung: Seri Praktis Bangunan Sipil A*, Penerbit Armico, Bandung, 1986
10. Panduan Green Infrastructure, 2001
11. Panduan dan Buku Pengetahuan Dasar Komputer
12. Standar Nasional Indonesia (SNI) tentang Konstruksi Bangunan
13. Presentasi (MS Powerpoint) rangkuman dari dosen
14. Referensi situs/laman terkait

ENCV 6 0 0007
ENCV 6 1 0007
SURVEYING
3 SKS
Learning Objectives : Students are expected to understand the use of soil parameters in relation to the calculation the strength and stability of soil for building/simple civil engineering

construction mapping out survey results as well as utilizing these methods in general civil engineering works
Can be able to use measuring instruments in the field during a practicum and implement a measurement map to the field in civil engineering activities
Syllabus : Explanation of land surveying concept in civil engineering work and mistake theory; introduction to distance, angle and other measuring tools which are usually used in mapping and civil engineering work, description of horizontal distance, vertical distance, and angle measurement methods; description of basic concepts of mapping, width measurement, calculation of volume. Usage of measuring tools, flat sipat and Theodolite for field data acquirement and implementation of measurement results to the field in civil engineering activities
Prerequisites :
Text Books:
1. Barry F. Kavanagh, Surveying: with Construction Application, Prentice Hall, New Jersey,1997
2. Russel C. Brinker, Paul R. Wolf , Elementary Surveying, Harper & Row.
3. Sinaga, Indra, Pengukuran dan Pemetaan Pekerjaan Konstruksi, LP4, Pustaka Sinar Harapan, 1995
4. Irvine, William, Surveying for Construction, McGraw-Hill

ENCV 6 0 0008
ENCV 6 1 0008
SOLID MECHANICS
4 SKS
Learning Objectives: By the end of this subject-student are expected to be able to calculate various internal forces (axial, shear, flexural moments and torsional forces), stress and strains occurred due to internal forces of cross sections of simple elastic member by considering the characteristics and laws of mechanical materials and its combination and be able to calculate beam deflections and column elastic buckling columns

Syllabus : Material properties; stress and axial deformation of statically determined structures; stress and axial deformation of statically indetermined structures, flexural stress of beam; stress and torsional deformation of statically indetermine structures; analysis and design of elastic stress due to loads combinations; stress and strain transformation; yield criteria and failure criteria of elastic buckling; beam deflection; understanding elastic buckling theory and can be able to use it in steel column design
Prerequisites : Static and Physic
Text Books:
1. Hibbeler, R.C., Mechanics of Materials, 8/e, Pearson, 2011
2. Egor P. Popov (Author), Engineering Mechanics of Solids (2nd Edition), Prentice Hall, 1998
3. Beer, F. and Johnston, P., Mechanics of Materials, 6/e. Mc Graw Hill, 2011
4. Gere, J.M. and Timoshenko, S.P. (1997). Mechanics of Materials, 4th ed., PWS Publishing Co., Boston, Mass.
5. Vable, M., Mechanics of Materials, http://www.me.mtu.edu/~mavable/MoM2nd.htm
6. JAMES M. GERE , MEKANIKA BAHAN 1 ed.4, Penerbit Erlangga, Kode Buku: 37-01-010-6 Tahun: 2000
7. JAMES M. GERE , MEKANIKA BAHAN 2 ed.4, Penerbit Erlangga, Kode Buku: 37-01-010-7 Tahun: 2002

ENCV 6 0 0009
ENCV 6 1 0009
BASIC SOIL MECHANICS (2+1)
3 SKS
Learning Objectives : Students are expected to understand the use of soil parameters in relation to the calculation the strength and stability of soil for building/simple civil engineering construction
Syllabus : Engineering geology and soil properties ;Definition of the science of geology, geotechnical engineering with other disciplines/civil; Topographic maps and geomorphology; Definition and meaning of topographic units and equipment; Kind of structure of geology; Identification and influence of coating, stocky, faults, inconsistency of the construction; Weathering and soil movement; Introduction of variety, processes, and identification of weathering; Geological and Geotechnical maps; Analysis of basic topography map; Criteria of geotechnical and geological map; Soil properties;
Soil as a three-phase material; Physical characterization of soil; Atterberg limit; Theory of compaction and CBR; Permeability and introduction to seepage, flow line; Theory of stress and effective stress; Effective stress reactions due to changes in total stress in fully saturated soil; Soil shear strength test in the laboratory between sand and clay; Consolidation theory and its test;

Critical state of soil mechanics.
Prerequisites : Engineering Geology and Soil Property
Text Books :
1. Muni Budhu, Soil Mechanic& Foundations,
2. AASHTO: Guide for Design of Pavement Structures, 1993
3. Yoder, EJ, Witczak M.W: Principles of Pavement Design, second ed. John Willey

ENCV 6 0 0010
ENCV 6 1 0010
CIVIL ENGINEERING SYSTEM

3 SKS
Learning Objectives:
1. The students are able to develop basic design of the alternative plans or the solutions of civil engineering problems based on problem formulation through literature study and field survey.
2. The students are able to do the basic study of the proposed project design based on field observation

Syllabus : Introduction to the problem formulation and finding the solutions of civil engineering problems, introduction to the quantitative tools for planning and management of civil engineering system
Prerequisites : Introduction to Civil Engineering System
Text Books :
1. Dale D Meredith, Kam W Wong, Ronald W Woodhead, Robert H Worthman (1975), Design & Planning of Engineering Systems, Prentice Hall
2. C Jotin Khisty, Jamshid Mohammadi, (2001), Fundamental of System Engineering with Economics, Probability, and Statistics, Prentice Hall
3. M David Burghardt, (1999), Introduction to Engineering Design and Problem Solving

ENCV 6 0 0011
ENCV 6 1 0011
ADVANCED CHEMISTRY
2SKS
Learning Objectives: This subject covers applied chemistry in the environment for civil engineers. The first part of course will focus on chemistry in individual system and the second part of course will focus on the impact of built environment to chemical equilibrium and vice versa
Syllabus : Concepts of chemical cycle in the environment : Equilibrium – Disturbed Equilibrium; Aquatic Chemistry; Soil chemistry; Atmospheric chemistry; Material chemistry; Impact of built environment to the chemical equilibrium; Impact of chemical cycle to the built environment
Prerequisites :
Text Books:
1. Haimei Zhang, (2011), Building Materials in Civil Engineering

ENCV 6 0 0012
ENCV 6 1 0012
SUSTAINABLE BUILT ENVIRONMENT
2 SKS
Learning Objectives: Students are able to apply the basic principles of natural systems and the built environment as well as concept of sustainable development to civil engineering including to design Civil Buildings with the concept of green building and sustainability
Syllabus : Principles of natural environmental systems and life cycle (cycle of matter and energy, hydrological cycle, food chain); Basic Principles of the built environment system and its impact on the natural environment and life cycle system (social system, ecosystem, build environment, the concept of niche, power capacity and resilience); Impact of development sector and infrastructure on the natural environment; Agenda 21 and environment-based development (global / national / local Agenda, social, environment and economic pillars in development); Sustainability concept of Civil Engineering (zero waste, efficiency, hierarchy waste management, waste and pollution carrying capacity of the environment, sustainable consumption and production); concept of Green Building (LEED) Green Building Criteria: Sustainable sites (EIA); Water efficiency: Energy and atmosphere; materials and natural resources; Innovation and design process; Green Building concept Strategy: Example of Green Building concept in Indonesia, and other nation; Environmental Law and other regulations, ISO 14001
Prerequisites :
Text Books:
1. G. Tyler Miller, Jr. SUSTAINING THE EARTH, An Integrated Approach. 6th edition, Thomson Learning Inc. 2004. ISBN. 0-534-40086-8
2. ASHRAE, GREEN GUIDE, The Design, Construction, and Operation of Sustainable Buildings, 2nd edition, 2006, American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc, ISBN 1-933742-07-0
3. William J. Mitsch and Sven Erik Jorgensen, ECOLOGICAL ENGINEERING AND ECOSYSTEM RESTORATION, 2004, John Willey & Sons, Inc, ISBN 0-471-33264-X.
4. Benny Joseph, ENVIRONMENTAL STUDIES, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005, ISBN 0-07-059092-3
5. Lester R. Brown. 2008. Plan B 2.0: Mobilizing to Save Civilization. W. W. Norton & Co. New York. USA.
6. Herbert Girardet. 2008. Cities People Planet: Urban Development and Climate Change. John Willey & Sons, Ltd. Chicester. UK.
7. Juliet B. Schor and Betsy Taylor. 2002. Sustainable Planet: Solutions for the Twenty-First Century. Becon Press. Boston. USA.
8. Anthony MH Clayton & Nicholas J Radcliffe. 1996. Sustainability: a System Approach. Westview Press, Inc. London. UK.
9. Philip A. Lawn. 2001. Toward Sustainable Development: An Ecological Economics Approach. Lewis Publishers. Washington, DC
10. James L. Sipes. 2010. Sustainable Solution for Water Resources: Policies, Planning, Design, and Implementation. John Willey & Sons, Inc. Canada

ENCV 6 0 0013
DYNAMICS
2 SKS

Learning Objectives: students should be able to do calculations of kinematics and kinetics of particles and rigid bodies and calculate natural frequency and free vibration and forced vibration responses of mechanical vibration without damping

Syllabus : Particles kinematics, particle kinetics using Newton's 2nd Law approach, particles kinetics using energy and momentum approach, kinematics of rigid bodies, motion of rigid bodies using force and acceleration approach, plane motion of rigid bodies using energy and momentum approach, mechanical vibration without damping with free vibration and forced vibration

Prerequisites : Statics

Text Books:

1. Ferdinand P Beer, Vector Mechanics for Engineers, Dynamics, 7th ed. Mc Graw Hill, 2004
2. R.C. Hibbeler, Engineering Mechanics: Staticand Dynamics, Prentice Hall, USA, 1998

ENCV 6 0 0014
ENCV 6 1 0014
CONSTRUCTION MANAGEMENT
3 SKS

Learning Objectives:

At the end of the course, students are expected to be able to:

1. Understand the concept and process of construction projects management starting from planning stage, execution stage, and project hand over.
2. Identify the planning process and implementation of project management techniques in terms of cost, time, and quality of the project.
3. Understand the construction law and legal aspect of construction project

Syllabus : Construction project knowledge inclulding: Project Planning; Bidding documents preparation; Legal aspect and contract administation; Construction planning; Construction execution; Monitoring & Controlling; Material Management; Quality Management; Project Cost Management; Time Management; Health, Safety, and Environmental Management; Resource Management; Project Organization and Stakeholder Management

Prerequisites :

Text Books:

1. Harold Kerzner phD (1997), Sixth Edition, Project Management A System Approach to Planning, Scheduling , and Controlling
2. PMBOK Guide, A Guide to The Project Management Body Of Knowledge, PMI.
3. European Construction Institute, Total Project Management of Construction Safety, Health and Environment, Thomas Telford, London,1995
4. Clough, R. H., Sears, G. A. and Sears, S. K., Construction Project Management, 4th ed., John Wiley & Sons Inc., New York, 2000
5. Holroyd, T. M., Site Management for Engineers, Thomas Telford, London, 1999
6. Michael T. Callahan, Daniel G. Quakenbush, and James E. Rowing, Construction Planning and Scheduling, McGraw-Hill Inc., New York, 1992.
7. Ritz, G., J. (1994). Total Construction Project Management, McGraw-Hill, Inc
8. Ahuja, H. N., Successful Construction Cost Control. New York, John Wiley and Sons.
9. Gould, F. E. (1997). Managing the Construction Process (Estimating, Scheduling and Project Control). New Jersey, Prentice Hall.
10. Halpin, D., W. (1998). Construction Management. USA, John Wiley and Sons, Inc
11. Hendrickson, C., Project Management for Construction. Fundamental Concepts for Owners, Engineer, Architects, and Builders. Singapore, Prentice Hall.

ENCV 6 0 0015
ENCV 6 1 0015
STRUCTURAL ANALYSIS
3 SKS

Learning Objectives: Analysing statically indetermined structural responses of truss, beams and frame affected by external loads, temperature change and degradation of placement. Influence lines of statically indetermined structures.

Syllabus : Introduction, beam deflection,statically indetermined structural analyses of truss, beam and frame using the Consistent Deformation method, Three Moment Equation method, Slope Deflection method, Moment Distribution method and Slope Deflection method

Prerequisites : Static, Material Property and Solid Mechanics

Text Books :

1. Hibbeler,R.C., *Structural Analysis*, Prenice Hall, 1998
2. Aslam Kassimali, *Structural Analysis*, Third Edition, Thomson, 2005
3. Ghali A., A.M. Neville, *Structural Analysis : A unified Classical and Matrix Approach*, 4th ed., Thompson pub., 1997
4. West, H.H., L.F. Geschwindner, *Fundamental of Structural Analysis* , John Wiley & Sons, Inc., 1993
5. Chu Kia Wang , *Statically Indeterminate Structures*, McGraw-Hill Book Co. International Edition, New Jersey, 1952

ENCV 6 0 0101
ENCV 6 1 0101
CONCRETE STRUCTURAL DESIGN 1
3 SKS

Learning Objectives: After attending this class, students will understand about design concepts,load applied on structures, structural systems and be able to design structural members from reinforced concrete according to procedures and design standards.

Syllabus: Introduction to structural system analysis and design, design steps, LRFD, reduction factor and allowable stress; Loads and Loading: Load Forms, load types, location of loads, load distribution, load factor and load combination; Structural systems for concrete structures; Materials and cutting properties of reinforced

Prerequisites : Material Property, Solid Mechanics

Text Books:
1. ________________, Tata Cara Penghitungan Struktur Beton untuk Bangunan Gedung, SKSNI T-15-1991-03, Yayasan Lembaga Penyelidikan Masalah Bangunan, Bandung, Dep. Pekerjaan Umum ,1991.
2. ________________, Tata Cara Perencanaan Struktur Beton untuk Bangunan Gedung, Draft Standar, SKSNI-03-xxxx-2001, Badan Standarisasi Indonesia, 2001
3. **Mac Gregor, J.G., Reinforced Concrete: Mechanics and design, 3rd edition, Prentice Hall, 1997**
4. Wahyudi , Syahril A.Rahim, Struktur BetonBertulang, Penerbit Gramedia, 1997

ENCV 6 0 0201
ENCV 6 1 0201
SOIL MECHANICS (2+1)
3 SKS

Learning Objectives: Students are expected to understand the use of soil parameters in relation to the calculation the strength and stability of soil for building/simple civil engineering construction

Syllabus: Bearing capacity of the soil: Allowable bearing capacity and Ultimate bearing capacity due to inclination and eccentricity of load; One-dimensional elastic settlement and consolidation settlement; Seepage through dam; Stress distribution in the soil; A point load, distributed load, Strip, circle, and square area of footing using Fadum and Newmark theories; Lateral earth pressure : Rankine and Coulomb theories; Structure design of earth retaining wall, gravity wall, cantilever wall, earth retaining cantilever wall; Slope stability : concept of slope stability, undrained analysis, slice method, introduction of Fillenius method, Bishop method.

Prerequisites : Basic Soil Mechanics

Text Books:
1. Muni Budhu, Soil Mechanic& Foundations,
2. AASHTO: Guide for Design of Pavement Structures, 1993
3. Yoder, EJ, Witczak M.W: Principles of Pavement Design, second ed. John Willey

ENCV 6 0 0301
ENCV 6 1 0301
PAVEMENT DESIGN
3 SKS

Learning Objectives: Student is able to explain the concept of highway pavement design which cover type of highway pavement, design of pavement, analyze of pavement materials based on laboratory testing
Student is able to identify pavement distresses and its repair maintenance processes

Syllabus : Type of pavement, structure and function of structural layers; soil stabilization for subgrade pavement; type of asphalt concrete material testing and analysis of laboratory testing results; job mix formula and mix design of asphalt concrete; laboratory works; Introduction to asphalt mixing plant type, operations and production; Design criterion and method for highway flexible pavement based on emprirical and analytical approaches, pavement design based on Bina Marga method and AASHTO method; design of highway pavement stages construction; Design of rigid pavement, rigid pavement type; and type of joints; Highway pavement maintenance strategy; type of distresses, method of observation of distress types; type of maintenance and repair

Prerequisites :

Text Books:
1. J.G. Schoon (1993) : Geometric Design Project for Highway, ASCE
2. Direktorat Jendral Bina Marga (1997) : Standar Perencanaan Geometrik Jalan Luar Kota
3. Direktorat Jendral Bina Marga (1992) : Standar Perencanaan Geometrik Jalan Luar Kota
4. Direktorat Jendral Bina Marga (1990) : Petunjuk Desain Drainase Permukaan Jalan
5. Sudarsono DU, Konstruksi Jalan Raya, Penerbit PU
6. Guide for Desain of Pavement Structures, AASHTO, 1986
7. Standar Perencanaan Tebal Perkerasan Lentur, Bina Marga, Penerbit Departemen PU, 1983
8. AASHTO Maintenance Manual, AASHTO 1987
9. Krebs RD, Walker Richard D, Highway Material, McGraw-Hill, 1974

ENCV 6 0 0302
ENCV 6 1 0302
TRANSPORTATION SYSTEM
3 SKS

Learning Objectives: The students are able to describe the components of transportation system from various dimensions and the current issues concerning both of global and Indonesian transportation system

Syllabus : Various dimensions of transportation system (people, goods; single mode, intermodal; urban, national, regional, global; strategic, tactical, real time; public transport, private vehicles, combination; supply, demand, equilibrium; level of service, cost; land-use, transportation, environment; nodes, link, network) ; transportation system components; transportation system phase; current issues on global and Indonesian transportation system

Prerequisites:

Text Books:

1. Sigurd Grava. Urban Transportation System, Choices for Communities. Mc Graw-Hill
2. Marvin L. Manheim , Fundamentals of Transportation Systems Analysis. Vol 1 : Basic Concepts , The MIT Press.
3. W.W. Blunden, J.A. Black. The Land-use / Transport System, Pergamon Press

ENCV 6 0 0401
ENCV 6 1 0401
WATER ENGINEERING 1
3 SKS

Learning Objectives: After completing the whole studies, students are expected to be able to present the final design of a simple water infrastructure in the form of systematic written documents and are able to deliver them orally.

Syllabus : Students be able to Execute and interpret the data, Read and interpret the topography map, basic water resources, Flood Forecasting Estimation, Water Availability Assessment, water Demand Estimation and water balance

Prerequisites :

Text Books:

1. Bedient, P. B. and Huber, W. C.: *Hydrology and Floodplain Analysis*, 2nd ed., Addison-Wesley Publishing Company, 1992.
2. Chow, ven Te, et al.: *Applied Hydrology*, McGraw Hill International Editions, Civil Engineering Series, 1988.
3. USACE, Water Resources Support Center, Institute for Water Resources: *Guidelines for Risk and Uncertainty Analysis in Water Resources Planning, Volume I – Principles – With Technical Appendices.* The Greeley-Polhemus Group, Inc., *1992.*
4. Davis, C.V., et al.: *Handbook of Applied Hydraulics*, 2nd ed., McGraw Hill International Student Edition, 1952.
5. Potter, Merle C. and Wiggert, David C.: *Mechanics of Fluids*, Prentice-Hall International Inc., 1997
6. Jurnal-Jurnal Pengairan

ENEV 6 0 0009
ENEV 6 1 0009
DESIGN OF INTEGRATED SOLID WASTE MANAGEMENT
3 SKS
Refer to 108

ENEV 6 0 0011
ENEV 6 1 0011
ENVIRONMENT IMPACT ANALYSIS & ISO
2 SKS
Refer to 109

ENCV 6 0 0102
ENCV 6 1 0102
STEEL STRUCTURAL DESIGN 1
3 SKS

Learning Objectives: After attending this class, students will understand about design concepts,load applied on structures, structural systems and be able to design structural members from steel according to procedures and design standards.

Syllabus: Introduction to structural system analysis and design, design steps, LRFD, reduction factor and allowable stress; Loads and Loading: Load Forms, load types, location of loads, load distribution, load factor and load combination; Structural systems for steel structures; Materials and cutting properties of steel,work load tension, serviceability structures; Behavior of structural member with LRFD towards tension, bending and compression forces, and combination of bending and tension forces (beam-column, uniaxial) combination of bending and compression for steel structures, according to standards which apply; Connections.

Prerequisites : Structural Analysis

Text Books :

1. _________________, Tata Cara Perencanan Struktur Baja untuk Bangunan Gedung, Standar, SNI-03-1729-2021, Badan Standarisasi Indonesia, 2002
2. Segui,William T., LRFD Steel Design, ITP-PWSPublishing Co., Boston, 2003
3. Manual of Steel Construction, Load Resistance Factor Design, Structural Members, Spesification & Codes Volume 1
4. Manual of Steel Construction, Load Resistance Factor Design, Structural Members, Spesification & Codes Volume 2
5. Steel Design Hand Book, LRFD Method, Akbar R Tamboli, Mc Graw Hill, 1997

ENCV 6 0 0103
ENCV 6 1 0103
CONCRETE STRUCTURAL DESIGN 2
3 SKS

Learning Objectives: Students should be able to understand flexural and non-flexural behaviours and combination of compression and biaxial bending of structures and slabs, shear walls, high beams, reinforced concrete foundations and retaining walls and to able to design structures using ultimate strength based on SNI (Indonesian National Standards).

Syllabus : Material behaviours; flexural and non-flexural behaviours; strut-and-tie modeling, shear, torsion, bond and bond length: Continuous beam design, Slab and floor system: two-way slabs with or without beams, direct design and portal equivalent, Yield Line Analysis: Column Designs: interaction diagram of square and circular column, biaxial bending, slender frame and column (braced and unbraced), moment magnification factor and P-δ effect analysis, shear on columns; shear walls and high beams; Frame design analysis, detailing, beam-column connection, corbel and bearing; Foundations and footings; Durability and fire resistance; Introduction to pre-stressed concretes.

Prerequisites: Concrete Structural Design 1

Text Books :

1. Mac Gregor, J.G., Reinforced Concrete : Mechanics and design, 3rd edition, Prentice Hall, 1997
2. Warner RF, Rangan BV., Hall, AS., Faulkes, KA., Concrete Structures, Addison Wesley Longman. 1998
3. Nawi, E.G., Reinforced Concrete : A Fundamental Approach. 3rd edition, Prentice-Hall, 1996
4. -----------------, Tata Cara Perencanaan Struktur Beton untuk Bangunan Gedung, Draft Standar, SKSNI-03-xxxx-2001, Badan Standarisasi Indonesia, 2001
5. Lin., T.Y. & Burns, H.H., Design of Presstressed Concrte Structures, Third Edition, John Wiley & Sons

ENCV 6 0 0202
ENCV 6 1 0202
FOUNDATION ENGINEERING
3 SKS

Learning Objectives:

1. To understand fundamentals of soil mechanics required in analysis and design of deep foundations and deep retaining structures
2. To analyze and design deep foundations (e.g., driven piles, bored piles) and to understand construction aspects of this type of geotechnical structures
3. To understand fundamentals of pile loading tests, including axial compression, lateral, and high-strain dynamic
4. To analyze and design deep retaining structures (e.g., sheet piles, cantilever or with simple strut) and to understand construction aspects of this type of geotechnical structures

Syllabus : Soil properties requried in analysis and design of deep foundations and deep retaining structures. Deep foundations: construction methods and materials, axial compression capacity, settlement, lateral capacity, lateral displacement, pile loading tests, introduction to structural design. Deep retaining structures: construction methods and materials, analytical and design methods

Prerequisites : Soil Mechanics

Text Books:

1) Bowles, J.E., *Foundation Analysis and Design*, Int.Student Edition, McGraw-Hill, Kogakusha, Ltd., Japan, 1988
2) Coduto DP., *Foundation Design*, Prentice Hall, Inc.,1994
3) Poulos, H.G & Davis, E.H., *Pile Foundation Analysis and Design*, John Wiley & Sons, Inc., 1980.
4) Prakash S & Sharma HD., Pile foundation in Engineering Practice, John Wiley $ Sons, 1990
5) Tomlinson M. dan Woodward J. (2007). Pile Design and Construction Practice, 5th Ed., Taylor & Francis, Oxon, UK. [T&W]
6) Reese L.C., Isenhower W.M. dan Wang S.-T. (2006). Analysis and Design of Shallow and Deep Foundations, John Wiley & Sons, Inc., Hoboken, USA. [R,I,W]
7) Fleming K., Weltman A., Randolph M., and Elson K. (2009). Piling Engineering, 3rd Ed., Taylor & Francis, Oxon, UK. [F,W,R,E]

Journal

1) ASCE, journal of geotechnic and geomechanics
2) Canadian geotechnical journal

ENCV 6 0 0303
ENCV 6 1 0303
ROAD GEOMETRIC DESIGN
3 SKS

Learning Objectives : Student is able to design simple highway geometric considering economic, environmental issues, comfort and safety principles

Syllabus : Introduction to Indonesia norms, standards, codes and manuals for geometric design; Highway classification and functions ; Design criteria and control : vehicles, drives, capacity, safety, environmental and economic factors ; Design elements : sight distance, horizontal alignment, vertical alignment, cross section, right of way, lanes, curb, median, pedestrian and bicycle facilities ; Cut and fill, drainage design for raod; Stacking, out, road lighting ; Project work : a complete set of road geometric design

Prerequisites :

Text Books:

1. J.G. Schoon (1993) : Geometric Design Project for Highway, ASCE
2. Direktorat Jendral Bina Marga (1997) : Standar Perencanaan Geometrik Jalan Luar Kota

3. Direktorat Jendral Bina Marga (1992) : Standar Perencanaan Geometrik Jalan Luar Kota
4. Direktorat Jendral Bina Marga (1990) : Petunjuk Desain Drainase Permukaan Jalan
5. Sudarsono DU, Konstruksi Jalan Raya, Penerbit PU
6. Guide for Desain of Pavement Structures, AASHTO, 1986
7. Standar Perencanaan Tebal Perkerasan Lentur, Bina Marga, Penerbit Departemen PU, 1983
8. AASHTO Maintenance Manual, AASHTO 1987
9. Krebs RD, Walker Richard D, Highway Material, McGraw-Hill, 1974

ENCV 6 0 0402
ENCV 6 1 0402
WATER ENGINEERING 2
3 SKS

Learning Objectives: After completing the whole studies, students are expected to be able to present the final design of a simple water infrastructure in the form of systematic written documents and are able to deliver them orally

Syllabus : Students be able to Apply the conservation energy to design the channels so that the flow rate can be distributed, Use the application of WinTR20 to simulate the storage effect that occurs at the flow through the channels that have been projected and design the simple water infrastructure's system (channels and reservoir) at observed watershed

Prerequisites : PIK 1

Text Books:
1. Bedient, P. B. and Huber, W. C.: *Hydrology and Floodplain Analysis*, 2nd ed., Addison-Wesley Publishing Company, 1992.
2. Chow, ven Te, et al.: *Applied Hydrology*, McGraw Hill International Editions, Civil Engineering Series, 1988.
3. USACE, Water Resources Support Center, Institute for Water Resources: *Guidelines for Risk and Uncertainty Analysis in Water Resources Planning, Volume I – Principles – With Technical Appendices.* The Greeley-Polhemus Group, Inc., *1992.*
4. Davis, C.V., et al.: *Handbook of Applied Hydraulics*, 2nd ed., McGraw Hill International Student Edition, 1952.
5. Potter, Merle C. and Wiggert, David C.: *Mechanics of Fluids*, Prentice-Hall International Inc., 1997
6. Jurnal-Jurnal Pengairan

ENCV 6 0 0501
ENCV 6 1 0501
MECHANICAL EARTHWORKS AND HEAVY EQUIPMENTS
3 SKS

Learning Objectives:
1. Student know and capable in calculating capacity and production cost of heavy equipment, capable in analysis characteristics, type and volume of work
2. Student capable in calculating and planning earth moving by using heavy equipment

Syllabus : Definition of mechanical earth moving, characteristic, type of soil and soil volume, operation of heavy equipment, capacity and production cost of heavy equipment, designing to combing equipment for optimalization times and cost; Calculate production of heavy equipment, the way to work of each heavy equipment, the way to planning project, some way to calculate volume of cut and fill, construction method, calculation of the work schedule and related cost.

Prerequisites : Ilmu Ukur Tanah

Text Books:
1. Imam Sugoto. 1980. ***Mempersiapkan Lapisan Dasar Konstruksi Jilid 1.*** Jakarta: Departemen Pekerjaan Umum.
2. Imam Sugoto. 1980. ***Mempersiapkan Lapisan Dasar Konstruksi Jilid 2***. Jakarta: Departemen Pekerjaan Umum

ENCV 6 0 0502
ENCV 6 1 0502
ETHICS AND CONSTRUCTION LAW
2 SKS

Learning Objectives: Provides knowledge and understandings as well as basic ability in project construction management, beginning from bidding / auction preparation until the construction execution and hand over of work

Syllabus : Understandings of construction projects; Preparation of bidding documents; Legal and contract administration aspects; Construction planning; Construction execution; Observation and operation; Management Materials; Safety, Health and Environment; Construction Labor

Prerequisites :

Text Books:
1. Andy Kirana, M.S.A, Etika Bisnis Konstruksi, 1996
2. Wallers S. Poage, AIA, CCS, Plans, Specs and Contracs for Building Professionals, 1987
3. Robby I. Chandra, Etika Dunia Bisnin, Kanisius, 1995

ENCV600016
CAPITA SELECTA (2 SKS)

Course Description:
This course provides an opportunity for setting up new business. Students develop tools and skills necessary to manage a succesful new venture. It is an experential course designed to stimulate the real life activities of entrepreneur's mind-set.

Course Objective:
Able to understand industrial development and

its problems.
This course aims to give the students a broad understanding of the field of setting up new business. The course will explore Business Set Up Model and Selling Skill.
By the end of the successful competion of this course, students will be better able to:
1. Having a new business with Sales
2. Having a new business with strong correlation to green technology (Reduce, Reuse, Recycle)
3. Having a good selling skill
4. Practice leadership and or fellowship
5. Aprreciate and deal with differencs among team member
6. Identity and asses market opportunities and available / potential resources (economic, human, social capital)
7. Develop managerial and entreprenual mindset and skills.
8. Prepare and present a bussiness action plan, result, and evaluation

Syllabus:
Special topics in industries which are not covered in other courses.
Requirement:-
References: -

ENCV 6 0 0017
ENCV 6 1 0017
INTERNSHIP
3 SKS
Learning Objectives: Internship is intended to students learn in the real world of works based on interest field in civil and environmental engineering
Syllabus : Specify the job objectives in the proposal; Implement an internship at a site that has been approved and in accordance with its specificity; Study and describe the process of technical work, quality control, project management, project specifications, engineering drawings and other aspects; Identify the problem related to the technical work, quality control, project management, project specifications, engineering drawings and other aspects; Conduct problems that occur at each stage of the project; Determine ways or solutions to overcome the problems associated with the project learned; Prepare a final report includes project description, existing problems and problem solving
Prerequisites : Building Construction, Soil Mechanics, Construcion Management, Concrete Structural Design 1, Steel Structural Design 1
The student is able to start to do an internship if:
1. Already got at least 75 credits (SKS) and already pass 6th semesters
2. Registered and fill out IRS for Internship Special Course, and expresses him/herself to the Internship Coordinator in the Department of Civil Engineering
3. Students choose a project and / or object of selected activities at internships site and location that has been contacted previously
4. Students must complete and submit the registration form at the Secretariat of Civil Engineering Department

Text Books:

ENCV 6 0 0019
ENCV 6 1 0019
SEMINAR
1 SKS
Learning Objectives: Students are able to communicate in verbal and writing a research proposal, to formulate a research problem and objectives, to conduct literature study, to develop a research hypothesis, to construct research methodology, and to present preliminary research results in a form of scientific report to be presented in front of the board of examiners
Syllabus : Developing problem description; developing basic research design, including relevant assumptions and constraints; conducting literature study and constructing research methodology; preparing and presenting a well-structured and well-written final report
Prerequisites : Passing 110 credits with GPA >= 2,00 and without grade of E

ENCV 6 0 0018
CAPSTONE PROJECT
3 SKS
Learning Objectives: Students in a group is expected to be able to work together to design a project from initial to implementation stage. This course aims to achieve some of the basic civil engineering competencies such as designing construction project, analyzing project's economic feasibility, and increasing communication skills and professionalism awareness.
Syllabus : The course consists of designing construction project that involves at least two knowledge specializations, e.g. Structure - Geotechnical, Structure - Transport, Transport-MSDA, Construction Management -Geotechnical-Structure, etc. The students are expected to present and deliver the group's final report on the given tasks.
Prerequisites : Building Construction, Soil Mechanics, Construction Management, Concrete Structural Design 1, Steel Structural Design 1
Text Books:

ENCV 6 0 0020
ENCV 6 1 0020
FINAL PROJECT
4 SKS
Learning Objectives:
Students are able to (1) prepare a research proposal based on good understanding of research methodology, (2) prepare a well-written research report (in Bahasa Indonesia), and (3) present and defend research results.
Syllabus : Synthesizing various lectures taken by students to design or to solve engineering problems. Preparing a written report of the synthesis.
Prerequisites : Passing 128 credits with GPA >= 2,00 and without grade of E

ENCV 6 0 0104
STRUCTURAL ANALYSIS WITH STIFFNESS METHOD
3 SKS
Learning Objectives: Students should be able to analyze 2D/3D spatial structures using computer-based forces and deflection method (matrices method)
Syllabus : Introduction to structural modelling; Statics and kinematics required in structural systems; Bending, shear, axial and thermal member deformation of members and the application to obtain structural bending of frames and trusses; Virtual work and energy principles applied in the structural analysis; Introduction to statically indeterminate structural analysis using force and displacement method; Matrix Superposition Method for structural analysis; Implementation of Matrix Superposition Method in 2D/3D spatial truss, 2D/3D frame, grid; Analysis of multi-storey buildings with rigid floor; Application of SAP, STAAD III, GTSTUDL, ETABS, computer program; Application of several approacehes in portal structures analysis.
Prerequisites : Structure Analysis
Text Books:

ENCV 6 0 0304
ENCV 6 1 0304
TRANSPORTATION ENGINEERING
3 SKS
Learning Objectives: The students are able to analyze the road transport performance based on the variables related to the traffic flows through the application of Indonesian Highway Capacity Manual (MKJI) and Highway Capacity Manual (HCM)
Syllabus : Variable and Traffic Flow Model; Measurement of Traffic Flow Variables and Traffic Survey; Spot Speed Study; Volume Study; Travel Time and Delay Study; Parking Study; Link Capacity Study; Intersection Capacity Study ; Practice
Prerequisites :

Text Books:
1. Papacostas, CS, Preveduoros: Transportation Engineering and Planning, 2nd ed., Prentice Hall, 1993
2. C. Jotin Khisty: Transportation Engineering, An Introduction, Prentice Hall, 1990
3. William R. McShane and Roger P. Roess: Traffic Engineering, Prentice Hall, 1990
4. Subhas C. Saxena: A Course in Traffic Planning and Design

ENEV 6 0 0010
ENEV 6 1 0010
ENVIRONMENTAL GLOBAL ISSUES
3 SKS
Refer to 109

ENCV 6 0 0403
ENCV 6 1 0403
RIVER ENGINEERING
3 SKS
Learning Objectives: Understand the sources and properties of surface runoff and sediment transport in river as well as effect of the changes to river stability (equilibrium/regime), Able to calculate surface runoff and sediment transport, also the relation with technical works of water structure and river control structure
Syllabus : Definition of river system (DAS), utilization and river conservation, river characteristics and watershed; River hydrology: variation and effect of various variable in river flow, model statistic and deterministic of river flow; River hydraulics: various type of river flow from the view point of flow pattern, mathematic model and river flow physics, River morphology: sources and transport sediment mechanism. Mathematic model of river morphology; Effect of interaction between various hydrological, hydraulics, and morphological factors to river behavior; River control structure
Prerequisites : Fluid Mechanics, Water Engineering
Text Books:
1. Doelhomid Srimoerni W S, Sungai, Diktat Kuliah (tidak dipublikasikan), IMS-FTUI Jakarta
2. Breussers, 19xx, Sediment Transport, Lecture Notes (unpublished), International Institute for Hydraulic Engineering, Delft, the Netherlands
3. Prins A, 19xx, Rivers, Lecture Notes (unpublished), International Institute for Hydraulics Engineering, Delft, the Netherlands

ENCV 6 0 0404
ENCV 6 1 0404

HYDRAULICS
3 SKS
Learning Objectives : Have the basic ability to understand basic behavior and laws which apply in fluids especially as well as know the basic law concepts as well as its application
Syllabus : Relationship between fluid mechanics and hydraulics in civil engineering; definition of solids, liquid and gas; concept of continuum mechanics, intensive and extensive properties. Fluid properties; Kinetic energy, potential energy, and work through thermodynamics concepts as well as thermodynamics scale which are relevant with fluid mechanics. Hydrostatics; formulation of dot and surface pressure equations as well as their application. flowing fluid; stream classification; Lagrangian and Eulerian concepts, flux and control volume. General formulation of conservation laws of mass, first law of thermodynamics, Newton's second law, moment from momentum with the approach of volume control in the form of integrals and differentials. Internal flow; formulation of speed profile and loss.
Prerequisites : Physics, Calculus
Text Books : Mechanics of Fluids, Potter, M.C., and D.C Wiggert

ENCV 6 0 0105
WOOD STRUCTURAL DESIGN
Learning Objectives : After attending this class, students will understand about design concepts,load applied on structures, structural systems and be able to design structural members from wood according to procedures and design standards.
Syllabus: Introduction to structural system analysis and design, design steps, LRFD, reduction factor and allowable stress; Loads and Loading: Load Forms, load types, location of loads, load distribution, load factor and load combination; Structural systems for wood structures; Materials and cutting properties of wood, work load tension, serviceability structures; Behavior of structural member with LRFD towards tension, bending and compression forces, and combination of bending and tension forces (beam-column, uniaxial) combination of bending and compression for wood structures, according to standards which apply; Connections.
Prerequisites :
Text Books :
1. K.H. Felix Yap, Konstruksi Kayu, Penerbit : Bina Cipta, Maret 1984
2. Suwarno Wityomartono, Konstruksi Kayu, Penerbit Fakultas Teknik UGM, 1971
3. H.J. Blass et al, Timber Engineering Step 1 and 2, Centrum Hout, The Netherlands, 1995

ENCV 6 0 0106

ENCV 6 1 0106
STEEL STRUCTURAL DESIGN 2
Learning Objectives : Students should be able to design and calculate advanced joints, beam structures, girder plates, portal and composite structures of low-rise buildings and students should be able to use elastic and plastic methods for the design.
Syllabus : Calculation of continuous beams using plastic method; Beamn-Column; Plate girder theory and analysis for buildings; Advanced joints engineering; portal and gable frame design; Structural analysis; steel-steel composite structures and steel-concrete composite structures in low-strorey buildings; Concrete-prestressed steel composite structures and application of preflex system for buildings; Cold form section/ Light Gage Members
Prerequisites : Steel Structural Design 1
Text Books:
1. Salmon C.G dan Johnson J.E., Steel Structure : Design and Behavoir, Fourth Edition, Harper Collins Publisher, 1996
2. Bresler B., Lin T.Y, Scalzi J.B, Design of Steel Structures, John Wiley & Sons-Toppan Co., 1968
3. Segui William T., LRFD Steel Design, ITP-PWS Publishing CO, Boston, 1994

ENCV 6 0 0203
CONSTRUCTION METHODS IN GEOTECHNIC
3 SKS
Learning Objectives : Students can learn the methods of implementation of the foundation in, get to know some of geotextile material, and case studies in the field
Syllabus : The introduction of geotextile material in an effort to strengthen the soil and soil stabilization, as well as field case studies.Franky Pile and its method of implementation case studies in the field.Types of drilling in the ground. Foundation in the methods of implementation
Prerequisites :
Text Books :

ENEV 6 0 0017
ENEV 6 1 0017
POLLUTION PREVENTION
3 SKS
Learning Objectives : The undergraduate engineer is introduced to the need for reliable waste tracking and accountability utilizing the cradle-to-cradle approach. The waste hierarchy is presented in terms of the basics of production processes. Clean industrial production is examined utilizing concrete Indonesian case histories. Basic principles of product design, composition, and packaging are examined. Tools are presented for understanding, communicating, and managing industrial manufacturing process using a complete

materials balance, full life-cycle analysis

Syllabus : Course objective: To equip each student with a fundamental understanding of industrial pollution prevention and cleaner production as it applies within Indonesia, including: the principles of toxic use reduction, waste minimization, pollution prevention, sustainable development, cleaner industrial production, and the global environmental management hierarchy; the engineering process and method of developing a full-facility, multimedia pollution prevention program in selected industries; specific pollution prevention practices, as determined through assessmentsand mass-balance analyses of waste streams ; basic principles of product design, composition and packaging in terms of clean industrial production; the engineering method to assist selected industries in applying of P2 technologies

Prerequisites :

Text Books :

1. Harry M. Freeman, INDUSTRIAL POLLUTION PREVENTION HANDBOOK, Mc Graw-Hill, New York, 1995, 935 pages
2. United States Environmental Protection Agency (EPA), Facility Pollution Protection Prevention Guide (FP2G), epa/600/r-92/088, Washington DC, May 1992, 143 Pages
3. Paul Bishop, Fundamental and Practice, Pollution Prevention

ENCV 6 0 0405
RAIN MANAGEMENT
3 SKS

Learning Objectives : Definition of river system (DAS), utilization and river conservation, river characteristics and watershed; River hydrology: variation and effect of various variable in river flow, model statistic and deterministic of river flow; River hydraulics: various type of river flow from the view point of flow pattern, mathematic model and river flow physics, River morphology: sources and transport sediment mechanism. Mathematic model of river morphology; Effect of interaction between various hydrological, hydraulics, and morphological factors to river behavior; River control structure.

Syllabus : Introduction: explanation of the fundamental differences between conventionally-based rainwater management (drainage system and flood control) and environmentally-based rainwater management (integrated rainwater management system); Explanation of the gaps between “state of the art” and “state of the practice” rainwater management; Drainage System and flood control: definition, aim and target; drainage system component and flood control; Hydrology and hydraulics analysis; Determining type and dimension of conveyor channel, control and storage; Integrated rainwater management system: definition, aim and target; Component of integrated rainwater management system; Hydrology and hydraulics analysis; Determining type and dimension of conveyor channel, control and storage; Case study in a catchment area: evaluating the existing drainage system and flood control; designing integrated rainwater management system for that catchment area.

Prerequisites : Introduction to Civil Engineering

Text Books :

1. Walesh, S.G. : Urban Surface Management, John Wiley & Sons, Inc
2. Joint Task Force of the Water Environment Federation and the American Society of Civil Engineers : Urban Runoff Quality Management. WEF and ASCE, 1998
3. Center for WATERSHED Protection and Maryland Department of the Environment : 2000 Maryland Storm water design Manual, Volume I & II. Maryland Department of the Environment and Maryland Department of Natural Resources Coastal Zone Management Program, 2000
4. Iowa Statewide Urban Standard Specifications for Public Improvements Manual : Urban Design Standards Manual. Chapter 2 – Storm Water Management and Drainage, Iowa State University, Center for Transportation Research and Education. 2003

ELECTIVE COURSE FROM MASTER PROGRAM

STRUCTURE STREAM
(Odd Semester)

ENCV 8 0 0101
ADVANCED MECHANICS OF MATERIAL
3 SKS
Refer to Page 353

ENCV 8 0 0102
DESIGN OF PRESTRESSED CONCRETE
3 SKS
Refer to Page 353

ENCV 8 0 0103
DYNAMICS OF STRUCTURE
3 SKS
Refer to Page 353

GEOTECHNIC STREAM
(Odd Semester)

ENCV 8 0 0201
ADVANCED SOIL MECHANICS
3 SKS
Refer to Page 354

ENCV 8 0 0202
ADVANCED GEOTECHNICAL INVESTIGATION
3 SKS
Refer to Page 354

ENCV 8 0 0203
SLOPE STABILIZATION AND SOIL IMPROVEMENT
3 SKS
Refer to Page 354

TRANSPORTATION STREAM
(Odd Semester)

ENCV 8 0 0301
ADVANCED HIGHWAY GEOMETRIC DESIGN
3 SKS
Refer to Page 355

ENCV 8 0 0302
ADVANCED TRANSPORTATION SYSTEM
3 SKS
Refer to Page 355

ENCV 8 0 0303
TRAFFIC ENGINEERING AND CONTROL
3 SKS
Refer to Page 356

ENCV 8 0 0304
TRANSPORT PLANNING AND POLICY
3 SKS
Refer to Page 356

WATER RESOURCES MANAGEMENT STREAM

ENCV 8 0 0401
ENVIRONMENTAL CHEMISTRY
3SKS
Refer to Page

ENCV 8 0 0402
ENGINEERING HYDROLOGY
3 SKS
Refer to Page 356

ENCV 8 0 0001
ENGINEERING MATHEMATICS
3 SKS
Refer to Page 356

CONSTRUCTION MANAGEMENT STREAM
(Odd Semester)

ENCV 8 0 0501
ENGINEERING PROJECT MANAGEMENT
3 SKS
Refer to Page 356

ENCV 8 0 0502
ENGINEERING ECONOMICS AND MANAGEMENT
3 SKS
Refer to Page 356

ENCV 8 0 0503
SYSTEMS ENGINEERING AND VALUE MANAGEMENT
3 SKS
Refer to Page 356

ENCV 8 0 0601
CONSTRUCTION METHODS AND EQUIPMENT
3 SKS
Refer to Page 359

STRUCTURE STREAM
(Even Semester)

ENCV 8 0 0105
FINITE ELEMENT METHOD
3 SKS
Refer to Page 360

ENCV 8 0 0106
DESIGN OF EARTHQUAKE RESISTANCE BUILDING
3 SKS
Refer to Page 360

ENCV 8 0 0107
CONCRETE TECHNOLOGY AND ADV. REINFORCED CONCRETE
3 SKS
Refer to Page 360

GEOTECHNIC STREAM
(Even Semester)

ENCV 8 0 0204
ADV. FOUNDATION ENGINEERING AND DEEP EXCAVATION
3 SKS
Refer to Page 362

ENCV 8 0 0205
NUMERICAL METHODS IN GEOTECHNICAL ENGINEERING
3 SKS
Refer to Page 362

ENCV 8 0 0206
ENVIRONMENTAL GEOTECHNICS
3 SKS
Refer to Page 363

TRANSPORTATION STREAM
(Even Semester)

ENCV 8 0 0305
FREIGHT TRANSPORTATION
3 SKS
Refer to Page 363

ENCV 8 0 0306
TRANSPORT NETWORK ANALYSIS
3 SKS
Refer to Page 363

ENCV 8 0 0307
ADVANCED HIGHWAY PAVEMENT ENGINEERING
3 SKS
Refer to Page 363

ENCV 8 0 0308
TRANSPORT DEMAND ANALYSIS
3 SKS
Refer to Page 364

ENCV 8 0 0309
TRANSPORT SAFETY
3 SKS
Refer to Page 364

ENCV 8 0 0310
TRANSPORT ECONOMICS
3 SKS
Refer to Page 364

ENCV 8 0 0311
RAILWAY ENGINEERING AND PLANNING
3 SKS
Refer to Page 364

ENCV 8 0 0312
PORT PLANNING AND MANAGEMENT
3 SKS
Refer to Page 365

ENCV 8 0 0313
PUBLIC TRANSPORT PLANNING AND OPERATION
3 SKS
Refer to Page 365

ENCV 8 0 0314
SELECTED TOPICS IN TRANSPORTATION
3 SKS
Refer to Page 375

WATER RESORUCES MANAGEMENT
(Even Semester)

ENCV 8 0 0403
WATER RESOURCES MANAGEMENT
3 SKS
Refer to Page 365

ENCV 8 0 0404
QUALITATIVE HYDROLOGY
3 SKS
Refer to Page

ENCV 8 0 0405
SURFACE WATER QUALITY MODELING
3 SKS
Refer to Page 366

ENCV 8 0 0406
GROUND WATER RESOURCES MANAGEMENT
3 SKS
Refer to Page 366

CONSTRUCTION MANAGEMENT

ENCV 8 0 0505
TIME AND COST MANAGEMENT
3 SKS
Refer to Page 366

ENCV 8 0 0506
QUALITY AND RISK MANAGEMENT
3 SKS
Refer to Page 367

ENCV 8 0 0507
PROCUREMENT MANAGEMENT, CONTRACT AND CLAIM ADMINISTRATION
3SKS
Refer to Page 367

4.2. UNDERGRADUATE PROGRAM IN ENVIRONMENTAL ENGINEERING

Program Specification

1.	**Awarding Institution**	Universitas Indonesia	
2.	**Teaching Institution**	Universitas Indonesia	
3.	**Programme Tittle**	Undergraduate Program in Environmental Engineering	
4.	**Class**	Regular	
5.	**Final Award**	Sarjana Teknik (S.T)	
6.	**Accreditation / Recognition**	BAN-PT: B Accredited AUN-QA	
7.	**Language(s) of Instruction**	Bahasa Indonesia and English	
8.	**Study Scheme (Full Time / Part Time)**	Full Time	
9.	**Entry Requirements**	High school /equivalent AND pass the entrance exam.	
10.	**Study Duration**	Designed for 4 years	
	Type of Semester	Number of Semester	Number of weeks / semester
	Regular	8	17
	Short (optional)	3	8
11.	**Graduate Profiles:** "A bachelor engineering who is able to design system and infrastructure of environmental engineering in order to improve environmental quality and to protect humans from environmental degradation"		
12.	**Expected Learning Outcomes:** 1. Apply Basic Environmental Math & Science (BEMS) Knowledge, mass, energy, momentum conservation and transport principles to solve environmental engineering problems (EE1) 2. Design and conduct experiments necessary to gather data and create information for use in analysis and design systems, unit, process and infrastructure related to environmental engineering (EE-2) 3. Choose and use modern engineering tools necessary to solve environment engineering problems (EE-3 & UI-C) 4. Apply advanced knowledge and essential skills of environment engineering for professional practice of environmental engineering(EE-4) 5. Apply uncertainty and reliability principles in design engineered systems , built or operated to protect the environment and the public health, welfare and safety (EE5) 6. Formulate problem and analysis it based on proper environmental engineering background knowledge (EE-6). 7. Design of a system, component or process to meet desired needs related to a problem appropriate to environmental engineering (EE7) 8. Integrate the principles of sustainability into the analysis and design of engineered systems (EE-8) 9. Apply BEMS to predict and determine fate and transport of substances in and among air, water and soil as well as in engineered systems (EE-9) 10. Discuss and explain societal impact of public policy affecting environmental engineering issues and solutions (EE-10) 11. Analyze and propose solutions for globalization and other contemporary issues vital to environmental engineering (EE-11) 12. Apply professional and ethical issues in environmental engineering (EE-13) 13. Apply leadership principles to direct the efforts of a small, homogenous group to achieve goals (EE-18) 14. Show life-long learning skill to enhanced skills, awareness of technology, regulatory, industrial, and public concerns and current issues (EE-15) 15. Apply principles of project management relevant to environmental engineering (EE-16)		

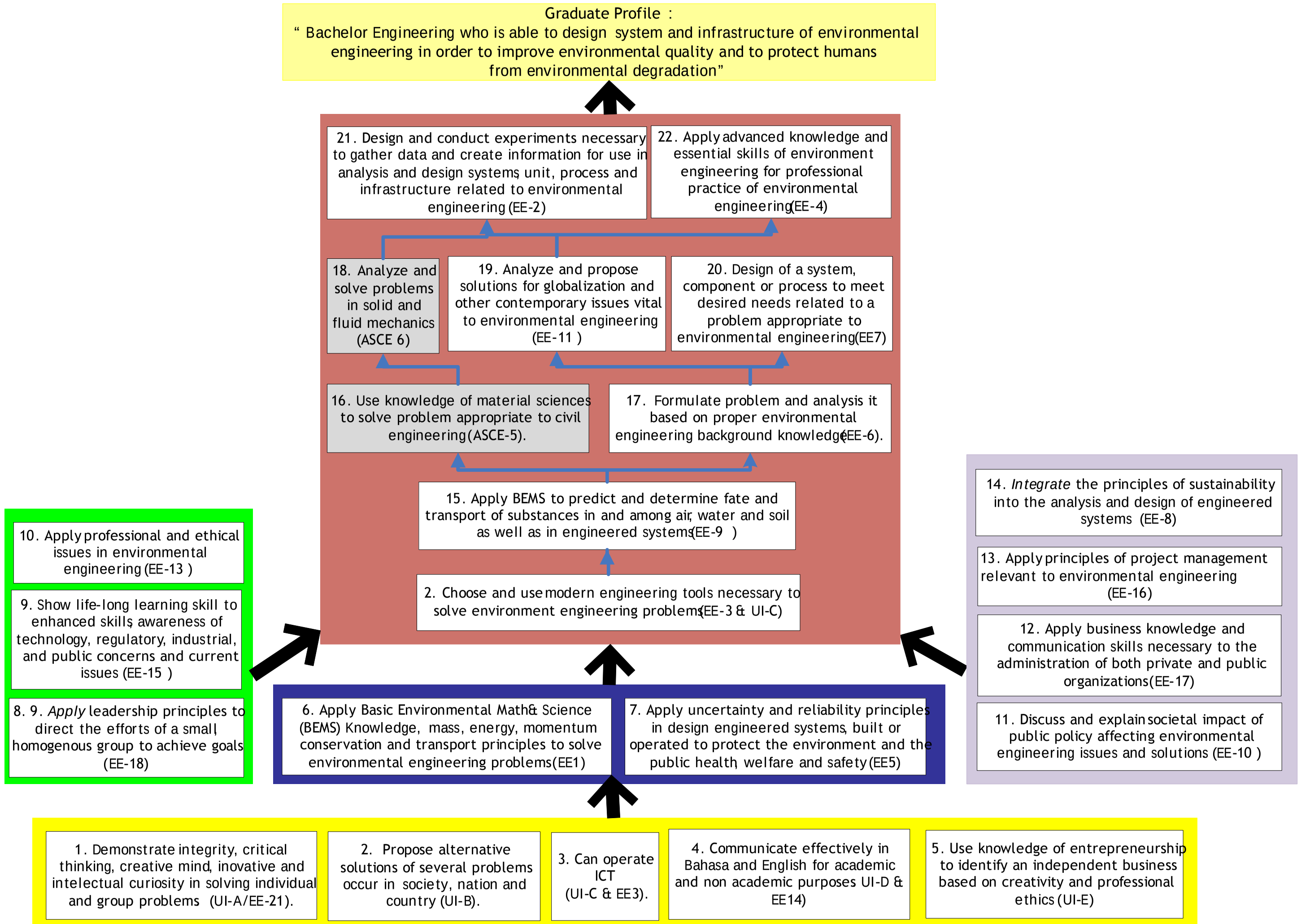
12.	16. Apply business knowledge and communication skills necessary to the administration of both private and public organizations (EE-17) 17. Use knowledge of material sciences to solve problem appropriate to civil engineering (ASCE 5) 18. Analyze and solve problems in solid and fluid mechanics (ASCE 6) 19. Demonstrate integrity, critical thinking, creative mind, inovative and intelectual curiosity in solving individual and group problems. (UI-a) 20. Propose alternative solutions of several problems occur in society, nation and country (UI-b) 21. Use knowledge of entrepreneurship to identify an independent business based on creativity and professional ethics (UI-e)
13	Classification of Subjects

No.	Classification	Credit Hours (SKS)	Percentage
i	**University General Subjects**	18	13 %
ii	**Basic Engineering Subjects**	22	15 %
iii	**Core Subjects**	72	50 %
iv	**Elective Subjects**	24	17 %
v	**Internship, Seminar, Undergraduate Thesis, Project**	8	6%
	Total	144	100 %
14.	**Total Credit Hours to Graduate**		144 SKS

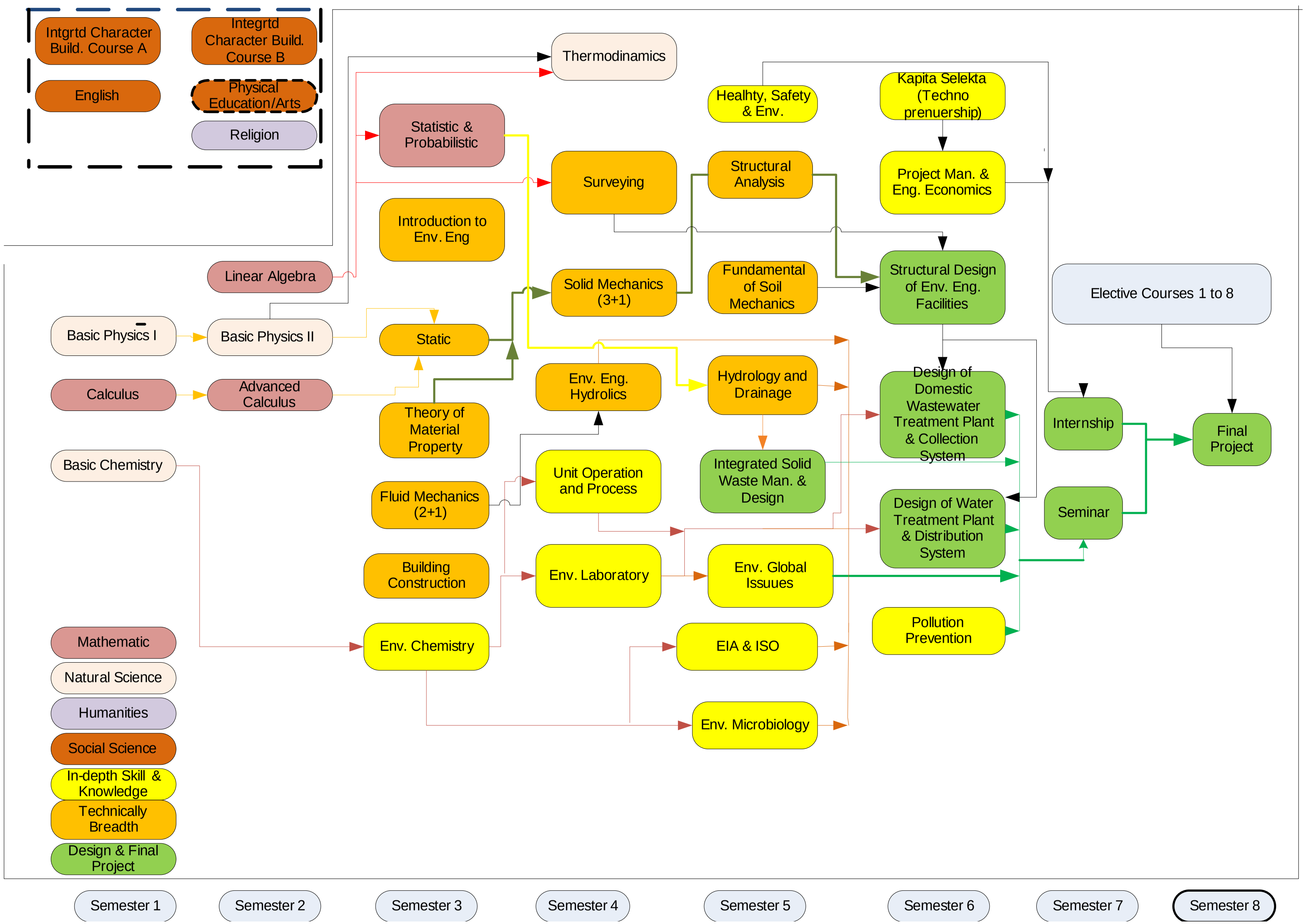
Career Prospects

a. Educational Sector — ranging from continuing citizen and professional education provided by community colleges to graduate instruction provided by research universities.
b. Public Service — ranging from operational manage¬ment of water, wastewater or solid waste utilities at the city or regional level to administration of environ¬mental regulations at the state and federal level, to environmental research.
c. Industry —manu¬facturing, construction, and energy industrial sectors which have responsibility for treatment facility operation and minor design.
d. Consulting Engineering Service — as facility design and can be expanded to include more emphasis on Brownfield investigations, pollut¬ant transport, regulatory guidance, sustainability, and facility operation.

Learning Outcomes Flow Diagram



Flow Diagram of Subjects



Course Structure of Undergraduate Programme in Environmental Engineering (Regular)

KODE	MATA AJARAN	SUBJECT	SKS
	Semester 1	**1st Semester**	
UIGE600004	MPKT B	Integrated Character Building Subject B	6
UIGE600002	Bahasa Inggris	English	3
ENGE600003	Fisika Dasar 1	Physics 1	4
ENGE600001	Kalkulus	Calculus	4
ENGE600010	Kimia Dasar	Basic Chemistry	2
		Sub Total	**19**
	Semester 2	**2nd Semester**	
UIGE600001	MPKT A	Integrated Character Building Subject A	6
UIGE600003	Olah Raga/Seni	Sport/ Art	1
ENGE600002	Aljabar Linear	Linear Algebra	4
ENGE600004	Fisika Dasar 2	Physics 2	4
UIGE600005-9	Agama	Religious Studies	2
ENCV 6 0 0001	Kalkulus Lanjut	Advanced Calculus	3
		Sub Total	**20**
	Semester 3	**3rd Semester**	
ENGE600005	Statistik dan Probabilistik	Statistic and Probability	2
ENCV 6 0 0003	Statika	Statics	4
ENCV 6 0 0004	Mekanika Fluida	Fluid Mechanics	3
ENCV 6 0 0006	Konstruksi Bangunan	Building Construction	4
ENEV 6 0 0001	Teori Properti Material	Theory of Material Properties	2
ENEV 6 0 0002	Pengantar Sistem Rekayasa Lingkungan	Introduction to Enviromental Engineering System	2
ENEV 6 0 0003	Kimia Lingkungan (2+1)	Environmental Chemistry (2+1)	3
		Sub Total	**20**
	Semester 4	**4th Semester**	
ENCV 6 0 0007	Ilmu Ukur Tanah	Surveying	3
ENCV 6 0 0008	Mekanika Benda Padat	Solid Mechanics	4
ENEV 6 0 0004	Termodinamika	Thermodynamics	2
ENEV 6 0 0005	Unit Operasi dan proses	Unit Operations and Processes	3
ENEV 6 0 0006	Hidrolika Teknik Lingkungan	Environmental Engineering Hydraulics	2
ENEV 6 0 0007	Laboratorium Lingkungan (2+1)	Environmental Laboratory (2+1)	3
		Sub Total	**17**
	Semester 5	**5th Semester**	
ENGE600008	K3LL	Health, Safety and Environment	2
ENCV 6 0 0009	Mekanika Tanah Dasar (2+1)	Basic Soil Mechanics	3
ENCV 6 0 0015	Analisa Struktur	Structural Analysis	3
ENEV 6 0 0008	Hidrologi dan drainase	Hydrology and Drainage	2
ENEV 6 0 0009	Perancangan Pengelolaan Limbah Padat Terpadu	Design of Integrated Solid Waste Management	3
ENEV 6 0 0010	Permasalahan Lingkungan dalam isu global	Environmental Global issues	2
ENEV 6 0 0011	Amdal, Audit Lingkungan dan ISO	Environment Impact Analysis and ISO	2
ENEV 6 0 0012	Mikrobiologi Lingkungan (1+1)	Environmental Microbiology (1+1)	2
		Sub Total	**19**
	Semester 6	**6th Semester**	
ENCV 6 0 0016	Kapita Selekta	Capita Selecta	2
ENEV 6 0 0013	Manajemen Proyek dan Ekonomi Teknik	Project management and Engineering Economics	3
ENEV 6 0 0014	Peranc. Struktur Bang. Teknik Lingkungan	Structural Design of Environmental Engineering Facilities	4
ENEV 6 0 0015	Perancangan Jaringan Pengumpul dan Bangunan Pengolahan Air Limbah Domestik	Design of Collection System and Domestic Wastewater Treatment Plants	3
ENEV 6 0 0016	Perancangan Bangunan Pengolahan dan Distri-busi Air Bersih	Design of Water Treatment Plants and Distribu-tion System	3
ENEV 6 0 0017	Pencegahan Pencemaran	Pollution Prevention	2
		Sub Total	**17**

KODE	MATA AJARAN	SUBJECT	SKS
	Semester 7	**7th Semester**	
ENEV 6 0 0018	Kerja Praktek	Internship	3
ENEV 6 0 0019	Seminar	Seminar	1
	Pilihan (*)	Electives (*)	12
		Sub Total	**16**
	Semester 8	**8th Semester**	
ENEV 6 0 0020	Skripsi	Final Project	4
	Pilihan (*)	Electives (*)	12
		Sub Total	**16**
		Total	**144**

(*) Elective Courses :

Students may choose elective courses :

1. Offered by undergraduate program in Semester 7 and 8; or
2. Offered by Master Degree program with maximum credits of 18 or]
3. Offered by other Department with maximum of 3 courses or 9 credits
4. For students pursue to Master Degree Program through fast track mechanism; at semester 7th and 8th, choose maximum of 18 credits from compulsary or elective courses at master degree program.

MATA AJAR PILIHAN

(*) Mk Pilihan pada Jenjang S1

(*) Electives Courses of Undergradute Program

KODE	MATA AJARAN	SUBJECT	SKS
Semester Gasal			
ENEV 6 0 0101	Epidemiologi	Epidemiology	2
ENEV 6 0 0102	Pencemaran Udara	Air Pollution	3
Semester Genap			
ENEV 6 0 0103	Dinamika sistem Lingkungan	Environmental System Dynamics	3
ENEV 6 0 0104	Toksikologi Lingkungan	Environmental Toxicology	3
ENCV 6 0 0501	PTM dan Alat Berat	Mechanical Earthworks and Heavy Equipments	3
	Hukum Lingkungan	Environmental Law	3

(*) Mk Pilihan pada Jenjang S2

Berikut adalah Mata kuliah wajib/pilihan Program S2 yang dapat diikuti oleh mahasiswa S1 sebagai mata kuliah pilihan

(*) Electives Courses of Master Degree Program

Following are Compulsory / Electives Courses at Master Degree Program offered to Bachelor students as elective courses

KODE	MATA AJARAN	SUBJECT	SKS
Semester Gasal			
ENCV 8 0 0801	Pengolahan Fisik, Biologis dan Kimiawi Dalam Teknik Lingkungan	Physical, Biological and Chemical Treatment in Enviromental Engineering	3
ENCV 8 0 0802	Perubahan Iklim dan Rekayasa Lingkungan	Climate Changed and Environmental Engineering	3
ENCV 8 0 0803	Audit Lingkungan	Environmental Audit	3

KODE	MATA AJARAN	SUBJECT	SKS
ENCV 8 0 0001	Matematika Teknik	Engineering Mathematics	3
ENCV 8 0 0807	Efisiensi Sumberdaya dengan Teknologi – Analisis Daur Hidup (LCA) dan Pengelolaan Limbah Padat Terpadu (**)	Technology of Resources Efficiency - Life Cycle Analysis (LCA) and Integrated Solid Waste Management (**)	3
ENCV 8 0 0808	Praktek Rekayasa dan Teknologi Limbah Padat (**)	Engineering Practice and Solid Waste Technology (**)	3
ENCV 8 0 0809	Kontaminasi dan Remediasi Tanah (**)	Contamination and Soil Remediation (**)	3
Semester Genap			
ENCV 8 0 0804	Kontrol Emisi Pada Instalasi Pengolahan Limbah Padat	Emision Control on Solid Waste Treatment Unit	3
ENCV 8 0 0805	Teknologi Pengolahan Limbah Padat: Operasional dan Desain	Technology of Solid Waste Treatment ; Operation and Design	3
ENCV 8 0 0806	Pengelolaan Limbah Industri dan B3 (**)	Hazardous and Industrial Waste Management	3
ENCV 8 0 0406	Pengelolaan Sumber Daya Air Tanah	Ground Water Resources Management	3

(**) Bukan mata Kuliah Wajib kekhususan Lingkungan pada Jenjnag S2

(**) Not a compulsory course of Environmental Concentration at Master Program

Description of Subjects

UIGE600001
UIGE610001
MPKT A / INTEGRATED CHARACTER BUILDING A
6 SKS
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UIGE600004
UIGE610004
MPKT B / INTEGRATED CHARACTER BUILDING B
6 SKS
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UIGE600002
ENGLISH
UIGE610002
ACADEMIC WRITING
3 SKS
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ENGE600001
ENGE610001
CALCULUS
4 SKS
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ENGE600010
ENGE610010
BASIC CHEMISTRY
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ENGE600003
ENGE610003
BASIC PHYSICS 1
4 SKS
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ENGE600004
BASIC PHYSICS 2
4 SKS
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ENGE600002
ENGE610002
LINEAR ALGEBRA
4 SKS
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UIGE600005-9
UIGE610005-9
RELIGIOUS STUDIES
2 SKS
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ENGE600005
ENGE610005

STATISTICS AND PROBABILITY
2 SKS
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ENCV 6 0 0001
ADVANCED CALCULUS
3 SKS
Refer to Page 78

ENCV 6 0 0003
STATICS
4 SKS
Refer to Page 79

ENCV 6 0 0004
FLUIDS MECHANICS
3 SKS
Refer to Page 79

ENCV 6 0 0006
BUILDING CONSTRUCTION
4 SKS
Refer to Page 80

ENEV 6 0 0001
THEORY of MATERIAL PROPERTIES
3 SKS
Learning Objectives :
Provide understandings concerning important elementary and practical aspects of materials in the civil engineering field
Syllabus : Particulate Materials, Aggregates, Portland Cement and Portland Concrete Cement, Structural Steel, Asphalt Cement and concrete asphalt, wood, plastic and polymer, Concrete Fibers
Prerequisites :
Text Books :
1. S. Young, Sidney, The Science and Technology of Civil Engineering Materials, Prentice-Hall International Inc., 1998
2. Shan Somayaji, 2001, Civil Engineering Materials, Prentice Hall.
3. Robert D Kerbs, Richad D Walker, (1971) Highway Materials, Mc Graw-Hill

ENEV 6 0 0002
INTRODUCTION TO ENVIRONMENTAL ENGINEERING SYSTEM
2 SKS
Learning Objectives : The Student has ability to describe (1) concept of environment, (2) natural resources and diversity, (3) man made resources and land, (4) material balance and environmental carrying capacity, (5) water, (6) waste water, (7) solid waste, (8)air polution, (9) urban planning in environmental engineering, (10) relation between sanitation and public health, (11)regulation
Syllabus : ecology, ecosystem, land resources, tropical forest, grassland, marine ecosystem,

dam, agricultural resources, land use management, climate change, *elemen,* energy, life, material cycle, water importance, availability & renewal hydrological cycle, water & pollution, water resources management, water demand, water supply treatment plant and water distribution, waste water characteristics & its identifications, domestic waste water treatment plant and sewerage, domestic solid waste and hazardous waste & air emission, soil, water & air contamination by waste, major source of energy, renewable & non-renewable resources, energy efficiency & green energy, national and international regulation

Prerequisites :

Text Books :

1. Kevin,T., Jonathan, P., Jeremy C. 2003. *Urban Sanitation: A Guide to Strategic Planning*. GHK International Ltd, London.
2. Gleynn Henry, J & Gary W. Heinke 2007. *Environmental Science & Engineering*, Prentice Hall, Inc, New Jersey 1996
3. Soemirat, J. 1994. Kesehatan Lingkungan. Gajahmada University Press,Yogyakarta.
4. Mc Ghee, T.J. 1991. *Water Supply and Sewerage. McGraww Hill,* New York.
5. Salvato, Joseph A. *Environmental Engineering & Sanitation,* John Wiley & Son Inc. Canada.

ENEV 6 0 0003
ENVIRONMENTAL CHEMISTRY
3 SKS

Learning Objectives :

1. Students able to explain the chemical processes occurring in the physical environment (water, soil and air)
2. Students able to analyze physical, chemical/ biochemical, natural water and contaminated water quality

Syllabus : Basic Principles of Environmental Chemistry; Basic Principles of Environmental Physical Chemistry; Basic Principles of Environmental Balance Chemistry; Interaction between Chemical Parameters & Physical Environment. Natural water physical parameters; Turbidity color, solid substances, Chemical parameters of natural/ contaminated water, pH, acidity, permanganate, sulfate, dissolved oxygen, nitrite, chloride; Biochemical parameters of natural water; Chemical Oxygen Demand (COD); Biochemical Oxygen Demand (BOD)

Prerequisites :

Text Books :

1. Manahan, S.E. (2005). *Environmental Chemistry*. Washington: CRC.
2. Sawyer, McCarty, and Parkin. (2003). *Chemistry for Environmental Engineering and Science*. Singapore: McGrawHill

ENCV 6 0 0007
SURVEYING
3 SKS
Refer to Page 80

ENCV 6 0 0008
SOLID MECHANICS
4 SKS
Refer to Page 81

ENEV 6 0 0004
THERMODINAMICS
2 SKS

Learning Objectives : This subject deals with both chemical thermodynamics and chemical kinetics and their application in the environment. The material that will be covered in this subject is intended to provide you with the tools and understanding to handle basic problems involving chemical systems at equilibrium and rates of simple chemical reactions in the environment

Syllabus : Element and energy cycle in the environment; State of a system, 0^{th} law, equation of state; Work, heat, first law; Internal energy, expansion work; Enthalpy; Adiabatic changes; Thermochemistry; Calorimetry; Second law; Entropy and irreversibility; Fundamental equation, absolute S, third law; Criteria for spontaneous change; Gibbs free energy; Multicomponent systems, chemical potential; Chemical equilibrium; Temperature, pressure and $K_{p;}$ Phase equilibria; Partition function; ; Model systems; Applications: chemical and phase equilibria; Introduction to reaction kinetics; Complex reactions and mechanisms; Steady-state and equilibrium approximations; Chain reactions; Temperature dependence, Ea, catalysis; Enzyme catalysis; Autocatalysis and oscillators

Prerequisites :

Text Books :

ENEV 6 0 0005
UNIT OPERATIONS & PROCESSES
3 SKS

Learning Objectives: Students able to conduct fluid transportation analysis through channel, analysis of sedimentation process, filtration, floatation, aeration gas transfer, heat transfer. Students able to use basic technical principles for calculations of toxic and hazardous substances treatment processes, i.e. physical-chemical processes, biological, stabilization, thermal and soil disposal methods

Syllabus : Fluid transport through closed conduit; Fluid transport through open channel; Mixing; Sedimentation; Flotation and Aerosol Separation; Flow through Particle Media; Vacuum Filtration; Gas Transfer and Aeration; Heat/Thermal Transfer

Prerequisites : Basic Chemistry, Basic Physics,

And Environmental Chemistry
Text Books:
1. Tom D. Reynolds and Paul Richards, Unit Operations and Process in Environmental Engineering Pws Series in Engineering;
2. Rich, Linvil G : " Unit Operation for Sanitary Engineering"Management, McGraw Hill

ENEV 6 0 0006
ENVIRONMENTAL ENGINEERING HYDRAULICS
2 SKS
Learning Objectives: Having basic capability to understand fundamental concept of water flow behavior in closed and open channel, also understand the basic concept simplification for application use. Knowing the utilization method of the concept in various main water structure
Syllabus : Inflow (*entrance*) and generated flow (*developed*); Theory of energy losses in developed flow; equation of minor and major losses. Flow in pipes system; Utilization of EGL (*Energy Grade Line*) for pipe system solution: series, parallel and bifurcation; pipes network analysis. Open channel flow; Equation for open channel; Losses in open channel; Concept of energy (specific energy and critical energy) significant in *steady uniform rapidly varied flow*; Concept of momentum in open channel flow. Various main water structure; *weir*, *intake*, conveyor *channel*, etc.
Prerequisites : Basic Physics, Calculus, Fluids Mechanics
Text Books : Mechanics of Fluids, Potter, M.C., and D.C. Wiggert

ENEV 6 0 0007
ENVIRONMENTAL LABORATORY
3 SKS
Learning Objectives : Students are able to apply the unit operation and process principals in designing and operating water and waste water treatment plant in laboratory scale
Syllabus : Application of the principles of unit operation and process in water and wastewater treatment plant in laboratory scale.
Prerequisites :
Text Books :
1. Standard Methods, Examination of Water & Wastewater, 20th Edition
2. Rich, Linvil G : "Unit Operation for Sanitary Engineering". Unit Operations and Process in Environmental Engineering (Pws Series in Engineering; Tom D. Reynolds and Paul Richards
3. Sawyer, McCarty, and Perkin. 2003. *Chemistry Environmental Engineering Science*. McGraw Hill

ENGE600008
ENGE610008
HEALTH, WORK SAFETY, AND ENVIROMENT
2 SKS
Refer to Page 78

ENCV 6 0 0009
BASIC SOIL MECHANICS (2+1)
3 SKS
Refer to Page 81

ENCV 6 0 0015
STRUCTURAL ANALYSIS
3 SKS
Refer to Page 83

ENEV 6 0 0008
HYDROLOGY AND DRAINAGE
2 SKS
Learning Objectives : Understand how to develop a drainage system design for various interest and implementing construction as well as monitoring. Able to design a drainage system that appropriate with the usage
Syllabus : Purposes and definition of drainage. Understand the basic concept of drainage technology based on hydrology and hydraulics knowledge. Rainfall Analysis covers distribution, duration, intensity and rainfall return period. Rainfall network system, type and material that can be used, as well as method for calculating rainfall design, time concentration, runoff coefficient, storage efficiency. Calculation and design of channel dimension also hydraulics characteristic using various wide used method. Drainage channel structures and recharge structure. Relation between micro drainage and macro drainage. Technical Specification, operation and maintenance, required equipment and drainage management institution
Prerequisites : fluids mechanics
Text Books :
1. James N. Luthin, *Drainase Engineering*, Willey Eastern Private Ltd. Publisher, 1970.
2. Ben Urbanos, Peter Stahre. *Stormwater: Best Management Practices and Detention for Water Quality, Drainage, and CSO Management.* Englewood Cliffs, NJ: PTR Prentice-Hall, 1993. ISBN 0-13-847492-3.
3. Hormoz Pazwash, *Urban Storm Water Management*, CRC Press, Taylor & Francis Group. 2011, ISBN: 978-3-4398-1035-4.
4. Phillip B. Bedient, Wayne C. Huber. *Hydrology and Floodplain Analysis*. 2nd ed. Addison-Wesley Publishing Company, Inc. 1992. New York. ISBN 0-201-51711-6.

ENEV 6 0 0009
ENEV 6 1 0009
DESIGN OF INTEGRATED SOLID WASTE MANAGEMENT
3 SKS
Learning Objectives: students are able to fully understand and plan for an Integrated Solid Waste Management (ISWM) as a tool to effectively protect human health and the environment

Syllabus : Students are expected to explain the properties and problems arising from solid waste materials as well as the development and selection of management alternatives in accordance with local conditions;Essence of ISWM (prevention or reduction of waste through recycling, composting, and destruction of waste as well as safe final disposal practice);Components of ISWM; Source, type and composition of solid waste material; Generation of solid waste materials; Collection, removal and transport of SW; Final disposal and processing of SW;Some crucial aspects in the SWMsuch as the organization, financing, regulatory, and aspects of public participation in the management of SW;Concept of designing ISWM system;ISWM management systems; Regulations in the management of SWM, and ISWM management method

Prerequisites :

Text Books:

1. Introduction to the Principles of Hazardous Waste Management,Firdaus Ali, Global Enviro. 2011.;
2. Standard Handbook of Hazardous Waste Treatment and Disposal, Harry M. Freeman, McGraw-Hill. 1988:
3. Basic Hazardous Wastes Management, William C. J. Lewis Publisher. 2001:
4. Hazardous Waste Management, LaGrega-Buckingham-Evans, McGraw-Hill. 1994, Handbook of Industrial and Hazardous Wastes Treatment, Lawrence K Wang, *et al*. Marcel Dekker. 2004

ENEV 6 0 0010
ENEV 6 1 0010
ENVIRONMENTAL GLOBAL ISSUES
3 SKS

Learning Objectives: Students can fully understand and explain systematically some environmental issues of global concern that requires international cooperation in handling and management.

Syllabus : The explosion in population and the challenge of civilization: the problem of scarcity and water security, food, and energy; addressing global warming and adaptation to climate change: carbon footprint and ecological footprint; loss of biodiversity and soil fertility; depletion of ozone layer; genetic engineering between challenges and opportunities; intensive farming and their impacts; water balance, reservoir and its environmental problems; nanotechnology; environmental biotechnology; pandemic and emerging diseases; nuclear energy and its challenges; urban sprawl; hazardous waste management and cross-country mobility issues; policies and strategies for water savings and energy.

Prerequisites :

Text Books:

1. Major Environmental Issues Facing the 21st Century, Mary & Louis Theodore, Prentice Hall PTR (1996);
2. Environmental Science: A Global Concern, Cunningham &Saigo, McGraw-Hill Publishing Co. (2011);
3. Multi-Purpose Deep Tunnel, Firdaus Ali, Global Enviro (2007); ENEP Year Book 2011: Emerging Issues in Our Global Environment, UNEP (2011);
4. Cities-People-Planet: Urban Development and Climate Change, Herbert Girardet, John Wiley & Sons, Ltd. (2008); Plan B 2.0: Rescuing a Planet Under Stress and a Civilization in Trouble, Lester R. Brown, Environmentalist and Earth Policy Institute (2006).

ENEV 6 0 0011
ENEV 6 1 0011
ENVIRONMENT IMPACT ANALYSIS & ISO
2 SKS

Learning Objectives: Students are expected to apply the methods of EIA and environmental audit of the business plan as an input protection of human and natural resources

Syllabus : Understanding the EIA; the EIA process and the benefits; Rules and regulations as well as the procedure of EIA;initial environmental condition and setting;Appraisal of environmental impact;Environmental impact of physical and chemical, biological, social, economic, social and cultural; EIA methods; Methods and techniques of identification, prediction, evaluation and interpretation of the EIA;Environmental Management Plan (RKL); Environmental Monitoring Plan (RPL); Environmental Permit (Government Regulation 27/2012) and its principles; and Environmental Audit and Environmental Management System (ISO 14.000).

Prerequisites :

Text Books:

1. Canter, L.W., *Environmental Impact Assesment*, New York, McGraw-Hill, 1996.
2. Soemarwoto, Otto., Analisis Mengenai Dampak Lingkungan, Yogyakarta, Gadjah Mada University Press, 2007.
3. Suratmo F. Gunarwan, *Analisis Mengenai Dampak Lingkungan*, Yogyakarta, Gajah Mada University Press, 1991.
4. Kuhre W. Lee., *Sistem Manajemen Lingkungan*, Jakarta, Prenhallindo, 1996.
5. "ISO 14000 Sistem Manajemen Lingkungan" by Brian Rotherry (1996)

ENEV 6 0 0012
ENVIRONMENTAL MICROBIOLOGY
2 SKS

Learning Objectives:

Student able to explain microbiology system and its relation to the transformation and mineralization of organic waste, along with pertaining issues in controlling the microbiology processes in waste treatment

Syllabus : Types of microbes, growth and kinetic growth, analysis of microbe activities, biodegradability, inhibitor and toxicity, engineering factors, quality analysis of water microbiology (planktons, nektons, benthos)

Prerequisites :

Text Books :

1. Willey, J.M., Sherwood, L.M., Woolverton, C.J. 2008. *Microbiology*. 7th. Edition. Mc Graw Hill, Boston.
2. Jemba, P. K. 2006. *Environmental Microbiology, Principles and Applications*. Science Publisher, Ohio.
3. LaGrega, M.D., Buckingham, P.L. and Evans, J.C. 1994, *Hazardous Waste Management*. McGraw Hill. Boston.
4. Metcalf & Eddy. 2000. *Wastewater Engineering.* McGraw Hill. New York.
5. AWWA. *Standard Method, Examination of Water and Wastewater*. 20th Edition.
6. Novita, E., Gusniani, I., Handayani, S.D. 2009. Modul Praktikum Mikrobiologi Lingkungan. Laboratorium Teknik Lingkungan-Departemen Teknik Sipil FT-UI. Depok.
7. Johnson, T.R., Case, C.L. 2010. *Laboratory Experiments in Microbiology.* Benjamin Cummings. Pearson. San Fransisco

ENCV600016
ENCV610016
CAPITA SELECTA (2 SKS)
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ENEV 6 0 0013
PROJECT MANAGEMENT AND ENGINEERING ECONOMICS
3 SKS

Learning Objectives: At the end of the course, students are expected to be able to identify and evaluate the project management plan based on economical feasibility from project initiation to implementation and project hand over.

Syllabus : Project: environmental infrastructure; project initiation; project selection, project planning: main activities and supporting facilities; project execution: execution plan, quality assurance; HSE management, procurement process; project control: project performance reporting; cost, time, and quality control; project closure: introduction to asset/infrastructure management.

Prerequisites : Structural Design of Environment Engineering Facilities

Text Books:

1. Blank, L and Tarquin, A., Engineering Economy, McGrawHill, New York, 2002
2. Halpin, D, W and Woodhead, R.W., Costruction Management, 2nd ed., John Wiley & Sons Inc., New York, 1998

Reference Book :

1. Duffield, C.F and Trigunarsyah, B., Manajemen Proyek – dari Konsepsi sampai Penyelesaian, Engineering Education Australia, Melbourne, 1999
2. Europen Construction Institute, Total Project Management of Construction Safety, Health and Enviornment, Thoman Telford, London, 1995
3. Slough, R.H., Sears, G.A. and Sears, S.K., Construction Project Management, 4th ed., John Wiley & Sons Inc., New York, 2000
4. Project Management Institute, A Guide to the Project Management Body of Knowledge (PMBOK®Guide). PMI, USA 2000

ENEV 6 0 0014
STRUCTURAL DESIGN OF ENVIRONMENTAL ENGINEERING FACILITIES
3 SKS

Learning Objectives: Students should be able to know the concepts of structural designs, applied forces and structural systems and should be able to proportionally design the steel, reinforced concrete of structural members for environemtal engineering facilities in accordance with the applied strandards.

Syllabus : The aims, steps and processes of structural designs and various design methods; shapes, types, forces application, distributions, factors and combination of forces; various structural systems of steel, reinforced concrete dan wood; mechanical properties, factors influencing the qualities of steel, structural steel, tensile stress, compressive stress, deflection beam, combination of axial and bending; design of simple joints using bolts (HTB) and welds; material properties and reinforced concete cross sectional properties, elastic concepts and ultimate strengths, simplification of Whitney stress block and balanced failure; square reinforced concrete beam with single reinforcement and double reinforcement and T-beam, axial and bending force applied on short columns and slender columns, shallow foundations, operating conditions of sanitary building engineering in loading designs, water-resistance requirements, joint details and placement, shrinkage reinforcement,d esign parameters and strength designs; square and circular reinforced concrete tanks structures.

Prerequisites : Soil Mechanics; Structure Analysis

Text Books :

1. _____________, *Tata Cara Perhitungan Struktur Beton untuk Bangunan Gedung*, SNI-03-2847-2002, Badan Standardisasi Nasional, 2002.
2. _____________, *Tata Cara Perencanaan Struktur Baja untuk bangunan Gedung*, SNI-03-1729-2002, Badan Standardisasi Nasional,

2002.

3. _____________, *Tata Cara Perencanaan Konstruksi Kayu Indonesia*, SNI, Badan Standardisasi Indonesia, 2002
4. Mac Gregor, J.G, *Reinforced Concrete: Mechanics and Design*, 3rd .edition, Prentice-Hall, 1997.
5. Segui, William T., *LRFD Steel Design,* ITPPWS Publishing Co., Boston, 1994
6. Wahyudi & Syahril A.R., *Struktur Beton Bertulang*, Gramedia, 1997.
7. JF. Seidensticker and ES Hoffman, Sanitary Structures-Tanks and Reservoirs, Handbook of Concrete Engineering, Second Edition, Edited by Mark Fintel, Van Nostrand Reinhold Company, 1985, New York
8. ACI Committee 350, Environmental Engineering Concrete Structures, ACI 350R-89, in ACI Manual of Concrete Practice 1993, Part 4, ACI, 1993
9. Rectangular Concrete Tanks, Information Sheet IS003 D, Portland Cement Assn., Skokie, 1981
10. Underground Concrete Tanks, Information Sheet IS071.03 D, Portland Cement Assn., Skokie, 1981
11. AW. Domel, AB Gogate, Circular Concrete Tanks without Prestressing , ISBN 0-89312-125-8, Portland Cement Assn., Skokie, 1993
12. ACI Committee 344, Design and Construction of Circular Prestressed Concrete Structures, ACI 344R-70
13. ACI Committee 344, Design and Construction of Circular Prestressed Concrete Structures with Circumferential Tendons, ACI 344-88
14. ACI Committee 344, Design and Construction of Circular Wire and Strand Wrapped Prestressed Concrete Structures, ACI 344-88

ENEV 6 0 0015
DESIGN OF DOMESTIC WASTEWATER TREATMENT PLANT & COLLECTION SYSTEM
3 SKS

Learning Objectives: Students are expected to able to plan building system and dimensions of domestic wastewater treatment plant.

Syllabus : Purpose of domestic wastewater treatment and effluent standard and stream standard; calculation of domestic wastewater projection production and design capacity; domestic wastewater treatment method (physical treatment method, chemical treatment method, biological treatment method); Domestic wastewater treatment flow diagram; Treatment unit calculation and design (design and physical treatment unit calculation, design and chemical treatment unit calculation, biological treatment unit calculation); Sludge treatment method; Design and calculation of sludge treatment unit; Layout and profile, membrane technology, Attached Growth, Suspended Growth, Biofilter

Prerequisites : Unit Operations & Processes, Fluids Mechanics, Environmental EngineeringHydraulics, Hydrology and Drainage

Text Books :

1. Water and Wastewater Technology, Mark J. Hammer, 1996
2. Cheremisinof. *Handbook of Water and Waste Water Technology*, 1995
3. Water Supply and Sewerage, Terence J. Mc.Ghee, 1991
4. Metcalf and Eddy, *Waste Water Engineering Treatment and Disposal, Reuse*, Singapour, McGraw-Hill Inc, 2004.
5. Qasim, Syeed, R, Wastewater Treatment Plants, Planning, Design and Operations, New York, CBS Collin Publishing,2000

ENEV 6 0 0016
DESIGN OF WATER TREATMENT PLANT & DISTRIBUTION SYSTEM
3 SKS

Learning Objectives: Students are expected to be able to plan building system and dimensions in water treatment plant of a city, design/plan pipe network

Syllabus : Water sources and demand, Quality, Quantity and Continuity. Water intake building. Aeration, Mixing, Coagulation, Flocculation, Sedimentation, Filtration, reservoir, Hydraulic profile, Oxidation and Disinfection's. Pipe Distribution network, Pump and its accessories, Operation and maintenance

Prerequisites : Unit Operations & Processes, Fluids Mechanics, Environmental Engineering Hydraulics, Hydrology and Drainage

Text Books :

1. Water Works Enginering, *Planning, Design & Operation* , Syed R. Qasim, 2000
2. *Water Treatment Principles and design, J. M. Montgomery, 1985*
3. Element of Water Supply and Wastewater Disposal, Fair and Geyer, 1971
4. Water and Wastewater Technology, Mark J. Hammer, 1996
5. Cheremisinof. *Handbook of Water and Waste Water Technology*, 1995
6. Water Supply and Sewerage, Terence J. Mc.Ghee, 1991

ENEV 6 0 0017
ENEV 6 1 0017
POLLUTION PREVENTION
3 SKS

Learning Objectives : The undergraduate engineer is introduced to the need for reliable waste tracking and accountability utilizing the cradle-to-cradle approach. The waste hierarchy is presented in terms of the basics of production processes. Clean industrial production is examined utilizing concrete Indonesian case histories.

Basic principles of product design, composition, and packaging are examined. Tools are presented for understanding, communicating, and managing industrial manufacturing process using a complete materials balance, full life-cycle analysis

Syllabus : Course objective: To equip each student with a fundamental understanding of industrial pollution prevention and cleaner production as it applies within Indonesia, including: the principles of toxic use reduction, waste minimization, pollution prevention, sustainable development, cleaner industrial production, and the global environmental management hierarchy; the engineering process and method of developing a full-facility, multimedia pollution prevention program in selected industries; specific pollution prevention practices, as determined through assessmentsand mass-balance analyses of waste streams ; basic principles of product design, composition and packaging in terms of clean industrial production; the engineering method to assist selected industries in applying of P2 technologies

Prerequisites :

Text Books :

1. Harry M. Freeman, INDUSTRIAL POLLUTION PREVENTION HANDBOOK, Mc Graw-Hill, New York, 1995, 935 pages
2. United States Environmental Protection Agency (EPA), Facility Pollution Protection Prevention Guide (FP2G), epa/600/r-92/088, Washington DC, May 1992, 143 Pages
3. Paul Bishop, Fundamental and Practice, Pollution Prevention

ENEV 6 0 0018
INTERNSHIP
3 SKS

Learning Objectives: Internship is intended to students learn in the real world of works based on interest field in civil and environmental engineering

Syllabus : Specify the job objectives in the proposal; Implement an internship at a site that has been approved and in accordance with its specificity; Study and describe the process of technical work, quality control, project management, project specifications, engineering drawings and other aspects; Identify the problem related to the technical work, quality control, project management, project specifications, engineering drawings and other aspects; Conduct problems that occur at each stage of the project; Determine ways or solutions to overcome the problems associated with the project learned; Prepare a final report includes project description, existing problems and problem solving

Prerequisites : Building Construction, Basic Soil Mechanics, Project Management and Engineering Economics, Structural Design and Environmental Engineering Facilities

The student is able to start to do an internship if:

1. Already got at least 75 credits (SKS) and already pass 6th semesters
2. Registered and fill out IRS for Internship Special Course, and expresses him/herself to the Internship Coordinator in the Department of Civil Engineering
3. Students choose a project and / or object of selected activities at internships site and location that has been contacted previously
4. Students must complete and submit the registration form at the Secretariat of Civil Engineering Department

Text Books :

ENEV 6 0 0019
SEMINAR
1 SKS

Learning Objectives: Students are able to communicate in verbal and writing a research proposal, to formulate a research problem and objectives, to conduct literature study, to develop a research hypothesis, to construct research methodology, and to present preliminary research results in a form of scientific report to be presented in front of the board of examiners

Syllabus : Developing problem description; developing basic research design, including relevant assumptions and constraints; conducting literature study and constructing research methodology; preparing and presenting a well-structured and well-written final report

Prerequisites : Passing 110 credits with GPA >= 2,00 and without grade of E

ENEV 6 0 0020
FINAL PROJECT
4 SKS

Learning Objectives:

Students are able to (1) prepare a research proposal based on good understanding of research methodology, (2) prepare a well-written research report (in Bahasa Indonesia), and (3) present and defend research results.

Syllabus : Synthesizing various lectures taken by students to design or to solve engineering problems. Preparing a written report of the synthesis.

Prerequisites : Passing 128 credits with GPA >= 2,00 and without grade of E

ENEV 6 0 0101
EPIDEMIOLOGY
2 SKS

Learning Objectives : Students are able to explain the interaction of human activities and the environment and its impact on human and environment health; based on the application of environment-based disease surveillance affected by physical, chemical and biological environment factors in the media, students are able to apply the technical efforts of prevention and control.

Syllabus : Epidemiology study and the interaction of the human activities with environment and its impact on human and environmental health; to know the various agents in the environment that could potentially cause health problems as well as the technical efforts of prevention and control. Beginning with a description of the definitions and concepts of epidemiology; followed by the principles-based health disturbance control environment, various environmental media and the mechanism of human exposure to various agents through the media. Then to discuss the principles and application of environment-based disease surveillance; physical, chemical, and biological environment factors in the media. Last taught a variety of technical efforts to prevent and control pollution impacts associated with relevant legal and regulatory.

Prerequisites : preferably students have been passed of Environmental Science course and Environmental Chemistry course

Text Books :

1. Gordis (2006), Epidemiology
2. Mukono (2002), Epidemiologi Lingkungan
3. Koren H & Bisesi M (2002), Handbook of Environmental Health, Volume 1 dan 2.

ENEV 6 0 0102
AIR POLLUTION
3 SKS

Learning Objectives : Students are able to explain the principles of air pollution and technologies needed to control air pollution not only happen in indoor but also outdoor environment.

Syllabus : The principles of air pollution, source and characteristics of air pollutant, mechanism of dispersion, environmental impact and air pollution control technologies. How to sample and analyze several type of air pollutant.

Prerequisites : Chemistry and Environmental Chemistry

Text Books :

1. Spengler, J. D., Slamet, J. M., Mc Carthy, J. F. 2000, Indoor Air Quality Handbook, McGraw Hill
2. Vallero, D, 2008. Fundamentals of Air Pollution, Fourth ed. Academic Press

ENEV 6 0 0103
ENVIRONMENTAL SYSTEM DYNAMICS
3 SKS

Learning Objectives: Students are expected to explain the basic principle of understanding the environmental dynamic system and the interactions that occur in each component of the environment (social, natural and artificial) that supports and decisive indecision making and the selection of the best technology to be used.

Syllabus : Introduction (understanding the basic system environment with the natural environment subsystems, artificial and social); Dynamics of environmental systems (integration of the basic principles of environmental science: interaction, interdependency, diversity, harmony and sustainability); System dynamics of the physical environment (recycling of matter and energy, hydrological cycle, food chain, risk and environmental pollution); Management models of physical environment systems (determining factor, the media and the interaction between the physical components of the environment in the environment system); Social systems management model (management of environmental conflicts and mediation); Physical case studies; and Social case study.

Prerequisites :

Text Books: Tyller Miller, Living in The Environment, McGraw-Hill, Singapore, 1994

Reference Book :

1. Amy, The Polities of Environmental Mediation, Columbia University Press, 1987
2. Fisher dkk, Mengelola Konflik Ketrampilan dan Strategi Untuk Bertindak, The British Council, Jakarta, 2000

ENEV 6 0 0104
ENVIRONMENTAL TOXICOLOGY
3 SKS

Learning Objectives : Students are expected to explains the principles of toxicology

Syllabus: Preliminary : Definition, Scope, relationsship with other science , Toxicology Historical, dose-response relationship, toxic source compound, toxicants movement in the environment ; History :Types of Air pollutants, Sources of Air pollutants, Examples of air pollutants, Environmental effects; Water and soil pollutants, Sources of water and soil pollutants, Examples of pollutants, Occupational toxicant, Regulation of exposure level, Routes of Exposure, Examples of industrial toxicants; Metals, Agricultural chemicals, Food additives and contaminants, Solvents, Therapeutic drugs, Drugs of abuse, Combustion Products, Cosmetics; Absorption and Distribution of Toxicants; Metabolism of Toxicants; Human Health Risk assessment; Dasar Environmental Toxicology; Transport and fate of toxicant in the Environment; Environmental Risk Assessment Prevention of Toxicity;

Prerequisites :

Text Books :

1. Hodgson, E.2004. *A Textbook of Modern Toxicology 3rd edition.* Wiley Interscience.
2. Williams and Burson. 1985. *Industrial Toxicology: Safety and Health Applications in the Workplace*. Van Nostrand Reinhold:

USA

ENCV 6 0 0501
MECHANICAL EARTHWORKS AND HEAVY EQUIPMENTS
3 SKS
Refer to Page 87

ELECTIVE COURSE FROM MASTER PROGRAM

ENCV 8 0 0406
GROUND WATER RESOURCES MANAGEMENT
3 SKS
Refer to Page 366

ENCV 8 0 0801
PHYSICAL, BIOLOGICAL AND CHEMICAL TREATMENT IN ENVIROMENTAL ENGINEERING
3 SKS
Refer to Page 357

ENCV 8 0 0802
CLIMATE CHANGED AND ENVIRONMENTAL ENGINEERING
3 SKS
Refer to Page 357

ENCV 8 0 0803
ENVIRONMENTAL AUDIT
3 SKS
Refer to Page 357

ENCV 8 0 0001
ENGINEERING MATHEMATICS
3 SKS
Refer to Page 356

ENCV 8 0 0807
TECHNOLOGY OF RESOURCES EFFICIENCY - LIFE CYCLE ANALYSIS (LCA) AND INTEGRATED SOLID WASTE MANAGEMENT
3 SKS
Refer to Page

ENCV 8 0 0808
ENGINEERING PRACTICE AND SOLID WASTE TECHNOLOGY
3 SKS
Refer to Page

ENCV 8 0 0809
CONTAMINATION AND SOIL REMEDIATION
3 SKS
Refer to Page 373

ENCV 8 0 0804
EMISION CONTROL ON SOLID WASTE TREATMENT UNIT
3 SKS
Refer to Page 366

ENCV 8 0 0805
TECHNOLOGY OF SOLID WASTE TREATMENT: OPERATION AND DESIGN
3 SKS
Refer to Page

ENCV 8 0 0806
HAZARDOUS AND INDUSTRIAL WASTE MANAGEMENT
3SKS
Refer to Page 366

ENCV 8 0 0406
GROUND WATER RESOURCES MANAGEMENT
3 SKS
Refer to Page 366

4.3. UNDERGRADUATE PROGRAM IN MECHANICAL ENGINEERING

Program Specification

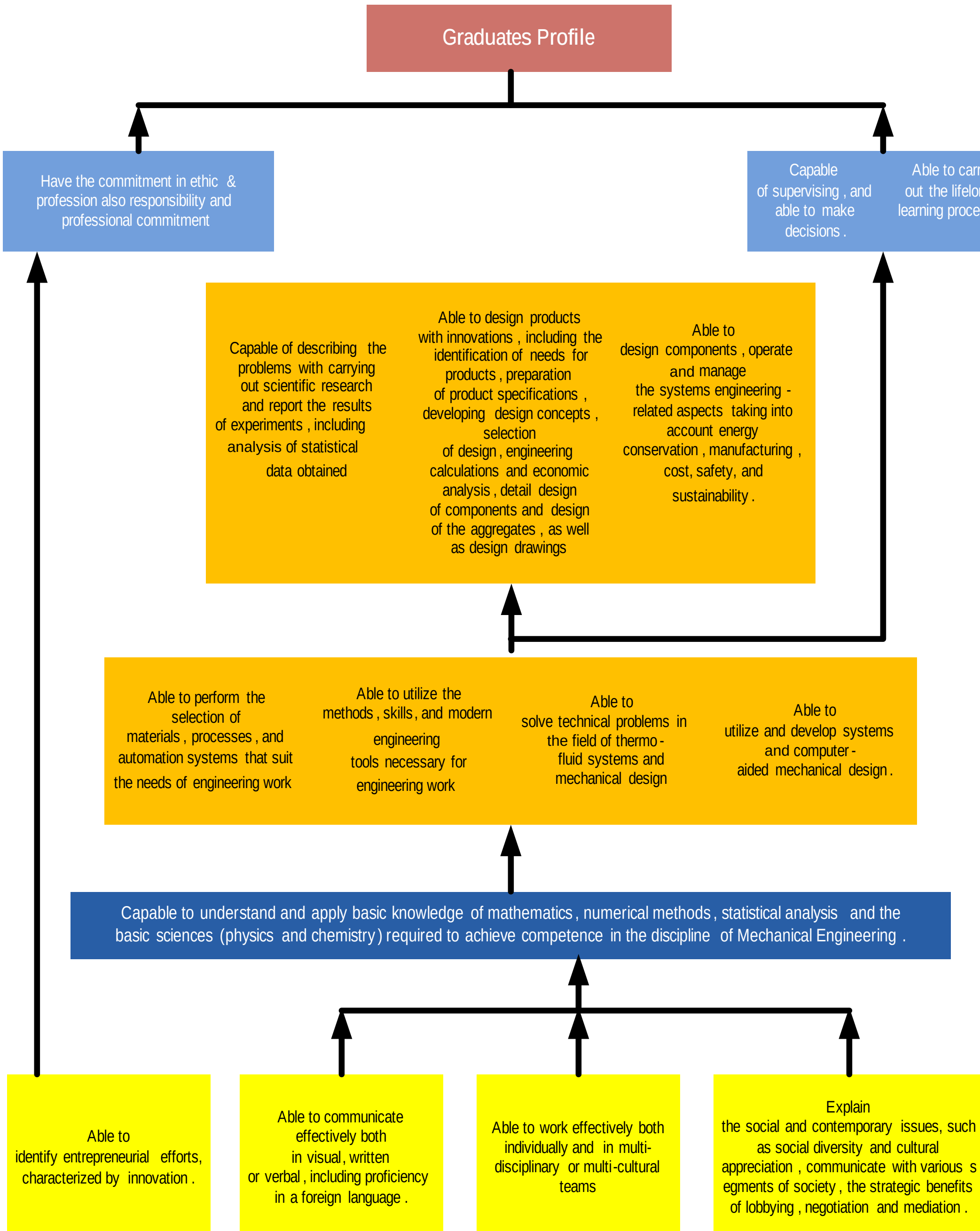
1.	**Awarding Institution**	Universitas Indonesia Double Degree: Universitas Indonesia and Partner University	
2.	**Teaching Institution**	Universitas Indonesia Double Degree: Universitas Indonesia and Partner University	
3.	**Programme Tittle**	Undergraduate Program in Mechanical Engineering	
4.	**Class**	Regular, Parallel and International	
5.	**Final Award**	Sarjana Teknik (S.T) Double Degree: Sarjana Teknik (S.T) and Bachelor of Engineering (B.Eng)	
6.	**Accreditation / Recognition**	BAN-PT: A Accredited - AUN-QA	
7.	**Language(s) of Instruction**	Bahasa Indonesia and English	
8.	**Study Scheme (Full Time / Part Time)**	Full Time	
9.	**Entry Requirements**	High school /equivalent, or D3 / Polytechnique / equivalent, AND pass the entrance exam.	
10.	**Study Duration**	Designed for 4 years	
	Type of Semester	Number of Semester	Number of weeks / semester
	Regular	8	17
	Short (optional)	3	8
11.	**Graduate Profiles:** Engineering graduates who have abilities to design and analyze in the field of mechanical engineering with excellent leadership and professional characters.		
12.	List of Graduates Competency: 1. Capable to understand and apply basic knowledge of mathematics, numerical methods, statistical analysis and the basic sciences (physics and chemistry) required to achieve competence in the discipline of Mechanical Engineering. 2. Capable of describing the problems with carrying out scientific research and report the results of experiments, including analysis of statistical data obtained. 3. Capable to solve technical problems in the field of thermo-fluid systems and mechanical design. 4. Able to carry out product design innovations, including the identification of needs for products, preparation of product specifications, developing design concepts, selection of design, engineering calculations and economic analysis, detail designand design aggregate components, and design drawings. 5. Able to design components, operate and manage the systems engineering-related aspects taking into account energy conservation, manufacturing, cost, safety, and sustainability. 6. Able to utilize the methods, skills, and modern engineering equipment that suit the needs of engineering work. 7. Able to perform the selection of materials, processes, and automation systems that suit the needs of engineering work. 8. Capable of supervising, and able to make decisions. 9. Able to utilize and develop systems and computer-aided mechanical design. 10. Professional responsibility and commitment. 11. Able to identify entrepreneurial efforts, characterized by innovation. 12. Able to work effectively both individually and in multi-disciplinary or multi-cultural teams. 13. Explain the social and contemporary issues, such as social diversity and culturalappreciation, communicate with various segments of society, the strategic benefits of lobbying, negotiation and mediation. 14. Able to communicate effectively both in visual, written or verbal, including proficiency in a foreign language. 15. Able to carry out the lifelong learning process.		

13	Classification of Subjects		
No.	**Classification**	**Credit Hours (SKS)**	**Percentage**
i	University General Subjects	18	12,5 %
ii	Basic Engineering Subjects	30	20,8 %
iii	Core Subjects	68	47,2 %
iv	Elective Subjects	16	11,1 %
v	Internship, Seminar, Undergraduate Thesis, Project	12	8,4 %
	Total	144	100 %
14.	Total Credit Hours to Graduate		144 SKS

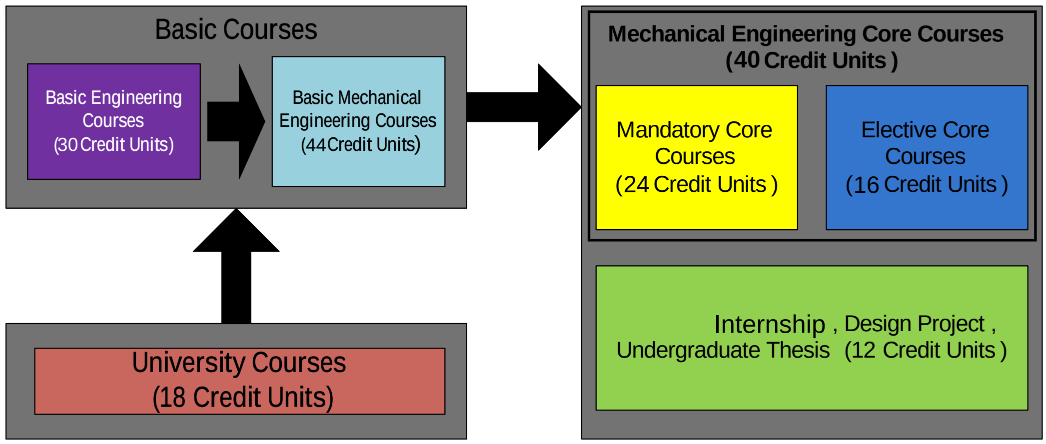
Career Prospects

Graduates of Mechanical Engineering has devoted itself in various fields, including automotive industry, oil and gas, heavy machinery, educational institutions, research institutions and other industries

Learning Outcomes Flow Diagram



Flow Diagram of Subjects



The basic structure of Mechanical Engineering Undergraduate Program shows the category and relation between courses in outline. In practice, groups of subjects distributed into the semester and each semester subject to the intake of science and the foundation for the next semester, either directly or indirectly, so that a complete science of mechanical engineering at the end of the course.

Before completing the undergraduate engineering program with 144 credit units, the students of Mechanical Engineering Study Program have to accomplish: University Courses (18 credit units), Basic Engineering Courses (30 credit units), Basic Mechanical Engineering Courses (44 credit units),Mechanical Engineering Core Courses (40 credit units) which consist of Mandatory Core Courses (24 credit units) and Elective Core Course (16 credit units) and 12 credits units consist of Design Project, Internship and Undergraduate Thesis.

University courses are a group of subjects who provide the knowledge base and opening depth of knowledge and common knowledge at the level of university /higher education with an emphasis on knowledge, among others, social cultural, art and history to students and graduates can understand, and interact with aspects of and non-technical areas to be the basis for the development of engineering skills.

Basic Engineering Courses are a group of courses that provide the basic knowledge to think logically and systematically by utilizing the basic principles of science (mathematics, physics, and chemistry) and aspects of health, safety and environment to be able to solve problems and development of mechanical engineering.

at the same time and continuously with The Basic Engineering Courses, The Basic Mechanical Engineering designed to provide the knowledge, comprehension and basic competence in the field of mechanical engineering with an emphasis on the ability of designing and planning of mechanical systems with emphasis on the areas of energy conversion, design and production / manufacturing.

The Mechanical Engineering Mandatory Core Courses is broadly follow The Basic Mechanical Engineering Courses given to increase the ability and competence in Mechanical Engineering field and rules in the application of these competencies, as well as provide an understanding in the field of managerial and entrepreneurship development.

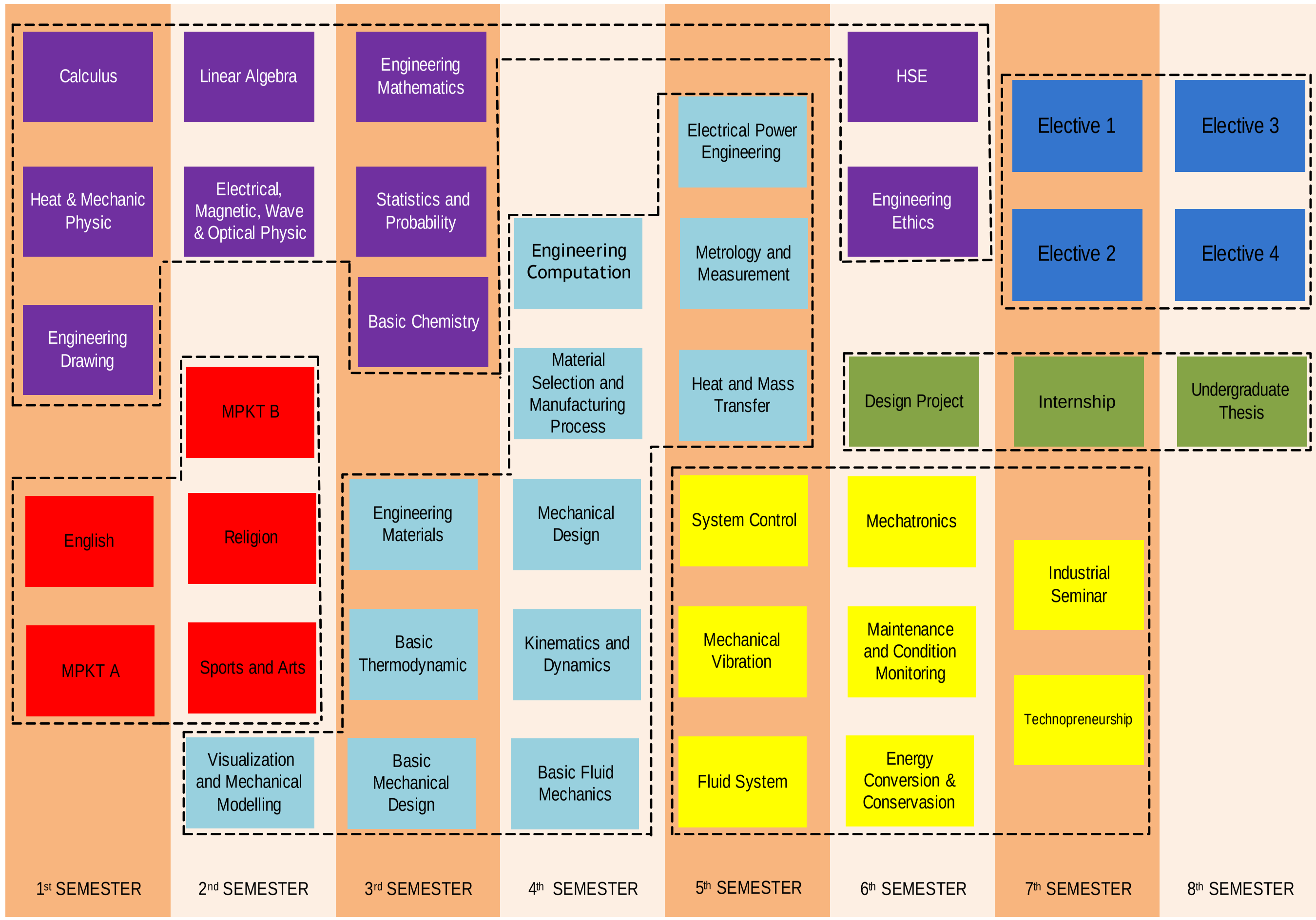
The Mechanical Engineering Elective Core Courses given to increase the ability and competence specifically in Mechanical Engineering Field to build the more specific competence or in the field with a wider mechanical engineering knowledge.

Further development of skills and capabilities in innovation and implementation ofmechanical engineering sciences, subjects administered through Design Project, Internship and Undergraduate Thesis. In an effort to give opportunities to students who want to increase and broaden their horizons, skills, knowledge and capabilities, then the student may be allowed to take subjects across departments / faculties are offered by departments / faculties in accordance with the terms and conditions set out. Apart from that, the Department of Mechanical

Engineering, also offers some of the subjects as subjects of cross department / office that can be taken and open to students with different academic disciplines to add insight and knowledge. The Curriculum was designed and developed so that the learning process can produce well competent graduates with the characteristic according to the education purpose, which are:

1. Have a strong engineering knowledge.
2. The ability to design and conduct the research and also the ability to analyze the data.
3. The ability to identify, formulate and solve the problems in mechanical engineering field according to the study of new cases.
4. The ability to design a system, component or process of a mechanical system to fulfill the requirement with considering and applying the economical aspect.
5. Leadership knowledge, a good communication skill, teamwork, knowledge and self improvement.

The groups of the courses can be seen according to the characteristic and the education purposes that are expected as shown in figure below.



Course Structure Undergraduate Program in Mechanical Engineering Regullar and Parallel

KODE	MATA AJARAN	SUBJECT	SKS
	Semester 1	**1 st Semester**	
UIGE 6 0 0004	MPK Terintegrasi B	Integrated Character Building Subject B	6
UIGE 6 0 0002	Bahasa Inggris	English	3
ENGE 6 0 0001	Kalkulus	Calculus	4
ENGE 6 0 0009	Menggambar Teknik	Engineering Drawing	2
ENGE 6 0 0003	Fisika Dasar 1 (Mekanika dan Panas)	Basic Physics 1	4
		Subtotal	**19**
	Semester 2	**2 nd Semester**	
UIGE 6 0 0001	MPK Terintegrasi A	Integrated Character Building Subject A	6
UIGE 6 0 0005-9	Agama	Religious Studies	2
UIGE 6 0 0003	Olahraga/Seni	Sports/Arts	1
ENGE 6 0 0002	Aljabar Liniear	Liniear Algebra	4
ENGE 6 0 0004	Fisika Dasar 2	Basic Physics 2	4
ENME 6 0 0001	Visualisasi dan Permodelan Mesin	Mechanical Visualization and Modelling	3
		Subtotal	**20**
	Semester 3	**3 rd Semester**	
ENME 6 0 0002	Matematika teknik	Engineering Matematics	4
ENGE 6 0 0005	Statistik dan Probabilitas	Statistic and Probability	2
ENGE 6 000010	Kimia Dasar	Basic Chemistry	2
ENME 6 0 0003	Material Teknik	Material Engineering	4
ENME 6 0 0004	Termodinamika Dasar	Basic Thermodynamics	4
ENME 6 0 0005	Dasar Perancangan Mekanikal	Fundamental of Mechanical Design	4
		Subtotal	**20**
	Semester 4	**4 th Semester**	
ENEE 6 0 0031	Komputasi Teknik	Engineering Computation	2
ENME 6 0 0007	Proses Manufaktur dan Pemilihan Material	Material Selection and Manuf. Process	6
ENME 6 0 0008	Kinematika dan Dinamika	Kinematics and Dynamics	4
ENME 6 0 0009	Mekanika Fluida Dasar	Basic Fluid Mechanics	4
ENME 6 0 0010	Perancangan Mekanikal	Mechanical Design	4
		Subtotal	**20**
	Semester 5	**5 th Semester**	
ENME 6 0 0011	Getaran Mekanis	Mechanical Vibration	2
ENME 6 0 0012	Pengukuran dan Metrologi	Measurement and Metrology	3
ENME 6 0 0013	Perpindahan Kalor dan Massa	Heat and Mass Transfer	4
ENEE 6 0 0017	Teknik Tenaga Listrik	Electrical Power Engineering	2
ENME 6 0 0015	Pengendalian Sistem	Control System	4
ENME 6 0 0016	Sistem Fluida	Fluid System	3
		Subtotal	**18**
	Semester 6	**6 th Semester**	
ENME 6 0 0024	Etika Enjiniring	Engineering Ethics	2
ENGE 6 0 0008	K3L (Kesehatan, Keselamatan, dan Lindung Lingkungan)	Health, Safety and Enviroment	2
ENME 6 0 0017	Pemeliharaan dan Pemantauan Kondisi Mesin	Maintenence and Condition Monitoring	3
ENME 6 0 0018	Konversi dan Konservasi Energi	Energy Conversion and Conservation	4
ENME 6 0 0019	Mekatronika	Mechatronics	4
ENME 6 0 0020	Tugas Merancang	Design Assignment	4
		Subtotal	**19**
	Semester 7	**7 th Semester**	
ENME 6 0 0025	Kapita Selekta Industrial	Industrial Seminar	2
ENME 6 0 0021	Teknopreneurship	Technopreneurship	2

ENME 6 0 0022	Kerja Praktik	Internship	2
	Pilihan 1	Elective 1	4
	Pilihan 2	Elective 2	4
		Subtotal	**14**
	Semester 8	**8 th Semester**	
ENME 6 0 0023	Skripsi	Final Project	6
	Pilihan 3	Elective 3	4
	Pilihan 4	Elective 4	4
		Subtotal	**14**

Electives can be taken from other department or selected from the Master Program, please see the following table. Fast Track students must take electives from a particular stream only

1. Energy Conversion Stream

Code	Mata Kuliah	Subject	Credits
	Semester 7	**7th Semester**	
ENME 8 0 0114	Teknik Pembakaran	Combustion Engineering	4
ENME 8 0 0115	Motor Pembakaran Dalam	Internal Combustion Engineering	4
ENME 8 0 0116	Pengukuran dan Visualisasi AliranTerapan	Applied Flow Measurement and Visualiza-tion	4
ENME 8 0 0117	Aplikasi CFD	CFD Application	
	Semester 8	8 th Semester	**Credits**
ENME 8 0 0111	Rekayasa Penukar Kalor dan Massa	Heat and Mass Transfer Engineering	4
ENME 8 0 0112	Teknik Aerodinamika	Aerodynamics Engineering	4
ENME 8 0 0113	Pembangkitan Daya	Power Generation	4

2. Building Utility System and Fire Safety Stream

Code	Mata Kuliah	Subject	Credits
	Semester 7	**7 th Semester**	
ENME 8 0 0214	Teknik Refrijerasi	Refrigeration Engineering	4
ENME 8 0 0215	Teknik Keselamatan dan Proteksi Kebakaran	Fire Safety and Protection Engineering	4
	Semester 8	**8 th Semester**	**Credits**
ENME 8 0 0211	Sistem Ventilasi dan Tata Udara	Air Conditioning and Ventilation System	4
ENME 8 0 0212	Perancangan Sistem Utilitas Bangunan	Building Utility System Design	4
ENME 8 0 0213	Audit Energi	Energy Audit	4
ENME 8 0 0202	Sistem Mekanikal dan Elektrikal Gedung	Building Mechanical and Electrical System	4

3. Design and Product Manufacturing Stream

Code	Mata Kuliah	Subject	Credits
	Semester 7	7 th Semester	
ENME 8 0 0314	Fabrikasi Mikro dan Manufaktur Presisi	Microfabrication and precision manufac-turing	4
ENME 8 0 0315	Dinamika Sistem Mekanikal	Dynamics of Mechanical System	4
ENME 8 0 0316	Pengembangan Produk Komposit	Composite Product Development	4
ENME 8 0 0317	Finite Element dan Multiphysics	Finite Element and Multiphysics	4
	Semester 8	8 th Semester	Credits
ENME 8 0 0311	Perancangan untuk Manufaktur dan Perakitan	Design For Manufacture and Assembly	4
ENME 8 0 0312	Kegagalan Mekanikal	Mechanical Failure	4
ENME 8 0 0313	Kebisingan dan Getaran	Noise and Vibration	4

4. Automation and Manufacturing System Stream

Code	Mata Kuliah	Subject	Credits
	Semester 7	7 th Semester	
ENME 8 0 0413	System Machine Vision	System Machine Vision	4
ENME 8 0 0414	Sistem Manajemen Produksi dan Mutu	Quality and Production Management System	4
	Semester 8	8 th Semester	Credits
ENME 8 0 0411	CAD/CAM	CAD/CAM	4
ENME 8 0 0412	Penilaian Kinerja Manufaktur	Manufacturing Performance Assesment	4
ENME 8 0 0402	Otomasi dan Robotika	Automation and Robotics	4

5. Vehicle Engineering and Heavy Equipment Stream

Code	Mata Kuliah	Subject	Credits
	Semester 7	7 th Semester	
ENME 8 0 0513	Teknologi Mutakhir Kendaraan	Modern Vehicle Technolgy	4
ENME 8 0 0514	Peralatan Pengeboran Minyak dan Gas	Oil and Gas Drilling Equipment	4
	Semester 8	8 th Semester	Credits
ENME 8 0 0511	Teknik Kendaraan Rel	Railway Vehicle Engineering	4
ENME 8 0 0512	Mesin dan Peralatan Pengangkat	Handling and Construction Equip-ment	4

For students who are willing and capable to continue the education program to pursue Masters in Engineering through the Fast track program, credit transfer can be performed as many as 20 credits.

The numbers of credits that can be transferred consist of: 4 credits from Engineering Mathematic course, 8 credits from 2 Mandatory Core Courses and 8 credits from 2 Elective Core Courses.

Terms and conditions to become the participant of Fast Track program are:

1. Expressed a desire to follow the Fast Track Program, by writing an application to the Head of the Department of Mechanical Engineering with Study Plan includes a plan-making subjects in Semester 6 to 8 (in the Bachelor of Engineering) and subject Semester 1 to 4 (the Master of Engineering Program) in accordance with the Master of Engineering Program Specialisation, no later than the end of 5th Semester the undergraduate program.
2. Have an excellent academic record, with 3.0 GPA until 5th semester and have passed all the basic courses.
3. The students that follow the Fast Track program expressed their willingness to join this program on full time basis.
4. If the application of the fast track program can be approved by the Head of Department / Study Program, the student will be discussed along with the Academic Advisor for the finalization of the study plan in undergraduate and graduate program.

The students from the undergraduate program that have the aggrement to join the fast track program have to reschedule their study in 7th and 8th semester to get along with their 1st and 2nd semester in graduate program.

Mechanical Engineering Undergraduate International Program Curriculum

The international program of mechanical engineering study is divided into two phase which are the first will be done at University of Indonesia and the other phase will be completed at partner universities in Australia. There will be option to continue the second phase at UI. A student at the Department of Mechanical Engineering - Univesity of Indonesia must complete and pass 72 - 74credits over 4 semester before continuing to partner universities. The courses are classified into General courses (7 credits); Basic courses (65 credits) that consist of Basic Engineering courses (28 credits) and Basic Mechanical Engineering courses (37credits).

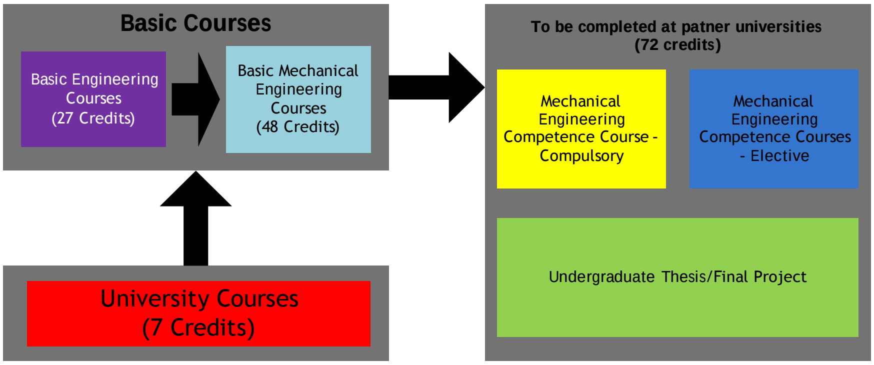


Table 6. Course Structure of Mechanical Engineering at QUT + Semester 5 s/d 8

CODE	SUBJECT	SKS
	1 st Semester	
UIGE 6 1 0002	Academic Writing	3
ENGE 6 1 0001	Calculus	4
ENGE 6 1 0010	Basic Chemistry	2
ENGE 6 1 0009	Engineering Drawing	2
ENGE 6 1 0003	Basic Physics 1 (Mechanic & Heat)	4
ENGE 6 1 0005	Statistics and Probability	2
ENME 6 1 0024	Engineering Ethics	2
	Subtotal	19
	2 nd Semester	
ENGE 6 1 0002	Liniear Algebra	4
ENGE 6 1 0004	Basic Physics 1 (Elec, Magnet, Wave, and Optic)	4
ENME 6 1 0001	Mechanical Visualization and Modelling	3
ENME 6 1 0003	Material Engineering	4
ENME 6 1 0005	Fundamental of Mechanical Design	4
	Sports/Arts	1
	Subtotal	20
	3 rd Semester	
ENME 6 1 0002	Engineering Matematics	4
ENME 6 1 0004	Basic Thermodynamics	4
ENME 6 1 0010	Mechanical Design	4
ENME 6 1 0008	Kinematics and Dynamics	4
ENEE 61 0017	Electrical Power Engineering	2
	Subtotal	18
	4 th Semester	
UIGE 6 1 0005-9	Religious Studies	2
ENGE 6 1 0008	Healthy, Safety and Enviroment	2
ENME 6 1 0006	Engineering Computation	2
ENME 6 1 0007	Material Selection and Manuf. Process	6
ENME 6 1 0009	Basic Fluid Mechanics	4
ENME 6 1 0011	Mechanical Vibration	2
	Subtotal	18
	5 th Semester	
UIGE 6 1 0001	Integrated Character Building Subject A	6
ENME 6 1 0012	Metrology and Measurement	3
ENME 6 1 0013	Heat and Mass Transfer	4
ENME 6 1 0015	System Control	4
ENME 6 1 0016	Fluid System	3
	Subtotal	20
	6 th Semester	
UIGE 6 1 0004	Integrated Character Building Subject B	6
ENME 6 1 0017	Maintenance and Condition Monitoring	3

CODE	SUBJECT	SKS
	6th Semester	
ENME 6 1 0019	Mechatronics	4
ENME 6 1 0021	Teknoprneurship	2
ENME 6 1 0020	Design Assignment	4
	Subtotal	19
	7 th Semester	
ENME 6 1 0025	Capita Selecta	2
ENME 6 1 0018	Energy Conversion and Conservation	4
ENME 6 1 0022	Internship	2
	Elective 1	4
	Elective 2	4
	Subtotal	16
	8 th Semester	
ENME 6 1 0023	Final Project	6
	Elective 3	4
	Elective 4	4
	Subtotal	14
ELECTIVES		
ENME 8 0 0411	CAD/CAM	4
ENME 8 0 0113	Power Generation	4

Year 3	Semester 5 (UQ) July	Credits
KODE	Course Title	
ENB222 ENB231 ENB311 MAB233	Thermodynamics 1 Materials and Manufacturing 1 Stress Analysis Engineering Mathematics 3, or Electives	12 12 12 12
	subtotal	48

Year 3	Semester 6 (UQ) March	Credits
KODE	Course Title	
ENB215 ENB321 ENB331	Fundamentals of Mechanical Design Fluids Dynamics Materials and Manufacturing 2 Elective / Minor	12 12 12 12
	subtotal	48

Year 4	Semester 7 (UQ) July	Credits
KODE	Course Title	
ENB312 ENB316 ENB421	Dynamics of Machinery Design of Machine Elements Thermodynamics 2	12 12 12
	subtotal	36

Year 4	Semester 8 (UQ) March	Credits
KODE	Course Title	
BEB801 ENB313 ENB317	Project 1 Automatic Control Design and Maintenance of Machinery Electives / Minor	12 12 12 12
	Subtotal	48

Table 7. Course Structure of Mechanical Engineering at University of Queensland

For July Intake

Year 3	Semester 5 (UQ) July	Credits
KODE	Course Title	
MECH2700 MECH3100 MECH3200 MECH3410	Engineering Analysis I Mechanical and Space System Design Advanced Dynamics and Vibration Fluid Mechanics	2 2 2 2
	subtotal	8

Year 3	Semester 6 (UQ) March	Credits
KODE	Course Title	
MATH2010 STAT2201 MECH3300 MECH3400 MECH3600	Analysis of Ordinary Differential Equation Analysis of Engineering and Scientific Data Finite Element Method and Fracture Mechanics Thermodynamics and Heat Transfer Engineering Management and Communication	1 1 2 2 2
	subtotal	8

Year 4	Semester 7 (UQ) July	Credits
KODE	Course Title	
MECH4501	Engineering Thesis Elective Elective Elective	4 2 2 2
	subtotal	10

Year 4	Semester 8 (UQ) March	Credits
KODE	Course Title	
MECH4501 METR3200	Engineering Thesis Introduction to Control System Elective Elective	4 2 2 2
	subtotal	10

List of Electives at UQ (is called Part B Electives)

B2 - Advanced Electives

Code	Course Title	Credits
AERO3100	Aerospace Materials	2
CHEE4302	Electrochemistry & Corrosion	2
ELEC2003	Electromechanics & Electronics	2
ENGG4101	Systems Engineering & Design Management	2
ENGG4102	Advanced Product Design Methods	2
ENGG4103	Engineering Asset Management	2
MECH3250	Engineering Acoustics	2
MECH3305	Science & Engineering of Metals	2
MECH3750	Engineering Analysis II	2
MECH4301	Materials Selection	2
MECH4304	Net Shape Manufacturing	2
MECH4450	Aerospace Propulsion	2
MECH4460	Energy & Environment	2
MECH4470	Hypersonics & Rarefied Gas Dynamics	2
MECH4480	Computational Fluid Dynamics	2
MECH4552	Major Design Project [5]	4
MECH4800	Space Engineering	2
MECH4950	Special Topics C	2
MECH4951	Special Topics D	1
METR3100	Sensors & Actuators	2
METR4202	Advanced Control & Robotics	2
TIMS3309	Fundamentals of Technology and Innovation Management	2

List of Electives at UQ (is called Part B Electives)

B3 - Other Electives

Code	Course Title	Credits
MATH1050	Mathematical Foundations [6]	2
SCIE1010	Introduction to Research Practices - The Big Issues	2

Table 8. Course Structure of Mechanical Engineering at Curtin University

For July Intake

Year 3	Semester 5 (Curtin) July	Credits
KODE	Course Title	
307660	Engineering Sustainable Development	12.5
307664	Engineering Law	12.5
308803	Mechanical Design	25
308810	Fluid Flow Modelling	25
308815	Automatic Control	12.5
3864	Electrical Plant	12.5
	subtotal	100

Year 3	Semester 6 (Curtin) March	Credits
KODE	Course Title	
308801	Thermal Engineering Processes	25
308812	Industrial Technology	25
308813	Materials	25
308814	Dynamic Systems	25
	subtotal	100

Year 4	Semester 7 (Curtin) July	Credits
KODE	Course Title	
5051	Mechanical Project	25
	Optional Unit	25
	Optional Unit	25
	Optional Unit	25
	subtotal	100

Year 4	Semester 8 (Curtin) March	Credits
KODE	Course Title	
308821	Mechanical Project	37.5
310544	Professional Practice	12.5
	Optional Unit	25
	Optional Unit	25
	subtotal	100

List of Optional Units at Curtin

Year 4	Semester 7 (Curtin) July	Credits
KODE	Course Title	
12907	Design For Manufacturing	25
12911	Automatic Control	25
12925	Fluid Mechanics	25
302862	Finite Element Analysis	25
302866	Noise	25

Year 4	Semester 8 (Curtin) March	Credits
KODE	Course Title	
12926	Materials	25
302863	Vibration	25
302864	Heat Transfer	25
310545	Design Methodology	25
312200	Sustainable Energy Systems and Technologies	25
4282	Mechanical Measurements	25

Course Description

UIGE600001
UIGE610001
MPKT A / INTEGRATED CHARACTER BUILDING A
6 SKS
Refer to Page 74

UIGE600004
UIGE610004
MPKT B / INTEGRATED CHARACTER BUILDING B
6 SKS
Refer to Page 74

UIGE600002
ENGLISH
UIGE610002
ACADEMIC WRITING
3 SKS
Refer to Page 74

UIGE600003
UIGE610003
SPORTS / ARTS
1 SKS
Refer to Page 77

ENGE600001
ENGE610001
CALCULUS
4 SKS
Refer to Page 74

ENGE600010
ENGE610010
BASIC CHEMISTRY
Refer to Page 75

ENGE600003
ENGE610003
BASIC PHYSICS 1
4 SKS
Refer to Page 75

ENGE600004
BASIC PHYSICS 2
4 SKS
Refer to Page 77

ENGE600002
ENGE610002
LINEAR ALGEBRA
4 SKS
Refer to Page 75

UIGE600005-9
UIGE610005-9
RELIGIOUS STUDIES
2 SKS
Refer to Page 76-77

ENGE600005
ENGE610005
STATISTICS AND PROBABILITY
2 SKS
Refer to Page 78

ENGE600008
ENGE610008
HEALTH, WORK SAFETY, AND ENVIROMENT
2 SKS
Refer to Page 78

ENGE600009
ENGE610009
ENGINEERING DRAWING (2 SKS)

Learning Objective(s): Course participants are able to transfer geometric component by drawing according to standard draw which is recognized by International Standard Organization (ISO). Students understand the theory and procedure of engineering drawing based on ISO standard. Students are able to read, interpret, and transfer 2D/3D geometric draw from component or construction. Students are able to draw the orthogonal projection based on ISO standard.

Syllabus: Illustration: Function and benefit of Engineering Drawing; SAP; Measurement and Evaluation; Introduction to drawing equipment; Basic definition of geometric, paper format, draw regulation, line, field, line configuration, basic geometric form; Visualization geometric: Skew projection and isometric, function and line types, configuration geometric form; Orthogonal Projection: Projection standard, viewing concept, width display principle; Advanced orthogonal projection: Circle region concept, special region concept, trimming concept, display width, refraction.

Pre-requisite(s): -

Text Book(s):

1. ISO 1101, Technical Drawings, International Organization for Standardization.
2. A.W. Boundy, Engineering Drawing , McGraw-Hill Book Company
3. Colin Simmons & Dennis Maguire, Manual of Engineering Drawing, Edward Arnold
4. Warren J. Luzadder, Fundamentals of Engineering Drawing, Prentice-Hall, Inc.
5. Giesecke-Mitchell-Spencer-Hill-Dygdon-Novak, Technical Drawing, Prentice Hall Inc.

ENME600001
ENME610001
MECHANICAL VISUALIZATION AND MODELLING (3 SKS)
Course Objective:
Students have the basic ability to visualize the information content of one component effectively, capable to create a model for 2D and 3D visualization with utilize the software and interprete the subject into a drawing that can be used as working guidance and can be understand clearly by the user.
Syllabus:
The purpose and the advantage of the drawing in the design and manufacturing process, surface working quality and tolerance, standard and marking classification of working quality, standard and marking classification of working tolerance, Welding construction, standard and marking of kampuh (seam?) and welding, line diagram, 2D and 3D representation method, introduction to modeling software interface, modeling, manipulation and 2D & 3D visualization.
Requirement: Engineering Drawing
References:
1. A.W. Boundy, Engineering Drawing, McGraw-Hill Book Company
2. Colin Simmons & Dennis Maguire, Manual of Engineering Drawing 4th edition 2012, Elsevier.
3. ISO 1101, Mechanical Engineering Drawings, International Organization for Standardization.
4. Japanese Industrial Standard, Technical Drawing for Mechanical Engineering, Japanese Standards Association.
5. Warren J. Luzadder, Fundamentals of Engineering Drawing, Prentice-Hall, Inc..

ENME600002
ENME610002
ENGINEERING MATHEMATICS (4 SKS)
Course Objective:
Complete student's anylitical ability. Students understand and able to use the advances mathematical concepts in order to solve the engineering problems.
Syllabus:
Introduction to differential equation, 1st order differential equation, 2nd order differential equation, higher order differential equation, vector analysis, vector differential, grad operation, divergence and culr, vector integration, laplace transform, laplace transform to solve the differential equation, fourrier transform, convulsion, numerical method, root of equation, numerical differentiation, numerical integral.
Requirement: Calculus, Linear Algebra
References:
1. Croft, A, et.al, Mathematics for Engineers, 3rd Edition, 2008, Prentice Hall
2. Chapra S.C., Canale, Numerical Methods for Engineer, 6th Edition, 2010, Mc Graw Hill
3. Kreyszig, E, Advanced Engineering Mathematics 10th Edition, John Wiley and Sons

ENME600003
ENME610003
ENGINEERING MATERIALS (4 SKS)
Course Objective:
Engineering materials are one of the basic knowledge in field of design, especially in mechanical engineering. From the discussion of the behavior of several materials, the students are expected to have the overview about several thing that has to be the concern related to the working process or the specific need. The students are expected to have the basic ability to identify and explain the nature and behavior of materials related to the treatment in working process and specific need.
Syllabus:
Introduction to the importance of the engineering material science in mechanical engineering, atomic structure, crystalic material, metal and non metal material, process, phase diagram and solidificatiom, heat treatment process, mechanical behavior of crystalic material, elastic material, plastic deformation, crystal plasticity, method of material mechanical testing, dislocation, strengthening, failure and remaining lifetime of material, introduction to mechanical crack and steel mechanical structure behavior, material structure degradation, corrosion process, corrosion prevention, Oxidation, wear and erotion, concrete material behavior, wood, cement and its structure behavior.
Requirement: -
References:
1. Kalpakjian, Manufacturing Engineering and Technology, Addison Wesley- 2008
2. Thomas H. Courtney, Mechanical Behavior of Materials, 2nd Edition McGraw-Hill Book Co. - 2005
3. R.A. Higgins, Property of Engineering Materials, Edward Arnold - 1994
4. Flinn & Trojan, Engineering Materials and Their Applications, John Wiley & Sons, Inc.- 1995
5. James A. Jacobs & Thomas F. Kilduff, Engineering Material Technology, Prentice-Hall, Inc. - 2001

ENME600004
ENME610004
BASIC THERMODYNAMICS (4 SKS)

Course Objective:
This course introduces the basic concept of thermodynamics and its application in real life and gives the understanding about the design of thermodynamics system.

Syllabus:
Scope and basic understanding of thermodynamics system, temperature concept, pressure, thermodynamics equilibrium, reversible/irreversible process, zero law of thermodynamics and absolute temperature, first law of thermodynamics, second law of thermodynamics, thermodynamics equation, gas power cycle, gas compressor, combustion engine cycle, internal combustion engine , simple gas turbine cycle, brayton's cycle, stirling's cycle, steam power cycle, refrigeration, carnot's cycle, simple rankine's cycle, rankine's cycle with modification, biner cycle, phsycometrich chart, cooling tower, real gas, real gas equation, enthalpy and entrophy.

Requirement: -

Referencess:

1. Michael J. Moran, Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, 5th Edition, John Wiley & Sons, 2004.
2. Reynolds W.C., Perkins H.C., Engineering Thermodynamics, Mc. G. Hill .
3. Zemansky , Aboot , van Ness, Basic Engineering Thermodynamics, McGraw Hill
4. Kenneth Wark Jr. Thermodynamics , Mc.Graw Hill
5. H.D. Baehr, Termodynamik , Springer Verlag

ENME600005
FUNDAMENTAL OF MECHANICAL DESIGN (4 SKS)

Course Objective:
This course gives the basic knowledge in material strength and mechanics of system that will be needed in engineering of machine elements.

Syllabus:
Design consept, load and support reaction in the construction, normal force diagram, shear and moment in beam, calculations in beam construction, Trusses, Frame & Machine, 2nd Area Moment and Intertia, stress and strength, normal stress, torsion and bending, deformation, beam with indeterminate static load, Buckling, solid state materials, failure analysis for static load, failure analysis for cyclic load and shock load, basic and simple application of FEM in design, Final Assignment : Application of calculation and FEM in simple axis design.

Requirements: Mechanical Visualization and Modeling ; Engineering Materials

References:

1. Beer, Ferdinand P, Mechanics for Engineers: STATICS, Mc GrawHill.
2. Hibbeler RC, Mechanics of Materials, 5th ed., Prentice Hall, 2003.
3. Riley, F William, Engineering mechanics: STATICS, John wiley & sons
4. Hamrock, Fundamental of Machine Element, Mc Graw-Hill.
5. Shigley, Joseph Edward, Mechanical Engineering Design, McGrawHill.
6. Kurowski, P.M., Finite Element Analysis for Design Engineers, SAE International,2004

ENEE 6 0 0031
ENEE 6 1 0031
NUMERICAL COMPUTATION (2 SKS)
Refer to Page 179

ENME600007
ENME610007
MATERIAL SELECTION and MANUFACTURING PROCESS (6 SKS)

Course Objective:
To give the knowledge, understanding and competence about the theory, application method and product manufacturing process technology that consist of: characteristic and how the process work, process constraint, force and energy that needed in process, the effect of the process parameter to the product quality and the relation between process and material to the material characterisc that needed in every process.

Syllabus:
Manufacturing process and production system, materials in manufactur, theory and method in metal casting, theory and method of bulk formation, theory and method of sheet metal forming, theory and method of powder metallurgy, theory and method of machining/metal cutting process, theory and precess of product surface quality improvement, theory and method of joining, theory and method of prototyping process, characteristic of engineering materials, correlation of material and process characteristic, process parameter control of material, Desing of material selection and manufacturing process that related to the market needs (assignment), Laboratory activity.

Requirement: Engineering Material

Referencess:
1. Ashby, Material selection in Mechanical Design, Butterworrth Heinneman, 2005
2. Ashby, Material selection in Mechanical Engineering, Pergamon Press, 2004
3. John A. Schey, Introduction to Manufacturing Processes, McGraw Hill, 1999
4. Degarmo, E. Paul, Materials and Processes in Manufacturing, Prentice Hall Int. Inc, 8th edition, 2005
5. Kalpakjian, S, Manufacturing Engineering and Technology, McGraw Hill 4th edition, 2001.
6. Buku Panduan Praktikum Proses Produksi, Departemen Teknik Mesin FTUI.

ENME600008
ENME610008
KINEMATICS and DYNAMICS (4 SKS)
Course Objective:
The students have the ability to understand the key concept of kinematics and dynamics of mechanical system and capable to analyse the movement, velocity, acceleration forca and equilibrium.
Syllabus:
Vector velocity analysis, free body diagram, linier motion, velocity polygon, 2D motion, rectangular coordinates, N-T and pole, relative motioan and velocity of 2 coincide/relate point, Coriolis acceleration and stiff body kinematics, Inertia Force, Statics, particle system, works, energy, impuls, linear-angular momentum, stiff body motion, works and energy, relative motion, rotating mass balancing and back & forth motion, cam dynamics and Giroscope.
Requirements:
Mechanical visalization and modeling, Fundamental of Mechanical Design, Mechanical Design
References:
1. Meriam & Kraige, Engineering Mechanics. Vol-2, Wiley New York.4th, 1998.
2. Holowenko, Dynamics of Machinery, John Wiley, 1995.
3. Beer & Johnston, Mechanics for Engineer, Dynamics, Mc Graw-Hill, 1976.

ENME600009
ENME610009
BASIC FLUID MECHANICS (4 SKS)
Course Objective:
Fluid meachanic are one of the applied mechanical science branch that will be used to investigate, analyse, and learn the nature and the behavior of fluids. Fluid that will be explored could be a moving or stationary fluid. Fluid Mechanics course intends to complement the ability of a student to be able to apply the basic laws of fluid mechanics in practical engineering calculations of fluid mechanics and be able to analyze the behavior of the fluid and developing knowledge in the field of fluid mechanics.
Syllabus:
Fluid and its nature, fluid statics, the relative balance, concept and basic equations of fluid flow, dynamic of flow, the equation of fluid motion (Newton, Euler, Navierstokes), Basic Equation of Fluid Dynamics (Continiuty, Energy and momentum), dimentional analysist and hydraulic similarity, ideal fluid flow, viscous flow, viscous flow: transition from laminar into turbulent flow, fully developed turbulent flow, flow around submerged objects, general characteristic of outside flow, concept and characteristic of layer in closed flow, measurement and visualization of flow, pressure measurement concept, flow and capacity, flow measurement devices (Pitot tube, Venturi, orifice, Nozzel, HWA, LDV), Flow visualization method.
Requirement: -
References:
1. Munson, B.R., Fundamentals of Fluid Mecha-nics 4th Ed, John Wiley & Sons, Inc. 2000
2. Smits, A.J., A, Physical Introduction to Fluid Mechanics, John Wiley & Sons, Inc. 2000
3. Kumar, K.L., Engineering Fluid Mechanics, Eurasia Publishing House Ltd., 2000

ENME600010
ENME610010
MECHANICAL DESIGN (4 SKS)
Course Objectives:
Give the understanding about the application of engineering mechanic science and material strength in machine element. The students have the basic competence to design the machine element.
Syllabus:
Basic mechanical design review, design of joint : welding, solder, adhesive bonding, rivet, pin, bolt, nut, thread, axel, shaft, hub, roller & lauch bearing, lubrication, wear and friction, spring, break, fixed and unfixed clutch, chain, belt, basic of gear, straight & tilt bearing, Final Assignment : Design process consist of the understanding of purpose, load and calculation of machine element.
Requirement:
Mechanical Visualization and Modeling; Engineering Materials; Fundamental of Mechanical

Design.

References:

1. Hamrock, Fundamental of Machine Element, Mc Graw-Hill, 2004
2. Shigley, Joseph Edward, Mechanical Engineering Design, McGrawHill., 2003
3. Sularso, Dasar Perencanaan & Pemilihan Elemen Mesin, Pradnya Paramita, 1994
4. Hibbeler RC, Mechanics of Materials, 5th ed., Prentice Hall, 2003.
5. Riley, F William, Engineering Mechanics: STATICS, John wiley & sons

ENME600011
ENME610011
MECHANICAL VIBRATION (2 SKS)

Course Objective:

The students have an understanding of the key points and concepts of the mechanical vibrations of mechanical systems and have the basic competence to analyze the vibration behavior and what parameters can be controlled in order to vibration damping.

Syllabus:

Fundamental of mechanical vibration in mechanical system, oscillatory motion, free vibration, harmonic vibration, transient vibration, system with 2 degree of freedom and system witih multi degree freedom, lumped parameters system and continue system, Lagrange equation, random and non-linier vibration.

Requirements: Engineering Mathematics, Kinematics and Dynamics

Referencess:

1. Meriam & Kraige. Engineering Mechanics. Vol- 2, Dynamics. Wiley New York.4th eds.1998.
2. Holowenko. Dynamics of Machinery.John Wiley.1995.
3. William T.Thomson. Theory of Vibration with application. Prentice Hall India.1972.
4. Beer & Johnston.Mechanics for Engineer-Dynamics.Mc-Graw-Hill.1976.

ENME600012
ENME610012
METROLOGY AND MEASUREMENT (3 SKS)

Course Objective:

Introduce students to modern experimental techniques for mechanical engineering; provide exposure to and experience with a variety of sensors used in thermo-mechanical systems, including sensors to measure temperature, pressure, displacement, velocity, acceleration and strain; examine the role of error and uncertainty in measurements and analysis; exposure to and experience in using commercial software for data acquisition and analysis; discuss the role and limitations of spectral analysis of digital data; provide experience in working in a team in all aspects of the laboratory exercises, including set-up, data collection, analysis and report writing

Syllabus:

the basic concept of measurement and metrology, measurement terminology and systems, industrial measurement and system terminology, temperature measurement, pressure and flow measurement, force, stress, data acquisition, motion measurement : position, velocity, vibration and acceleration, types of sensors/ transducer, transfer function, FFT and filtering, uncertainty analysis, geometric and dimension calibration, room dimention, metrology (length measurement), surface texture, roughnes and roundness, flatness and straightness, angle measurement, introduction to CMM

Requirement: -

References:

1. Busch, Ted, Fundamentals of Dimensional Metrology, 4th Ed, Delmar Publishers
2. Fargo F.T., Curtis, M.A., Handbook of Dimensional Measurement, 3rd Ed, Industrial Press.
3. Slocum, A., Precision Machine Design, SME Press, 1992.
4. Raldi Artono Koestoer, Pengukuran Teknik, Departemen Teknik Mesin FTUI.

ENME600013
ENME610013
HEAT AND MASS TRANSFER (4 SKS)

Course Objective:

This course studies about the heat and mass transfer mechanism within a volume control system due to the temperature gradient, this course strictly related to the basic thermodynamics course. The purpose of this course is to develop the understading from the students about several heat and mass transfer mechanism between two systems if the temperature gradient ocure and the students able to calculate the heat transfer rate. The students capable to solve numbers of heat transfer probles using non-dimensional parameter.

Syllabus:

Fundamental of heat transfer, conduction heat transfer (1 dimentional and 2 dimentional), numerical analysis in conduction heat transfer/unsteady state, forced convection heat transver, free convection heat transfer, boiling and condensation, heat exchanger, radiation, fundamental of mass transfer, steady state molecul diffusion, unsteady state molecul diffusion, convection mass transfer, convection mass transfer correlation, mass transfer

apparatus.
Requirement: Basic Thermodynamic
Referencess:

1. Frank P Incropere, David P De Witt, Fundamental heat and mass transfer, 5th Ed., John Wiley & Sons, 1996, New York
2. Holman JP, Heat Transfer, 9th, Mc Graw Hill, 2003.
3. Koestoer, RA, Perpindahan Kalor untuk Mahasiswa Teknik, Salemba Teknika, 2003.
4. Welty R James, Wicks Charless, Wilson Robert, Fundamentals of Momentum, Heat, and Mass Transfer, 3rd Ed. John Wiley & Sons, 1996, New York
5. Cengel, Yunus, Heat Transfer a Practical Approach, 2nd Ed. Mc Graw Hill, 2003, Singapore.
6. Kreith Frank, Bohn Mark, Principles of Heat Transfer, 6th Ed. Brooks/cole, 2001, USA

ENEE600017
ENEE610017
ELECTRICAL POWER ENGINEERING (2 SKS)
Refer to Page 179

ENME600015
ENME610015
SYSTEM CONTROL (4 SKS)
Course Objective:
System control is one of the sciences discussed about the method to control the value of parameters within a system. Parameters within the system in this course are base on physic that could be position, velocity, rotation, pressure, acceleration flow rate, temperature and other variables. This course aims for students to understand the basics, analysis, and engineering design and control system compensation techniques, and be able to choose a control system (controller) is right for a mechanical system.
Syllabus:
Introduction to system control, laplace transform, reverse laplace transform, solution for linier ordinary differential equation, mathematical modeling I-IV, control action, PID controller, electronic controller, pneumatic and hydraulic control, transient response analysis I and II, root place analysis, design of system control with root place analysis method, frequency response analysis, stability analysis, MATLAB laboratory activity, design of control system with response frequency method, discrete time system and Z-Transform, PID control and introduction to robust control, space condition analysis I-II, design of control system within space condition, liapunove stability analysis and omptimum square control.
Requirements: Physic 1(mechanical and heat), Physic 2 (electric, magnetic, wave and optic), engineering mathematic.
References:

1. Ogata, Katsuhiko., Modern Control Engineering, Prentice-Hall Int., Inc. 1997
2. Francis H, Raven., Automatic Control Engineering. McGraw-Hill,1987.
3. Cheng, David K., Analysis of Linear System, Addison–Wesley P. C., Inc.

ENME600016
ENME610016
FLUID SYSTEM (3 SKS)
Fluid system is applied science and engineering of basic fluid science which studies the utilization of characteristic, behavior and properties of fluid and its flow behavior in various fluid machines i.e. rotodynamics, reciprocating, hydraulic and pneumatic system. The course is intended to equip student to understand characteristic of turbo fluid machines, hydraulic and pneumatic system and to be able to calculate and design a fluid system.
Syllabus:
Basic Thermo fluid in a Fluid System; Energy Transfer from Fluid to Rotor; Lagrangian and Eularian Approach; Energy Transfer Components; Impulse and Reaction; Turbo machinery Analysis with Flow; Operational Aspects of Rotodynamic Machinery; Hydraulic Similarities on Fluid Machinery; Reciprocating Machinery: Classification, Main Component and Operating; Discharge and Coefficient Discharge; Work and Power; Basic Hydraulic Machines; Hydraulic Machines; Hydraulic Accumulator; Hydraulic Intensifier, Hydraulic Press; Hydraulic Crane; Hydraulic lift; Pneumatic System: Basic Laws, Pressure Drop Losses, Basic Control Valve of Pneumatic Circuit.
Prerequisite: Basic Thermodynamics, Basic Fluid Mechanics
References:

5. Dixon, S.L, Fluid Mechanics and Thermodynamics of Turbo machinery, 4th Edition, Pergamon Press, 2005
6. Esposito, A., Fluid Power with Application, 5th Edition, Prentice Hall, 2003
7. Mobley, R.K, Fluid Power Dynamics, Newnes Butterworth-Heinemann, 1999
8. Giles, R.V, Fluid Mechanics and Hydraulics, 2nd Edition Schaum's Outline Series, Mc-Graw-Hill, 1994

ENME600017
ENME610017
MAINTENANCE AND CONDITION MONITORING (3 SKS)
Course Objective:

This course gives the understanding and the ability to analyze a system and design a system for maintenance and its procedure to improve the efficiency and reliability within a system. To give the understanding and competence to develop and implementation of vibration monitoring and engine condition so that the mechanical system reach the optimum performance.

Syllabus:

Quality, Reliability and Maintainability, maintenance system strategy, failure analysis, design of maintenance system and scheduling, maintenance system organization, condition monitoring and condition based maintenance, computer based maintenance system, total productive maintenance (TPM) and its implementation, the effectiveness measurement of total productive maintenance, reliability based maintenance system, planning;measurement and standardization of maintenance work, quality of maintenance system, basic theory of vibration and engine condition, basic of engine condition monitoring, vibration monitoring device in several mechanical systems and engine condition analysis.

Requirements: Mechanical Vibration

References:

1. Niebel, B.W., Engineering Maintenance Management, Marcel Dekker, Inc. 1994
2. Higgin, L.R., Maintenance Planning and control, Mc Graw Hill Book Company, 1998
3. Mishra, R.C., and K. Pathak, Maintenance Engineering and Management, PHI, 2002
4. Bruel & Kjaer. Handbook of Vibration & Condition Monitoring

ENME600018
ENME610018
ENERGY CONVERSION AND CONSERVASION (4 SKS)

Course Objectives:

This course discusses about the energy resources, type and classification of energy, energy conversion, energy consumption, basic concept of energy conversion, power resources and classification of energy conversion enginess. The students understand the energy source, type of energy conversion engine, conversion and conservasion of energy system, and also capable to perform a basic calculation of energy conversion engine performance and critical consideration of energy conversion.

Syllabus:

Definition of energy and energy resources, type and energy classification, law and equation in energy conversion, energy profile (resources, reserves and the world's and Indonesia's energy needs), basic concept of energy conversion system, power resources and classification of energy conversion engine, fuel in energy conversion, renewable energy, non-renewable energy, classification of combustion engine, calculation for internal combustion engine performance, steam power plant, fluid machinery, cooling engine classification, thermodynamic cycle of cooling engine, energy conversion method in vehicle, industry and building, laboratory activity.

Requirements: Basic Thermodynamics, Basic Fluid Mechanics, Heat and Mass Transfer

Referencess:

1. Kreith, F, Goswami, DY, Energy Conversion (Mechanical Engineering), CNC Press, 2007
2. Kreith, F, Goswami, DY, Energy management and Conservation Handbook, CNC Press, 2007
3. Patrick, D.R., et.al, Energy Conservation Guidebook, 2nd, 2007
4. Dincer, I., Rosen, Thermal Energy Storage: Systems and Applications, John Wiley, 2002
5. Panduan Praktikum Prestasi Mesin Konversi energi, Departemen Teknik Mesin versi 2003. Depok 2003.

ENME600019
ENME610019
MECHATRONICS (4 SKS)

Course Objective:

This course provides the ability to design electrical-mechanical that properly meet the needs of a process specification and a design that given in a laboratory scale with the mechanical, electrical theory and automation control.

Syllabus:

Mechatronics concept and theory, electronics analog system, electronis analog components, electronics digital system, analog and digital interface, sensors and actuators (electric motor, pneumatic, hydraulic), principles of microprocessor and microcontroller, microcontroller based control system theory, C/ C^{++} programming for electrical-mechanical for control, programmable logic controller (PLC), Laboratory activity.

Requirements: Physic 1(Mechanical and Heat), Physics (electrical, magneticm wave and optic)

References:

1. Smaili A. dan Mrad F., Applied Mechatronics, Oxford University Press, 2007
2. Sabri Cetinkunt, Mechatronics, Wiley, 2006

3. Histand, M.B., & Alciatore, D.G., Introduction to Mechatronics and Measurement System, McGraw-Hill, Singapore, 1999.
4. Fraser, C. dan Milne, J, Electromechanical Engineering, An Introduction, IEEE Press, McGraw-Hill, New York, 1994.
5. Gandjar K, Hand-out Mekatronika, DTMUI, 2007

ENME600020
ENME610020
DESIGN ASSIGNMENT (4 SKS)
Course Objective:
The students have the ability to design a mechanical system or product by using the knowledge and skills that previously obtained. The students capable to work in a team, communicate, report and defend and presenting the final project.
Syllabus:
Fundamental of problems and mechanical design process, teamwork in design, design process planning, understand the problem and develop engineering specifications, concept generation, evaluation and selection, product design phase, product generation, evaluation and performance, product evaluation or mechanical system for cost, manufacture, assembling and others.
Requirements: Engineering Materials, Mechanical Design, Material Selection and Manufacturing Process.
References:
1. David G.Ullman. The mechanical design process. Mc.Graw Hill.1997.
2. George Dieter. Engineering Design: A Material and Processing Approach.2000.
3. G.Pahl and W.Beitz. Engineering Design: A Systematic Approach. Springer Verlag.1991.

ENME600025
ENME610025
CAPITA SELECTA (2 SKS)
Course Objective:
Able to understand industrial development and its problems.
Syllabus:
Special topics in industries which are not covered in other courses.
Requirement:-
References: -

ENME600022
ENME610022
INTERNSHIP (2 SKS)
Course Objective:
The course is intended to provide opportunity for gaining experience in industries and applying mechanical engineering knowledge. Able to perform management tasks and engineering technique according to field of interest.
Syllabus:
Management and Engineering according to the field of interest. Presentation of on the job training results and report.
Requirement: Passed 95 SKS and GPA > 2.00

ENME600021
ENME610021
TECHNOPRENEURSHIP (2 SKS)
Course Objective:
To give insight in increasing student's ability who has not only high comptency in Mechanical Engineering but also enterpreneurship spirit, hence achieving excellence among their competitors and also dare to initiate new ideas as enterpreneurs. The student is expected to be able to develop commercial business for himself and others in order to be excellent and has broader choices in teh real world.
Syllabi:
Business: Enterpreneurship; Business and Ethics; Introduction on Business Fields. Management: Corporate Leadership; Innovative Product-based Company, Innovative Product-based Business Administration. Financing: Introduction on Capital and Financing, Practical Accounting for Non-Accountant; Financing Management; Introduction on Pricing Technique; Bankable- Business Proposal Development.
Syllabus: Basic Mechanical Design; Manufacture and Material Selection Processes; Design Assignment.
References:
1. Richard C. Dorf, Thomas H. Byers, *Technology Ventures, from idea to enterprise*, McGraw Hill, 2008
2. Robert G. Cooper, *Winning at New Products*, latest edition, Basic Books-Perseus Group, 2003
3. Arman H.N., Bustanul A.N., M. Suef, *"Membangun Spirit Teknopreneurship"*, penerbit Andi, Yogyakarta, 2007
4. Arman H.N., Indung S., Lantip T., *"Manajemen Pemasaran untuk Engineering"*, penerbit Andi, Yogyakarta, 2006

ENME 6 0 0023
ENME 6 1 0023
FINAL PROJECT
4 SKS
Learning Objectives:
Students are able to (1) prepare a research proposal based on good understanding of research

methodology, (2) prepare a well-written research report (in Bahasa Indonesia), and (3) present and defend research results.
Syllabus : Synthesizing various lectures taken by students to design or to solve engineering problems. Preparing a written report of the synthesis.
Prerequisites : Passing 128 credits with GPA >= 2,00 and without grade of E

ENME 6 0 0024
ENME 6 1 0024
ENGINEERING ETHICS
2 SKS
Learning Objectives:
Syllabus:
Pre-requisites:
Textbooks:

ELECTIVE COURSE FROM MASTER PROGRAM

ENERGY CONVERSION STREAM

ENME800114
COMBUSTION ENGINEERING (4 SKS)
Refer to Page 389

ENME800115
INTERNAL COMBUSTION ENGINE (4 SKS)
Refer to Page 389

ENME800116
APPLIED FLOW MEASUREMENT AND VISUALIZATION (4 SKS)
Refer to Page 389

ENME80117
CFD APPLICATIONS (4 SKS)
Refer to Page

ENME800111
HEAT AND MASS TRANSFER ENGINEERING (4 SKS)
Refer to Page 387

ENME800112
AERODYNAMIC ENGINEERING (4 SKS)
Refer to Page 388

ENME800113
POWER GENERATION (4 SKS)
Refer to Page 388

BUILDING UTILITY SYSTEM AND FIRE SAFETY STREAM

ENME800202
BUILDING MECHANICAL AND ELECTRICAL SYSTEM (4 SKS)
Refer to Page 391

ENME800214
REFRIGERATION ENGINEERING (4 SKS)
Refer to Page 392

ENME800215
FIRE SAFETY AND PROTECTION ENGINEERING (4 SKS)
Refer to Page 393

ENME800211
VENTILATION AND AIR CONDITIONING SYSTEM (4 SKS)
Refer to Page 391

ENME800212
BUILDING UTILITY SYSTEM DESIGN (4 SKS)
Refer to Page 392

ENME800213
ENERGY AUDIT (4 SKS)
Refer to Page 392

DESIGN AND PRODUCT MANUFACTURING STREAM

ENME800314
MICROFABRICATION AND PRECISION MANUFACTURING (4 SKS)
Refer to Page 395

ENME800315
DYNAMICS OF MECHANICAL SYSTEM (4 SKS)
Refer to Page 396

ENME800316
COMPOSITE PRODUCT DEVELOPMENT (4 SKS)
Refer to Page 396

ENME800317
FINITE ELEMENT AND MULTIPHYSICS (4 SKS)
Refer to Page 396

ENME800311
DESIGN FOR MANUFACTURE AND ASSEMBLY (4 SKS)
Refer to Page 394

ENME800312
MECHANICAL FAILURE (4 SKS)
Refer to Page 394

ENMEB00313
NOISE AND VIBRATION
Refer to Page 395

AUTOMATION AND MANUFACTURING SYSTEM STREAM

ENME800413
SYSTEM MACHINE VISION (4 SKS)
Refer to Page 397

ENME800414
QUALITY AND PRODUCTION MANAGEMENT SYSTEM (4 SKS)
Refer to Page 397

ENME800411
CAD/CAM (4 SKS)
Refer to Page 397

ENME800412
MANUFACTURING PERFORMANCE ASSESMENT (4 SKS)
Refer to Page 397

ENME800402
AUTOMATION AND ROBOTICS (4 SKS)
Refer to Page 428

VEHICLE ENGINEERING AND HEAVY EQUIPMENT STREAM

ENME800513
MODERN VEHICLE TECHNOLOGY (4 SKS)
Refer to Page 399

ENME800514
OIL AND GAS DRILLING EQUIPMENT (4 SKS)
Refer to Page 400

ENME800511
RAILWAY VEHICLE ENGINEERING (4 SKS)
Refer to Page 398

ENME800512
HANDLING AND CONSTRUCTION EQUIPMENT (4 SKS)
Refer to Page 398

4.4. UNDERGRADUATE PROGRAM IN NAVAL ARCHITECTURE AND MARINE ENGINEERING

Program Specification

1.	**Awarding Institution**	Universitas Indonesia	
2.	**Teaching Institution**	Universitas Indonesia	
3.	**Programme Tittle**	Undergraduate Program in Naval Architecture and Marine Engineering	
4.	**Class**	Regular	
5.	**Final Award**	Sarjana Teknik (S.T)	
6.	**Accreditation / Recognition**	BAN-PT: A - Accredited AUN-QA	
7.	**Language(s) of Instruction**	Bahasa Indonesia and English	
8.	**Study Scheme (Full Time / Part Time)**	Full Time	
9.	**Entry Requirements**	High school /equivalent AND pass the entrance exam.	
10.	**Study Duration**	Designed for 4 years	
	Type of Semester	Number of Semester	Number of weeks / semester
	Regular	8	17
	Short (optional)	3	8
11.	**Graduate Profiles:** Engineering graduates who have abilities to design and analyze in the field of naval architecture and marine engineering with excellent leadership and professional characters.		
12.	**List of Graduates Competency:** 1. Capable to understand and apply basic knowledge of mathematics, numerical methods, statistical analysis and the basic sciences(physics and chemistry) required to achieve competencein the disciplineof Maritime Engineering, 2. Capable of describing the problems with carrying out scientific research and report the results of experiments, including analysis of statistical data obtained, 3. Capable to identify, formulate, and solve engineering problems in the field of systems and design of maritime engineering 4. Able to carry out product design innovation maritime activities, including identification of needs for products, preparation of product specifications, developing design concepts, selection of design, engineering calculations and economic analysis, detail design and design aggregate components, and design drawings 5. Able to design components, operate, manage, and maintain machinery and related systems maritime engineering aspects of energy conservation, manufacturing, cost, safety, and sustainability. 6. Able to utilize the methods, skills, and modern engineering tools necessary for engineering work 7. Able to perform the selection of materials, processes, and automation systems that suit your needs engineering work, 8. Capable of supervising, monitoring, evaluation, and decision making, 9. Able to utilize and develop computer-aided design(CAD) system in maritime engineering 10. Understand and committe to professional ethics, professional responsibility and commitment, 11. Understanding of processes to generate innovation and entrepreneurship 12. Ability to work effectively both individually and in multi-disciplinary teams or multi-cultural 13. Understanding the social and contemporary issues, such as social diversity and cultural appreciation, communicating with different walks of life, the strategic benefits of lobbying, negotiation and mediation 14. Ability to communicate effectively both invisual, written orverbal, including proficiency in a foreign language(preferably English) 15. Able to carry out the process of lifelong learning.		

13	Classification of Subjects		
No.	**Classification**	**Credit Hours (SKS)**	**Percentage**
i	University General Subjects	18	12.5 %
ii	Basic Engineering Subjects	24	16.67 %
iii	Core Subjects	74	51.39 %
iv	Elective Subjects	12	8.33 %
v	Internship, Seminar, Undergraduate Thesis, Project	16	11.11 %
	Total	144	100 %
14.	Total Credit Hours to Graduate		144 SKS

Carrer Prospects

Naval architecture and marine engineering graduates have devoted themselves to various fields such as: maritime industry, government classification, research institutes, industrial engineering, automotive industry, shipbuilding industry, oil and gas industry, heavy machinery industry, educational institutions and other industries both within and foreign

DESCRIPTION

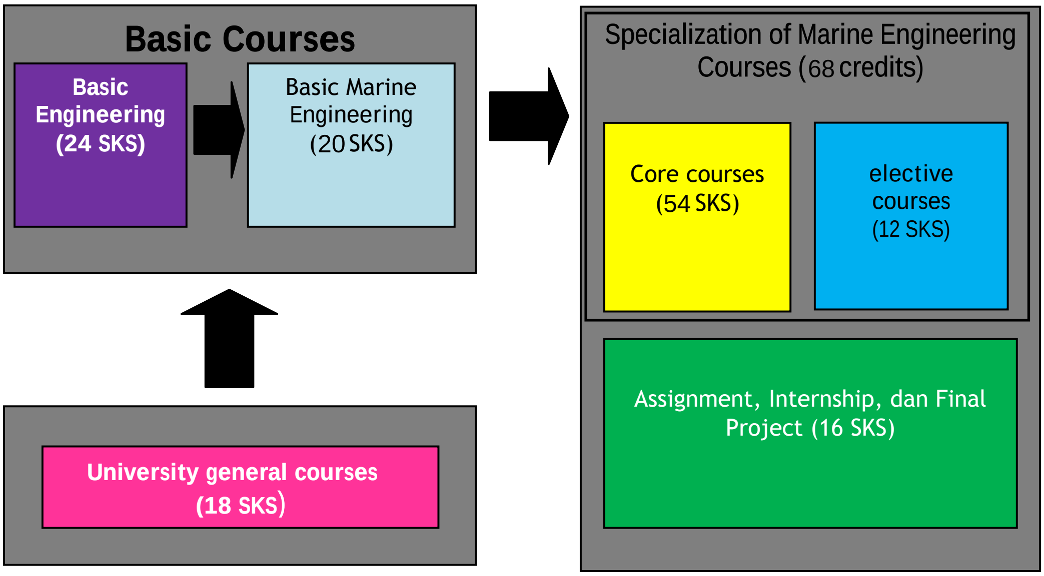
Naval architecture and marine Engineering study program was developed with a purpose, namely: producing graduates who have the attitude of leadership and excellence in scholarship and professionalism that have ability to analyze and synthesize characteristics of shipbuilding technology that includes design and planning process and ship machinery systems, as well as managing the installation and production systems ship, and were able to analyze and solve any scientific problem, work together in teams, and able to develop themselves and their knowledge.

The basic curriculum 2012 in Bachelor of Naval architecture and Marine Engineering which can be seen in the figure shows the grouping and the relationship between subject groups. Before reaching a Bachelor's degree from a total of 144 SKS, a student in Marine Engineering must complete the university courses (18 SKS), basic courses (44 SKS) which consists of basic engineering (24 SKS) and basic of marine engineering (20 SKS), and marine technical skills courses (68 SKS) consisting of core courses (54 SKS), elective courses (12 SKS), and the remaining 16 SKS in the form of assigment, intership and final project.

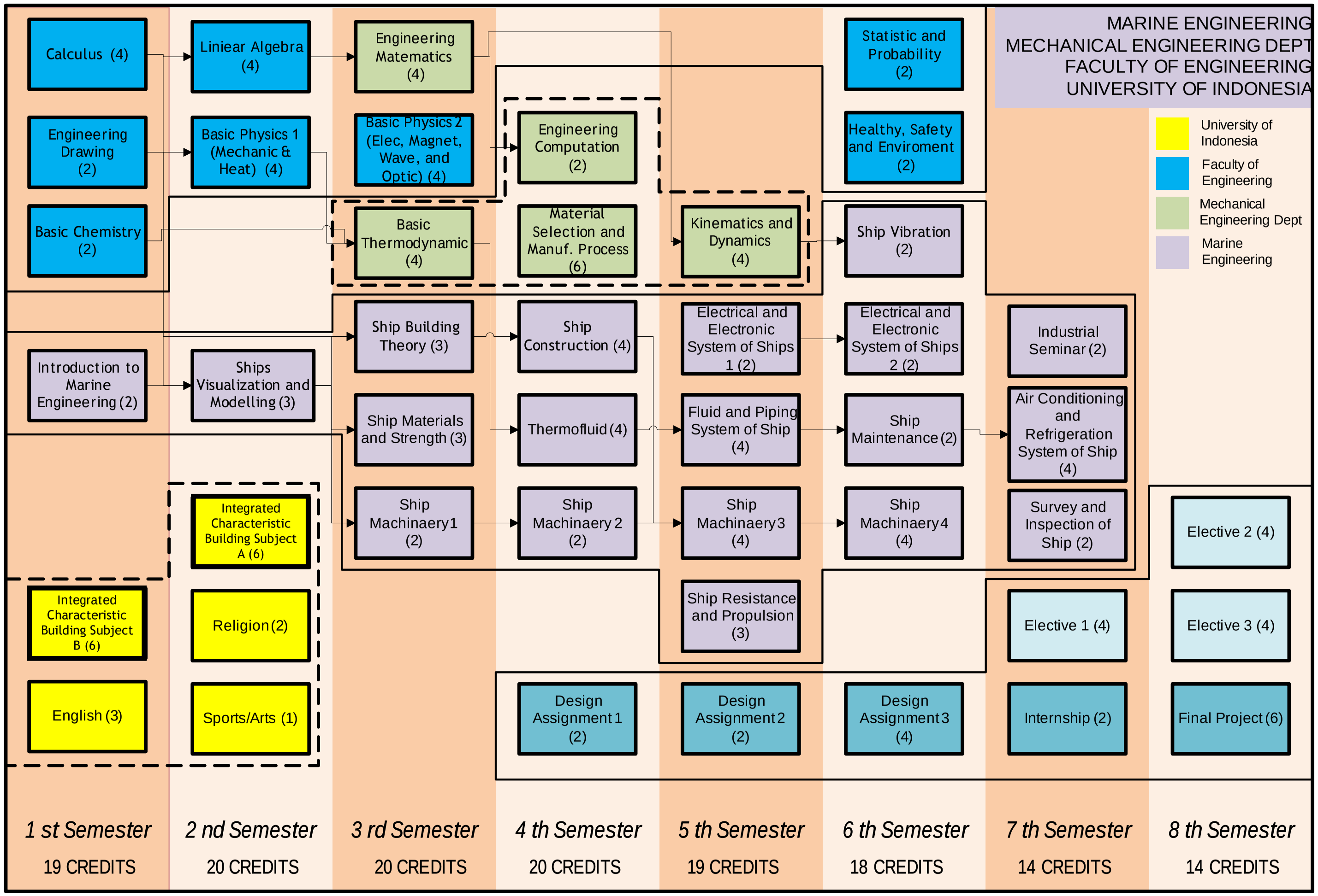
The curriculum was designed and developed to make the learning process is able to produce graduates who are competent in the field of Naval architecture and marine engineering with characteristics in accordance with the purpose of education, that is :

1. Having a strong base of engineering knowledge through the sciences of mathematics, physics, and chemistry
2. The ability to design and conduct research to analyze and interpret the data.
3. The ability to identify, formulate and solve problems in the field of shipbuilding techniques based on a review of the latest issue
4. The ability to design a system, component or process to meet desired needs by considering and implementing aspects of the economy,
5. Knowledge of leadership, ability to communicate well, work together in teams, and develop themselves and their knowledge

Basic of Marine Engineering can be seen in Figure 1



Learning Outcomes Flow Diagram



Course Structure Marine Engineering Program (Reguler / Paralel)

CODE	Mata Kuliah	SKS	SUBJECT	Credits
	Semester 1		1 st Semester	
UIGE 6 0 0004	MPKT B	6	Integrated Character Building Subject B	6
UIGE 6 0 0002	Bahasa Inggris	3	English	3
ENGE 6 0 0001	Kalkulus	4	Calculus	4
ENGE 6 0 0009	Menggambar Teknik	2	Engineering Drawing	2
ENGE 6 0 0010	Kimia Dasar	2	Basic Chemistry	2
ENMR 6 0 0001	Pengantar Teknik Perkapalan	2	Introduction to Marine Engineering	2
	Subtotal	19	Subtotal	19
	Semester 2		2 nd Semester	
UIGE 6 0 0001	MPKT A	6	Integrated Character Building Subject A	6
UIGE600005-9	Agama	2	Religious Studies	2
UIGE 6 0 0003	Olahraga / Seni	1	Sports/Arts	1
ENGE 6 0 0002	Aljabar Linear	4	Linear Algebra	4
ENGE 6 0 0003	Fisika Dasar 1	4	Basic Physics 1	4
ENMR 6 0 0002	Visualisasi dan Permodelan Kapal	3	Ships Visualization and Modelling	3
	Subtotal	20	Subtotal	20
	Semester 3		3 rd Semester	
ENGE 6 0 0004	Fisika Dasar 2	4	Basic Physics 2	4
ENME 6 0 0002	Matematika Teknik	4	Engineering Matematics	4
ENME 6 0 0004	Termodinamika Dasar	4	Basic Thermodynamics	4
ENMR 6 0 0003	Teori Bangunan Kapal	3	Ship Building Theory	3
ENMR 6 0 0004	Material dan Kekuatan Kapal	3	Ship Material and Strength	3
ENMR 6 0 0005	Permesinan Kapal 1	2	Ship Machinery 1	2
	Subtotal	20	Subtotal	20
	Semester 4		4 th Semester	
ENEE 6 00031	Komputasi Teknik	2	Engineering Computation	2
ENME 6 0 0007	Proses Manufaktur dan Pemilihan Material	6	Material Selection and Manuf. Process	6
ENMR 6 0 0006	Konstruksi Kapal	4	Ship Construction	4
ENMR 6 0 0007	Termofluida	4	Thermofluid	4
ENMR 6 0 0008	Permesinan Kapal 2	2	Ship Machinery 2	2
ENMR 6 0 0009	Tugas Merancang 1	2	Design Assignment 1	2
	Subtotal	20	Subtotal	20
	Semester 5		5 th Semester	
ENME 6 0 0008	Kinematika dan Dinamika	4	Kinematics and Dynamics	4
ENMR 6 0 0010	Sistem fluida dan Perpipaan Kapal	4	Fluid and Piping System of Ship	4
ENMR 6 0 0011	Sistem Kelistrikan dan Elektronika Kapal 1	2	Electrical and Electronic System of Ships 1	2
ENMR 6 0 0012	Hambatan dan Propulsi Kapal	3	Ship Resistance and Propulsion	3
ENMR 6 0 0013	Permesinan Kapal 3	4	Ship Machinery 3	4
ENMR 6 0 0014	Tugas Merancang 2	2	Design Assignment 2	2
	Subtotal	19	Subtotal	19

	Semester 6		6 th Semester	
ENGE 6 0 0005	Statistika dan Probablitas	2	Statistic and Probability	2
ENGE 6 0 0008	K3LL	2	Healthy, Safety and Enviroment	2
ENMR 6 0 0015	Getaran Kapal	2	Ship Vibration	2
ENMR 6 0 0016	Pemeliharaan Kapal	2	Ship Maintenance	2
ENMR 6 0 0017	Sistem Kelistrikan dan Elek-tronika Kapal 2	2	Electrical and Electronic System of Ships 1	2
ENMR 6 0 0018	Permesinan Kapal 4	4	Ship Machinery 4	4
ENMR 6 0 0019	Tugas Merancang 3	4	Design Assignment 3	4
	Subtotal	18	Subtotal	18
	Semester 7		7 th Semester	
ENME 6 0 0025	Kapita Selekta	2	Capita Selecta	2
ENMR 6 0 0020	Sistem Tata Udara dan Refrigerasi Kapal	4	Air Conditioning and Refrigeration System of Ship	4
ENMR 6 0 0021	Survei dan inspeksi Kapal	2	Survey and Inspection of Ship	2
ENMR 6 0 0022	Kerja Praktik	2	Internship	2
-------	Pilihan 1	4	Elective 1	4
	Subtotal	14	Subtotal	14
	Semester 8		8 th Semester	
ENMR 6 0 0023	Tugas Akhir	6	Final Project	6
-------	Pilihan 2	4	Elective 2	4
-------	Pilihan 3	4	Elective 3	4
	Subtotal	14	Subtotal	14

Courses are offered options for specailization of Master of Engineering, Maritime Resources and Technology and can be selected by maritime engineering undergraduates

	7 th Semester	**Sks**
ENME 8 0 0615	Marine and Offshore Structure	4
ENME 8 0 1616	Sea Transportation and Port Management	4
ENME 8 0 1617	Maritime Law and regulation	4
	8 th Semester	
ENME 8 0 0611	Ship Production Management	4
ENME 8 0 0612	Special Ship Project	4
ENME 8 0 0613	Welding Engineering	4
ENME 8 0 0102	Energy Optimization System	4

For students who are willing and capable to continue the education program to pursue Masters in Engineering through the Fast track program, credit transfer can be performed as many as 20 SKS. The numbers of credits that can be transferred consist of: 4 SKS from Engineering Mathematic course, 8 SKS from 2 Mandatory Core Courses and 8 credits from 2 Elective Core Courses.

TERMS AND CONDITIONS TO BECOME THE PARTICIPANT OF FAST TRACK PROGRAM ARE:

1. Expressed a desire to follow the Fast Track Program, by writing an application to the Head of the Department of Mechanical Engineering with Study Plan includes a plan-making subjects in Semester 6 to 8 (in the Bachelor of Engineering) and subject Semester 1 to 4 (the Master of Engineering Program) in accordance with the Master of Engineering Program Specialisation, no later than the end of 5^{th} Semester the undergraduate program.
2. Have an excellent academic record, with 3.0 GPA until 5^{th} semester and have passed all the basic courses.
3. The students that follow the Fast Track program expressed their willingness to join this program on full time basis.
4. If the application of the fast track program can be approved by the Head of Department / Study Program, the student will be discussed along with the Academic Advisor for the finalization of the study plan inundergraduate and graduate program.

The students from the undergraduate program that have the aggrement to join the fast track program have to reschedule their study in 7th and 8th semester to get along with their 1st and 2nd semester in graduate program.

Course Description

UIGE600001
UIGE610001
MPKT A / INTEGRATED CHARACTER BUILDING A
6 SKS
Refer to Page 74

UIGE600004
UIGE610004
MPKT B / INTEGRATED CHARACTER BUILDING B
6 SKS
Refer to Page 74

UIGE600002
ENGLISH
UIGE610002
ACADEMIC WRITING
3 SKS
Refer to Page 74

UIGE600003
UIGE610003
SPORTS / ARTS
1 SKS
Refer to Page 77

ENGE600001
ENGE610001
CALCULUS
4 SKS
Refer to Page 74

ENGE600010
ENGE610010
BASIC CHEMISTRY
Refer to Page 75

ENGE600003
ENGE610003
BASIC PHYSICS 1
4 SKS
Refer to Page 75

ENGE600004
BASIC PHYSICS 2
4 SKS
Refer to Page 77

ENGE600002
ENGE610002
LINEAR ALGEBRA
4 SKS
Refer to Page 75

UIGE600005-9
UIGE610005-9
RELIGIOUS STUDIES
2 SKS
Refer to Page 76-77

ENGE600005
ENGE610005
STATISTICS AND PROBABILITY
2 SKS
Refer to Page 78

ENGE600008
ENGE610008
HEALTH, WORK SAFETY, AND ENVIROMENT
2 SKS
Refer to Page 78

ENGE600009
ENGINEERING DRAWING (2 SKS)
Refer to Page 124

ENMR600001
INTRODUCTION TO MARINE ENGINEERING
(2 SKS)
Course Objective :
Provide basic competence of Ships Machinery System andapproachtodesign.
Syllabus :
History of Ship Building; Types of water bulding: the Classification Society and the International Agency; Ship Building and Construction; main dimension: Ship Motion; Ship Design Process; Stability: resistance and Propulsion; Tonnage; Ship building method. Historical of ship machinery, main engines, auxiliary engines, the engineer room layout.
Requirement :-
References:
1. GM Kok, A.C. Nierich., *Bangunan Kapal* , MARTECH
2. D A Taylor, *Introduction to Marine Engineering*.1996

ENMR 6 0 0002
SHIPS VISUALIZATION AND MODELING
(3 SKS)
Course Objective :
Provide and understanding the principles ofships design using CAD (Computer Aided Design) software
Syllabus:
Optimization of Main Dimensions; Ship Comparison Methode:Design procedure: Basics of economic calculation; Finance Analysis; Terms and Conditions and Type of ships: Optimization of Machine Selection: The selection of

propulsion system; Classification and Regulations statutory Rules; Ship Specifications. CAD(Computer Aided Design)
Requirement :-
References :
1. Tupper E.C., *Basic Ship Theory*, Butterworth Heinemann, 2001
2. David Watson, *Practical Ship Design*. Elsevier Science.1998
3. V. Bertram, H.Schneekluth, *Ship design for Efficiency and Economy*, Butterworth Heinemann, 1998
4. Tupper E.C. dan W. Muckle, *Introduction to Naval Architecture*, Butterworth Heinemann, 1996
5. T.C. Gillmer, Modern Ship Design, US Naval Institute, 1975.
6. Manual *Autocad* dan *Maxsurf 12.02*

ENME600002
ENGINEERING MATHEMATICS (4 SKS)
Refer to Page 131

ENME600004
BASIC THERMODYNAMICS (4 SKS)
Refer to Page 132

ENMR 6 0 0003
SHIP BUILDING THEORY (3 SKS)
Course Objective :
Provide and understanding about hydrostatic and dynamic satability calculation
Syllabus:
LinesPlan calculation and methodology; Bouyancy system; Metasentra, Static Stability: Calculation of hydrostatic curves and cross curves; docking, Ship crashes out, inclining test, ship launching, Wave Theory; Ship Hydrodynamics; Foil shape; Theory of Ship Motion; Plan Steering: Dynamic Stability: Theory of Stationary and Non-Stationary on a Ship Motion; Calculation ofCritical Conditions Due to shaky ship; Impact loading.
Requirement :-
References:
1. Bryan Barrass & Dr Derrett, *ship stability for master and mates*.2006
2. A.B Brain, *Ship hydrostatics and stability*, Butterworth, Heinemann, 2003.
3. Volker Bertram, *Practical ship hydrodynamics*, Butterworth, Heinemann, 2000.
4. Dr C B Barrass, *Ship stability notes & example,3rd edition* Butterworth, Heinemann, 2001
5. E.C. Tupper & K.J. Rawson, *Basic ship Theory*, Butterworth, Heinemann, 2001.
6. M.A. Talahatu, Hidrodinamika kapal I & II, FTUI. 1998.

ENMR 6 0 0004
SHIPS MATERIALS AND STRENGTH (3 SKS)
Course Objective :
Provide and understanding for calculating transversal and longintudinal constructions, profile and plate selection calcultaion.
Syllabus :
Stress and strain torsion(torque) and calculation of moment inertia; axial force, shear force and bending moment; Calculation of reaction cross-beam and diagrams, axial and moment diagrams; Analysis of stress and strain fields; Beams Deflection I ;Beams Deflection II: Static; column; energy method; cylinder wall sthick and thin; theory of plate; analysis of ship structures; longitudinal and transverse strength of ships; calculation of midship strength; Bending and torsion on the Hull Girder; Calculation of Cross Section,Bending and Bukling on the panels; concept of fatigue.
Requirement : Introduction to Marine Engineering
References :
1. Dr. Yong Bai, *Marine Structural Design*. Elsevier Science.2003
2. Tupper E.C., Basic Ship Theory, Butterworth Heinemann, 2001
3. B. Baxter, Naval Architecture Examples and theory, Charles Griffin & Co.
4. Biro Klasifikasi Indonesia
5. Lloyd's Register Rules and Regulations

ENMR 6 0 0005
SHIP MACHINERY 1 (2 SKS)
Course Objective :
Understanding Concept Design of Ships Machinery
Syllabus :
Introduction: History, Definition of Ship Machinery, Applications and Limitations. Ship Design Process: Design Requirements, Ship Design Procedures, Ship Machinery Requirements. Introduction to Main Propulsion Systems: Propulsion System Design Concepts, Propulsion System Selection, Plant Selection Propulsion. Transmission Systems: Type of Transmission System, gears, shafts, clutches, bearings.
Requirement : Introduction to Marine Engineering
References :
1. D A Taylor, *Introduction to Marine Engineering*.1996
2. M. Khetagurov. Marine Auxiliary Machinery and Systems. 1982. Peace Publishers Moscow
3. H. D. Mc. George. Marine Auxiliary Machinery. 7 edition 2010.

ENEE600031
ENEE610031
NUMERICAL COMPUTATION
3 SKS
Refer to Page 179

ENMR 6 0 0006
SHIP CONSTRUCTION (4 SKS)
Course Objective :
Provide knowledge and understanding types of construction on the ship sstructure and competence to design ship structures
Syllabus :
Bottom Structure: Ship hull and section system; Bulk head and girder; deck, Coaming and super structure: fore peak and after peak construction: Construction of Tankers; Gas Carrier Ship Construction: Doors and Windows; Fire Protection; Cabin Construction: Construction of loading and unloading Equipments; Painting and Corrosion Prevention.
Requirement : Ship Strength
References :
1. D. J. Eyres, Ship Construction, 5th edition. Butterworth-Heinemann. 2011
2. D. Taylor, Merchant Ship Construction, Prentice Hall
3. Biro Klasifikasi Indonesia
4. Lloyd's Register Rules and Regulations

ENMR 6 0 0007
TERMOFLUIDS (4 SKS)
Course Objective :
Provide and understanding about termofluids system of ship
Syllabus :
Principles of FluidDynamics: Pressure distribution of fluid flow, integral flow analysis, deffrensial flow analysis. Viscous flow, drag and lift force for floating and moving objects. Laminar and turbulent flow; Boundary Layer; Losses in Fluid Flow. Heat Transfer;one-dimensional steady state; Stedi dimensional conduction state; Convection principles; empirical formulas and practical for forced convection and heat transfer.;natural convection System,heat exchangers.
Requirement :-
References :
1. J.P. Holman, Heat Transfer, McGraw-Hill,
2. Govinda, Fluid Flow Machines, McGraw-Hill
3. Dixon, S.L, Fluid mechanics and Thermodynbamics. 4 th Edition, Pergamon Press, 2005.

ENMR 6 0 0008
SHIP MACHINERY 2 (2 SKS)
Course Objective :
Undestanding concept and types of air conditioning system, auxiliary system, tribology and cooling system of ships engine.
Syllabus :
Basic prinsiple of Diesel engine: combustion concept, 4 and 2 stroke teory, parameters, types of engine, diesel engine performance, turbo charger, Engine rating, engine component, Engine supporting system: starting system, fuel system, lubrication system, cooling system, engine propeller matching, experimental of diesel engine performance.
Requirement :Ships Machinery 1
References :
1. D A Taylor, *Introduction to Marine Engineering*.1996

ENMR 6 0 0009
DESIGN ASSIGNMENT 1 (2 SKS)
Course Objective :
Undestanding of ship design procedures and monitoring.
Syllabus :
Design Analysis (owner requirement based); study literature; initial finding: Displacement, main dimension, and shape of ship,finding power driven; linesplan skecth and monitong of calculation CSA(Curve of Sectional Area); general plan sketch(GA); initial assessment payload and unloading space, stability, hull arise, trim; free and unloading space estimates; watertight bulkhead positioning for passenger ships.
Requirement :Ship vizualisation and Modelling
References :
1. B. Baxter, Teach Yourself Naval Architecture, The English Universities Press. Signifi cant Ships, RINA
2. M.A Talahatu, Teori Merancang Kapal. FTUI 1998.

ENME600008
KINEMATICS and DYNAMICS (4 SKS)
Refer to Page

ENMR 6 0 0010
FLUID AND PIPING SYSTEM OF SHIP (4 SKS)
Course Objective :
Understanding types of fluid system, piping system, and practically on the Ship Construction
Syllabus :
Positive displacement of fluid engines, hydrolic system,pneumatic power systems. Experimental of water piping system, air piping system, pump impeller, Pelton turbine. Piping systems on ships and marine construction, type of

pipe material, pipe fittings, valves, tanks, sea-chest, standards and methods of drawing systems, bilga systems, ballast systems, fire extinguish system,supporting system (auxiliary motor), fuel system, lubrication system, cooling system, compressed air systems, domestic systems, tanker loading and unloading systems.

Requirement : Termofluid

References :

1. A.Keith Escoe. Piping and Pipeline Assesment Guide. Elsevier Inc. 2006
2. Dixon, S.L, Fluid Mechanics and Thermodynamics of Turbomachinery, 4th Edition, Pergamon Press, 2005
3. Esposito, A., Fluid Power with Application, 5th Edition, Prentice Hall, 2003
4. Mobley, R.K, Fluid Power Dynamics, Newnes Butterworth-Heinemann, 1999
5. Giles, R.V, Fluid Mechanics and Hydraulics, 2nd Edition Schaum's Outline Series, Mc-Graw-Hill, 1994

ENMR 6 0 0011

ELECTRICAL AND ELECTRONICS SYSTEM OF SHIPS 1 (2 SKS)

Course Objective :

Undesrtanding work principle, operation, and application of electrical and electronic system

Syllabus :

Basic of electronics: Passive Components: Semiconductors: Electronic Components; Digital Systems; Digital Combinational circuit; Digital Sequential circuit; PLC; Electronics Simple Plan; basic theory of DC circuit: basic theory of AC electrical circuits, working principle of DC motors, Types of MDC;operation of the MDC, the working principle ofAC Motor, Various kinds of MAC, MAC operation: principle of generator, voltage drop generator; generator no-load and under load; Parallel generator; Introduction of the application on ship; Electric propulsion and PTO.

Requirement :-

References :

1. E. Hughes, Electrical Technology, IBS
2. John Bird, Electrical & Electronic Principle and Technology. Jhon Bird.2003
3. John C Payne, The Marine Electronical & Electronics Bible, John Pyne.1993

ENMR 6 0 0012

SHIP RESISTANCE AND PROPULSION (3 SKS)

Course Objective :

Provide and understanding to calcutaion of ships resistance and propulsion teoritically and using model

Syllabus :

Ship force; Ship Resistance Comparative Law; Frictional resistance:wave resistance; pressure resistance: Air resistance; Effect of Ship Shape; Resistance predictions with Model Test; Wake Friction: Thrust reduction; Ship resistance in Bad Weather: The principle of Hydrofoil Ship; coefficient of propulsion; Calculation of Propeller Design with Form Data and Wageningen Graphs.

equirement :Ship Building Theory

References :

1. J. P. Ghose, R. P. Gokarn, Basic Ship Propulsion, 2004
2. Dave Gerr, The Propeller Handbook, McGraw-Hill Professional, 2001
3. Sv. Aa. *Harvald,* Resistance and *Propulsion* of *Ships, 1983*
4. C. Gallin, Ships and Their Propulsion System, Lohmann & Stolterfoht

ENMR 6 0 0013

SHIP MACHINERY 3 (4 SKS)

Course Objective :

Students understanding and about principle work of boiler, turbine, combustion engine, engine room layout.

Syllabus :

Marine Boiler and Steam Engineering: types of boiler, steam turbine, gas turbine, combustion chamber, compressor, Performance analysis of Gas Turbine. Engine Room Lay Out: ergonomic aspect on engine room layout, main motor layout, supporting system layout.

Requirement :Ship Machinery 2

References :

1. Doug Woodyard, *Pounder's Marine Diesel Engines and Gas Turbines*, Butterworth-Heinemann.2009
2. Anthony F. Molland, *The Maritime Engineering Reference Book*, Elsevier.2008
3. Nigel Calder, *Marine Diesel Engines*, McGraw-Hill, 2006

ENMR 6 0 0014

DESIGN ASSIGNMENT 2 (2 SKS)

Course Objective :

Undesrtanding calculation and monitoring of supporting ships design system

Syllabus :

Ship dispalcement methode; determine main dimension and coefficient; determine lines plan, hydrostatic calculation, main section plan, profile and bulkhead plan, design of air condirtioning system, ship maintenance design, communication devices election, navigate devices election, safety plan

Requirement :Design Assignment 1

References :

1. B. Baxter, *Teach Yourself Naval Architecture*, The English Universities Press. Signifi cant Ships, RINA
2. M.A Talahatu, Teori Merancang Kapal. FTUI 1998.

ENMR 6 0 0015
SHIP VIBRATION (2 SKS)
Course Objective :
Understanding of engine vibration system and vibration source detection
Syllabus :
Engine vibration system: free vibration, damping, transient vibrations, forced vibrations, vibrations with two degrees of freedom, torsional vibration, lateral and longitudinal in ship propulsion system; Experimental measurement of vibration
Requirement :Kinematics and Dynamics
References :

1. L.C. Burrill, *Ship vibration: simple methods of estimating critical frequencies*, North East Coast Institution of Engineers and Shipbuilders. 1935
2. Meriam & Kraige. Engineering Mechanics. Vol-2, Dynamics. Wiley New York.4th eds.1998.
3. Holowenko. Dynamics of Machinery.John Wiley.1995.
4. William T.Thomson. Theory of Vibration with application. Prentice Hall India.1972.
5. Beer & Johnston.Mechanics for Engineer-Dynamics.Mc-Graw-Hill.1976.

ENMR 6 0 0016
SHIP MAINTENANCE (2 SKS)
Course Objective :
Able to maintain dan control engine system
Syllabus :
Introduction to reliability system,reliability Fundamental Review of the concept, simple system Network Modelling, Network Modelling System, Introduction to Markov and Monte Carlo Simulation, Discrete Markov Chains and Markov Continuous Process. Public Review: Economic and Reliability,Maintenance Strategy. Functions of Manual Maintenance; Parts List and Stock; Preparation of Schedule Maintenance: Maintenance Document Preparation; Engine Room Maintenance, Maintenance of Inventory: The Role of Engine Builders Tips andTools: Spare-Parts.
Requirement : -
References :

1. D. Benkovsky, Technology of ship repairing, MIR Publisher.
2. Piero Caridis, Inspection, Repair, and Maintenance of Ship Structures, Witherby & Co.Ltd, 2001
3. Shields S., et.al, Ship Maintenance : A Quantitative Approach, IMARES, 1996

ENMR 6 0 0017
ELECTRICAL AND ELECTRONIC SYSTEM OF SHIPS 2 (2 SKS)
Course Objective :
Understanding the principles engineering and automation and control applications in the shipbuilding
Syllabus :
Introduction to automation systems engineering; proportional plus integral plus derivative control; Application of mathematical modeling to determine the performance of control system. Response system signalsI and OrderII: Analysis of transient response of the system order I and order II: Introduction to process control in shipbuilding applications; computer simulations and laboratory-scale models; Introduction of hydraulic and pneumatic control systems.Instruments for UMS classification
Requirement :Electrical and Electronics System of Ships 1
References :

1. E. Hughes, Electrical Technology, IBS
2. John Bird, Electrical & Electronic Principle and Technology. Jhon Bird.2003
3. John C Payne, The Marine Electronical & Electronics Bible, John Pyne.1993
4. P. Akinov. Marine Power Plant. 1982. Peace Publishers Moscow

ENMR 6 0 0018
SHIP MACHINERY 4 (4 SKS)
Course Objective :
Understanding theory, system, and principle work of ship equipment and technology.
Syllabus :
Anchoring and mooring equipment supplies; loading and unloading equipment; Water-tight windows and doors; Ventilation Equipment: Safety Equipment: Equipment Navigation and Communications; Firefighting Equipment: Equipment ShipSteering; Oil Separator Equipment: Pumps and System Installation.
Requirement :Ship Machinery 3
References :

1. H. McGeorge, Marine Auxiliary Machinery, Butterworth Heinemann, 2001.
2. D.A. Taylor, Introduction to Marine Engineering, Butterworth Heinemann, 1996
3. M. Khetagurov. Marine Auxiliary Machinery and Systems. 1982. Peace Publishers Moscow

ENMR 6 0 0019
DESIGN ASSIGNMET 3 (4 SKS)
Course Objective :
Understanding of calculation and monitoring ship engine design
Syllabus :
Engine and tools selection (auxilary engine); electrical load balance; Detailed drawings; Design of Ship Engine Room Layout; transmission system, reduction gear and shafting; Construction of a propeller and propeller maching; ship piping systems for engine and hull; fire extinguishing system; steering system; ventilation system; calculation, selection and layout of the marine cable; load analysis and design one-line diagram of electrical &Wiring Diagram instalasi including lighting vessels and equipment. Bilga system design and Engine Room Bilga System(Oily-Water BilgeSystem); Design System Reply: FireSystem Design: Design of Fuel System: Engine Lubrication System Design: Design of Engine Cooling System: Air Pressure System Design; Domestic Fresh Water System Design Air & Sea; Sanitary Disposal System Design: the design of loading and unloading systems; Ship Electrical Load Analysis: Calculation and selection of the number and capacity of Genset & Shore Connection: the calculation and selection of battery capacity; List Equipment Code
Requirement : Design Assignment 2
References :
1. B. Baxter, *Teach Yourself Naval Architecture*, The English Universities Press. Signifi cant Ships, RINA
2. M.A Talahatu, Teori Merancang Kapal. FTUI 1998.

ENMR 6 0 0020
AIR CONDITIONING AND REFRIGERATION SYSTEM OF SHIP (4 SKS)
Course Objective :
Understanding of air conditioning system on the ship
Syllabus :
Basic principles of refrigeration and air conditioning processes. Diagrams Psikrometri, ducting system design, heating system design, ventilation system design, system design of air conditioning and refrigeration, technical specifications and troubleshooting, ISO standards and the Class
Requirement : -
References :
1. James Harbach, Marine Refrigeration and Air Conditioning, Cornell Maritime Press, 2005
2. N. Larsen, Marine Air Conditioning Plant, Butterworth-Heinemann, 2001
3. Jones W.P., Air Conditioning Engineering, Butterworth-Heinemann, 2001

ENMR 6 0 0021
SURVEY AND INSPECTION OF SHIP (2 SKS)
Course Objective :
Understanding types of class survey, statutory approval and ship operation
Syllabus :
Statutory survey; Class survey; Hull survey; Loadline survey, Inclining experiment; Damage survey; Machinery Installations survey; Electrical & Genset survey; Seatrial procedure.
Requirement :
References :
1. D. Benkovsky, Technology of ship repairing, MIR Publisher.
2. Piero Caridis, Inspection, Repair, and Maintenance of Ship Structures, Witherby & Co.Ltd, 2001
3. Shields S., et.al, Ship Maintenance : A Quantitative Approach, IMARES, 1996
4. Biro Klasifikasi Indonesia
5. Lloyd's Register Rules and Regulations

ENME 6 00025
CAPITA SELECTA
Refer to Page 131

ENMR 600022
INTERNSHIP
Refer to Page 131

ELECTIVE COURSES FROM MASTER PROGRAM

ENME800615
MARINE AND OFFSHORE STRUCTURE (4 SKS)
Refer to Page 403

ENME800616
SEA TRANSPORT AND PORT MANAGEMENT (4 SKS)
Refer to Page 404

ENME800617
MARITIME LAW AND REGULATION (4 SKS)
Refer to Page 404

ENME800611
SHIP PRODUCTION MANAGEMENT (4 SKS)
Refer to Page 403

ENME800612
SPECIAL SHIP PROJECT (4 SKS)
Refer to Page 404

ENME800613
WELDING ENGINEERING (4 SKS)
Refer to Page 404

ENME800102
ENERGY OPTIMIZATION SYSTEM (4 SKS)
Refer to Page 390

4.5. UNDERGRADUATE PROGRAM IN ELECTRICAL ENGINEERING

Program Specification

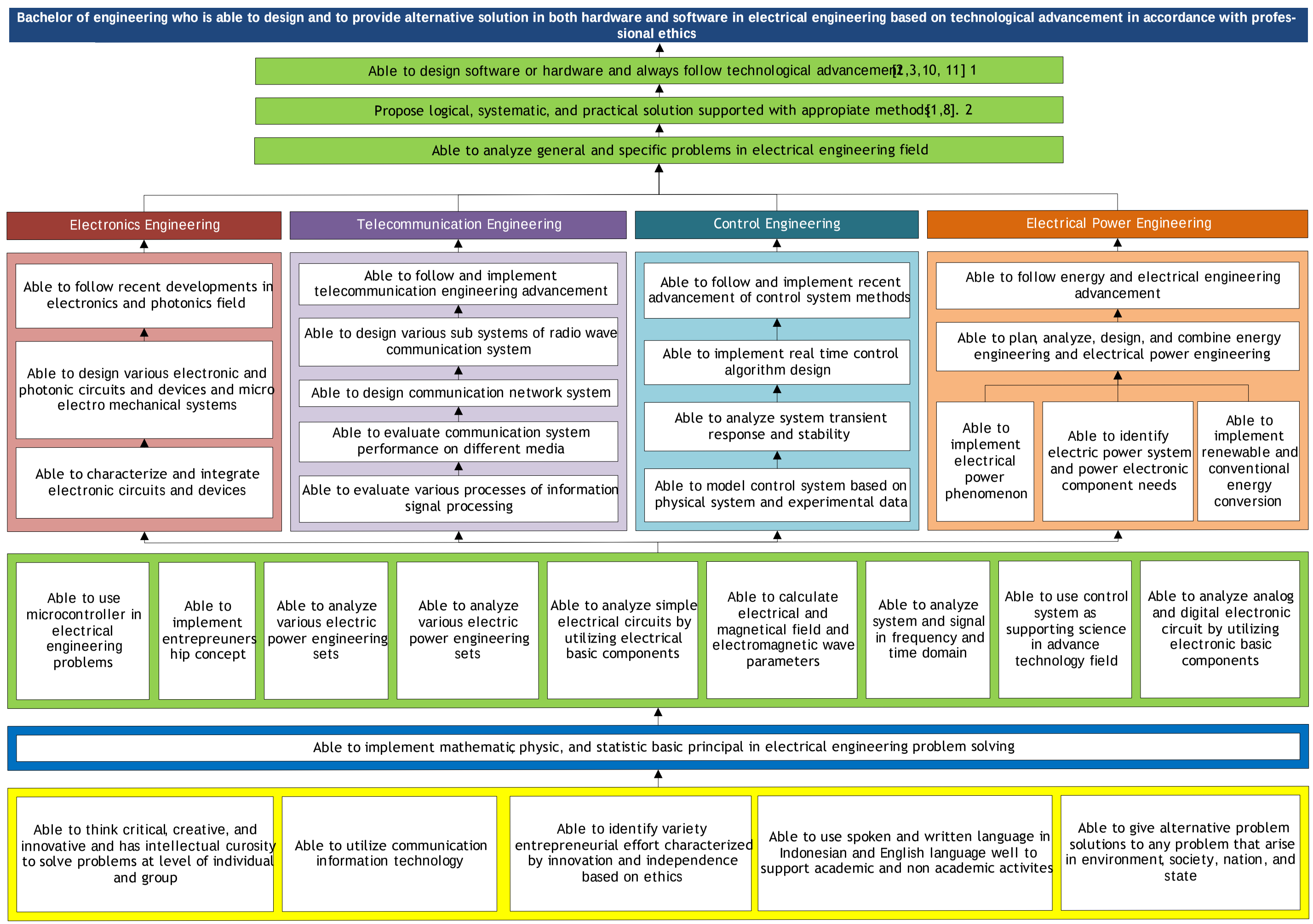
1.	**Awarding Institution**	Universitas Indonesia Double Degree: Universitas Indonesia and partner university	
2.	**Teaching Institution**	Universitas Indonesia Double Degree: Universitas Indonesia and partner university	
3.	**Programme Tittle**	Undergraduate Program in Electrical Engineering	
4.	**Class**	Regular, Parallel, International	
5.	**Final Award**	Sarjana Teknik (S.T) Double Degree: Sarjana Teknik (S.T) and Bachelor of Engineer-ing (B.Eng)	
6.	**Accreditation / Recognition**	BAN-PT: A accredited AUN-QA	
7.	**Language(s) of Instruction**	Bahasa Indonesia and English	
8.	**Study Scheme (Full Time / Part Time)**	Full Time	
9.	**Entry Requirements**	High school /equivalent, or D3 / Polytechnique / equivalent, AND pass the entrance exam.	
10.	**Study Duration**	Designed for 4 years	
	Type of Semester	Number of Semester	Number of weeks / semester
	Regular	8	17
	Short (optional)	3	8
11.	**Graduate Profiles:** Bachelor of engineering who is able to design both hardware and software, provide an alternative solution in electrical engineering based on technological advancement in accordance with profes-sional ethics.		
12.	**Expected Learning Outcomes:** General outcomes: • Able to design software or hardware and always follow technological advancement. • Propose logical, systematic, and practical solution supported with appropiate methods. • Able to analyze general and specific problems in electrical engineering field • Able to use microcontroller in electrical engineering problems • Able to implement entrepreunership concept • Able to analyze various electric power engineering sets • Able to use probability sciences and stochastic process to support engineering science • Able to analyze simple electrical circuits by utilizing electrical basic components • Able to calculate electrical and magnetical field and electromagnetic wave parameters • Able to analyze system and signal in frequency and time domain • Able to use control system as supporting science in advance technology field • Able to analyze analog and digital electronic circuit by utilizing electronic basic components • Able to implement mathematic, physic, and statistic basic principal in electrical engineering problem solving • Able to think critical, creative, and innovative and has intellectual curiousity to solve problems at level of individual and group • Able to utilize communication information technology • Able to identify variety entrepreneurial effort characterized by innovation and independence based on ethics • Able to use spoken and written language in Indonesian and English language well to support aca-demic and non academic activites • Able to give alternative problem solutions to any problem that arise in environment, society, na-tion, and state Specific outcomes in electronic major: • Able to follow recent developments in electronics and photonics field • Able to design various electronic and photonic circuits and devices and micro electro mechanical systems • Able to characterize and integrate electronic circuits and devices		

12.	Specific outcomes in telecommunication major: • Able to follow and implement telecommunication engineering advancement • Able to design various sub systems of radio wave communication system • Able to design communication network system • Able to evaluate communication system performance on different media • Able to evaluate various processes of information signal processing Specific outcomes in control major: • Able to follow and implement recent advancement of control system methods • Able to implement real time control algorithm design • Able to analyze system transient response and stability • Able to model control system based on physical system and experimental data Specific outcomes in electrical power major: • Able to follow energy and electrical engineering advancement • Able to plan, analyze, design, and combine energy engineering and electrical power engineering • Able to implement electrical power phenomenon • Able to identify electric power system and power electronic component needs • Able to implement renewable and conventional energy conversion		
13	**Classification of Subjects**		
No.	**Classification**	**Credit Hours (SKS)**	**Percentage**
i	**University General Subjects**	18	12,5 %
ii	**Basic Engineering Subjects**	18	13,89 %
iii	**Core Subjects**	79	40,06 %
iv	**Elective Subjects**	21	14,58 %
v	**Internship, Seminar, Undergraduate Thesis, Project**	8	5,56 %
	Total	144	100 %
14.	**Total Credit Hours to Graduate**		144 SKS

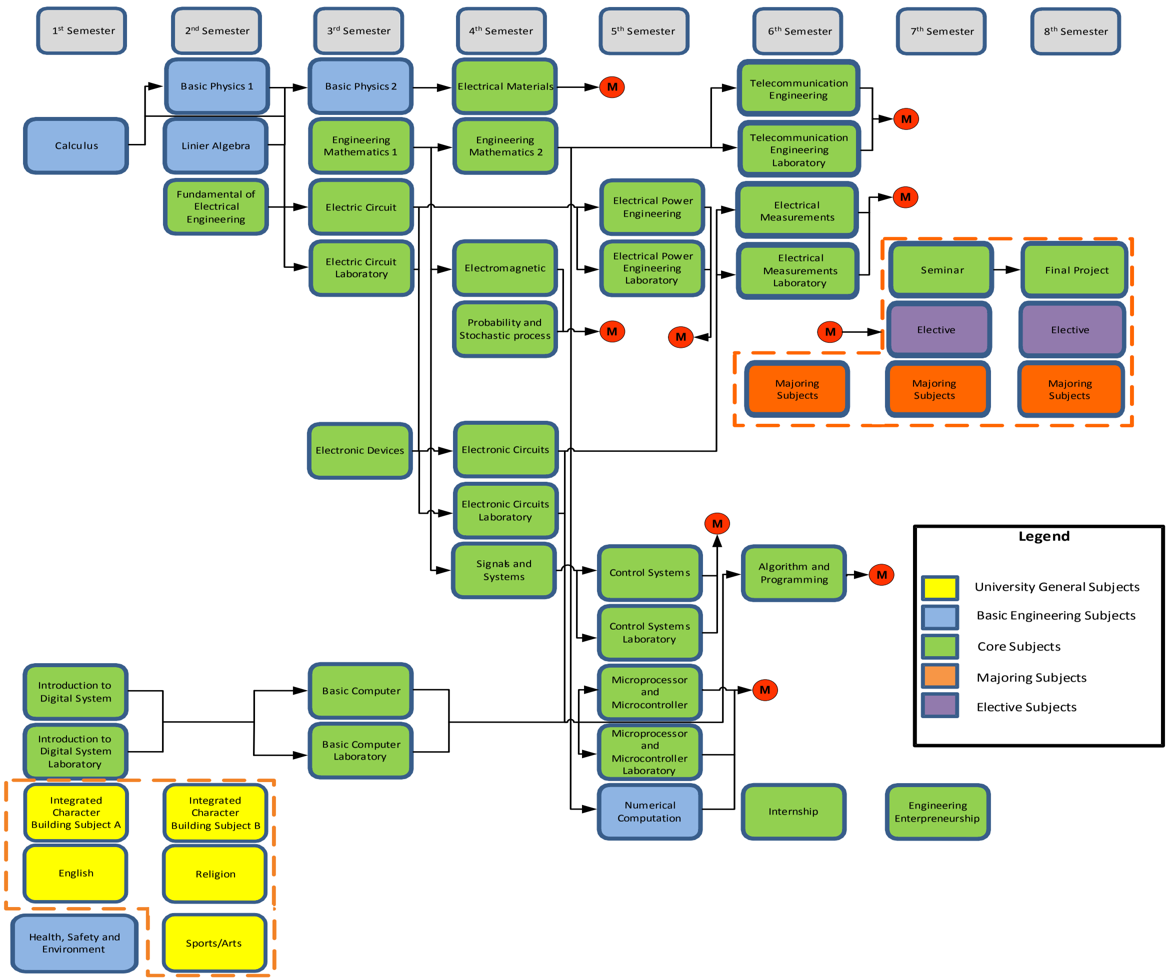
Career Prospects

The graduates of this program have been employed in various inductrial companies within one month (in average) after the graduation. Some of them are involved in power engineering, IT, electronic, oil & gas, telecommunication and other related inductries. Some of graduates were even employed before the graduation.
Some occupation or job titles that are suitable for this program are electrical engineer, process engineer, control engineer, instrumentation engineer, program manager, project manager, technical manager and professional lecturers.

Learning Outcomes Flow Diagram



Flow Diagram of Subjects



Course Structure of Undergraduate Programme in Electrical Engineering (Regular / Parallel)

Table 1 Courses of the 2012 Curriculum

KODE	MATA KULIAH	SUBJECT	SKS
	Semester 1	**1st Semester**	
UIGE600004	MPK Terintegrasi B	Integrated Character Building Subject B	6
UIGE600002	Bahasa Inggris	English	3
ENGE600001	Kalkulus	Calculus	4
ENGE600008	Kesehatan, Keselamatan, Kerja dan Lindung Lingkungan (K3LL)	Health, Safety and Environment	2
ENEE600001	Pengantar Sistem Dijital	Introduction to Digital System	2
ENEE600002	Praktikum Pengantar Sistem Dijital	Introduction to Digital System Laboratory	1
		Subtotal	**18**
	Semester 2	**2nd Semester**	
UIGE600001	MPK Terintegrasi A	Integrated Character Building Subject A	6
UIGE600005-9	Agama	Religious Studies	2
UIGE600003	Olah Raga/ Seni	Sports/Arts	1
ENGE600002	Aljabar Linier	Linier Algebra	4
ENGE600003	Fisika Dasar 1	Basic Physics 1	4
ENEE600003	Dasar Teknik Elektro	Fundamental of Electrical Engineering	3
		Subtotal	**20**
	Semester 3	**3rd Semester**	
ENGE600004	Fisika Dasar 2	Basic Physics 2	4
ENEE600004	Rangkaian Listrik	Electric Circuit	3
ENEE600005	Praktikum Rangkaian Listrik	Electric Circuit Laboratory	1
ENEE600006	Matematika Teknik 1	Engineering Mathematics 1	3
ENEE600007	Divais Elektronika	Electronic Devices	2
ENEE600008	Dasar Komputer	Basic Computer	3
ENEE600009	Praktikum Dasar Komputer	Basic Computer Laboratory	1
		Subtotal	**17**
	Semester 4	**4th Semester**	
ENEE600010	Probabilitas dan Proses Stokastik	Probability and Stochastic Process	3
ENEE600011	Matematika Teknik 2	Engineering Mathematics 2	3
ENEE600012	Rangkaian Elektronika	Electronic Circuits	3
ENEE600013	Praktikum Rangkaian Elektronika	Electronic Circuits Laboratory	1
ENEE600014	Elektromagnetika	Electromagnetic	3
ENEE600015	Sinyal and Sistem	Signals and Systems	3
ENEE600016	Material Teknik Listrik	Electrical Materials	2
		Subtotal	**18**

	Semester 5	5th Semester	
ENEE600031	Komputasi Numerik	Numerical Computation	2
ENEE600017	Teknik Tenaga Listrik	Electrical Power Engineering	3
ENEE600018	Praktikum Teknik Tenaga Listrik	Electrical Power Engineering Laboratory	1
ENEE600019	Sistem Kendali	Control Systems	3
ENEE600020	Praktikum Sistem Kendali	Control Systems Laboratory	1
ENEE600021	Mikroprosesor and Mikrokontroler	Microprocessor and Microcontroller	4
ENEE600022	Praktikum Mikroprosesor dan Mikrokontroler	Microprocessor and Microcontroller Laboratory	1
		Subtotal	**15**
	Semester 6	**6th Semester**	
ENEE600023	Kerja Praktek	Internship	2
ENEE600024	Teknik Telekomunikasi	Telecommunication Engineering	3
ENEE600025	Praktikum Teknik Telekomunikasi	Telecommunication Engineering Laboratory	1
ENEE600026	Algoritma and Pemrograman	Algorithm and Programming	3
ENEE600027	Pengukuran Besaran Listrik	Electrical Measurements	2
ENEE600028	Praktikum Pengukuran Besaran Listrik	Electrical Measurements Laboratory	1
	Peminatan Kelompok Ilmu	Majoring	6
		Subtotal	**18**
	Semester 7	**7th Semester**	
ENEE600029	Seminar	Seminar	2
ENCE601023	Rekayasa dan Kewirausahaan	Engineering Entrepreneurship	2
	Pilihan	Elective	6
	Peminatan Kelompok Ilmu	Majoring	9
		Subtotal	**19**
	Semester 8	**8th Semester**	
ENEE600030	Skripsi	Final Project	4
	Pilihan	Elective	9
	Peminatan Kelompok Ilmu	Majoring	6
		Subtotal	**19**
		Total	**144**

Table 2. Majoring Course

PEMINATAN KELOMPOK ILMU TELEKOMUNIKASI		MAJOR TELECOMMUNICATION ENGINEERING	
KODE	**MATA AJARAN**	**SUBJECT**	SKS
	Semester 6	**6th Semester**	
ENEE600023	Kerja Praktek	Internship	2
ENEE600024	Teknik Telekomunikasi	Telecommunication Engineering	3
ENEE600025	Praktikum Teknik Telekomu-nikasi	Telecommunication Engineering Laboratory	1
ENEE600026	Algoritma dan Pemrograman	Algorithm and Programming	3
ENEE600027	Pengukuran Besaran Listrik	Electrical Measurements	2
ENEE600028	Praktikum Pengukuran Besaran Listrik	Electrical Measurements Laboratory	1
ENEE600101	Komunikasi Multimedia Pita Lebar	Broadband Multimedia Communications	3
ENEE600102	Jaringan Komunikasi	Communication Networks	3
		Subtotal	**18**
	Semester 7	**7th Semester**	
ENEE600029	Seminar	Seminar	2
ENCE601023	Rekayasa and kewirausahaan	Engineering Entrepreneurship	2
	Pilihan	Elective	6
ENEE600103	Teori Coding dan Aplikasi	Coding and Modulation Techniques	3
ENEE600104	Antena dan Propagasi	Antennas and Propagation	3
ENEE600105	Komunikasi Optik	Optical Communications	3
		Subtotal	19
	Semester 8	**8th Semester**	
ENEE600030	Skripsi	Final Project	4
	Pilihan	Elective	9
ENEE600106	Komunikasi Nirkabel	Wireless Communication	3
ENEE600107	Divais Sistem Komunikasi	Communication System Device	3
		Subtotal	19

PEMINATAN KELOMPOK ILMU TENAGA LISTRIK		MAJOR ELECTRICAL POWER ENGINEERING	
KODE	**MATA AJARAN**	**SUBJECT**	SKS
	Semester 6	**6th Semester**	
ENEE600023	Kerja Praktek	Internship	2
ENEE600024	Teknik Telekomunikasi	Telecommunication Engineering	3
ENEE600025	Praktikum Teknik Telekomu-nikasi	Telecommunication Engineering Laboratory	1
ENEE600026	Algoritma dan Pemrograman	Algorithm and Programming	3

ENEE600027	Pengukuran Besaran Listrik	Electrical Measurements	2
ENEE600028	Praktikum Pengukuran Besaran Listrik	Electrical Measurements Laboratory	1
ENEE600201	**Elektronika Daya dan Praktikum**	**Power Electronics and Laboratory**	**3**
ENEE600202	**Manajemen dan Ekonomi Teknik**	**Engineering Economy and Management**	**3**
	Subtotal		**18**
	Semester 7	**7th Semester**	
ENEE600029	Seminar	Seminar	2
ENCE601023	Rekayasa dan kewirausahaan	Engineering Entrepreneurship	2
	Pilihan	Elective	6
ENEE600203	**Sistem Tenaga Listrik dan Praktikum**	**Electric Power Systems and Laboratory**	**3**
ENEE600204	**Konversi Tenaga Listrik**	**Electric Energy Conversion**	**3**
ENEE600205	**Teknik Tegangan dan Arus Tinggi dan Praktikum**	**High Voltage and Current Engineering and Laboratory**	**3**
	Subtotal		**19**
	Semester 8	**8th Semester**	
ENEE600030	Skripsi	Final Project	4
	Pilihan	**Elective**	**9**
ENEE600206	**Distribusi dan Transmisi Tenaga Listrik**	**Electric Power Transmission and Distribution**	**3**
ENEE600207	**Proteksi Sistem Listrik**	**Electric Power System Protection**	**3**
	Subtotal		**19**

PEMINATAN KELOMPOK ILMU ELEKTRONIKA		**MAJOR ELECTRICAL ELECTRONICS ENGINEERING**	
KODE	**MATA AJARAN**	**SUBJECT**	SKS
	Semester 6	**6th Semester**	
ENEE600023	Kerja Praktek	Internship	2
ENEE600024	Teknik Telekomunikasi	Telecommunication Engineering	3
ENEE600025	Praktikum Teknik Telekomunikasi	Telecommunication Engineering Laboratory	1
ENEE600026	Algoritma dan Pemrograman	Algorithm and Programming	3
ENEE600027	Pengukuran Besaran Listrik	Electrical Measurements	2
ENEE600028	Praktikum Pengukuran Besaran Listrik	Electrical Measurements Laboratory	1
ENEE600301	**Desain CMOS Analog**	**CMOS Analog Design**	**3**
ENEE600302	**Teknologi Proses dan Praktikum**	**Processing Technology and Laboratory**	**3**
	Subtotal		**18**

	Semester 7	**7th Semester**	
ENEE600029	Seminar	Seminar	2
ENCE601023	Rekayasa dan kewirausahaan	Engineering Entrepreneurship	2
	Pilihan	Elective	6
ENEE600303	Divais Fotonik dan Praktikum Pilihan	Photonic Devices and Optional Laboratory	3
ENEE600304	VLSI	VLSI	3
ENEE600305	Dasar Nanoelektronika	Fundamental of Nanoelectronics	3
	Subtotal		19
	Semester 8	8th Semester	
ENEE600030	Skripsi	Final Project	4
	Pilihan	Elective	9
ENEE600306	Sel Surya	Solar Cell	3
ENEE600307	MEMS dan Sensor Mikro	MEMS and Microsensors	3
	Subtotal		19
PEMINATAN KELOMPOK ILMU KENDALI		**MAJOR CONTROL ENGINEERING**	
KODE	**MATA AJARAN**	**SUBJECT**	SKS
	Semester 6	**6th Semester**	
ENEE600023	Kerja Praktek	Internship	2
ENEE600024	Teknik Telekomunikasi	Telecommunication Engineering	3
ENEE600025	Praktikum Teknik Telekomunikasi	Telecommunication Engineering Laboratory	1
ENEE600026	Algoritma dan Pemrograman	Algorithm and Programming	3
ENEE600027	Pengukuran Besaran Listrik	Electrical Measurements	2
ENEE600028	Praktikum Pengukuran Besaran Listrik	Electrical Measurements Laboratory	1
ENEE600401	**Sistem Kendali Dijital**	**Digital Control Systems**	**3**
ENEE600402	**Sistem Kendali Proses**	**Process Control Systems**	**3**
	Subtotal		**18**
	Semester 7	**7th Semester**	
ENEE600029	Seminar	Seminar	2
ENCE601023	Rekayasa dan kewirausahaan	Engineering Entrepreneurship	2
	Pilihan	Elective	6
ENEE600403	**Robotika**	**Robotics**	**3**
ENEE600404	**Sistem Kendali Penggerak Elektrik**	**Electric Drive Control Systems**	**3**
ENEE600405	**Pemodelan dan Identifikasi Sistem**	**Modeling and System Identification**	**3**
	Subtotal		**19**

	Semester 8	8th Semester	
ENEE600030	Skripsi	Final Project	4
	Pilihan	**Elective**	**9**
ENEE600406	**Mekatronika**	**Mechatronics**	**3**
ENEE600407	**Sistem Berbasis Pengetahuan**	**Knowledge Based System**	**3**
	Subtotal		**19**

Table 3. Elective Course

Odd Semester			
KODE	**MATA AJARAN**	**SUBJECT**	**SKS**
ENEE601108	Topik Khusus (Telekomunikasi 1)	Special Course (Telecommunications 1)	3
ENEE601208	Kualitas Daya Sistem Tenaga Listrik	Electrical Power System Quality	3
ENEE601308	Rekayasa Optik dan Praktikum	Optical Engineering and Laboratory	3
ENEE601408	Sistem Kendali Prediktif dan Adaptif	Adaptive and Predictive Control Systems	3
Even Semester			
ENEE601109	Topik Khusus (Telekomunikasi 2)	Special Course (Telecommunications 2)	3
ENEE601209	Utilisasi Tenaga Listrik	Electric Power Utilization	3
ENEE601210	Topik Khusus (Tenaga Listrik)	Special Course (Electrical Power)	3
ENEE601309	Perancangan RFIC	RFIC Design	3
ENEE601410	Topik Khusus (Kendali)	Special Course (Control)	3
ENEE601109	Topik Khusus (Telekomunikasi 2)	Special Course (Telecommunications 2)	3

Fast-Track (S1 and S2) Program

This program integrates the S1 and S2 for 5 years. In the 4th year of their study (7th and 8th semester), students are able to choose the fast track subjects in S2 semester 1 and 2 as the electives. While in 5th year, students can concentrate on completing S2 subjects and ends with the thesis. In Universitas Indonesia, especially in the Department of Electrical Engineering, for the academic year 2012/2013, this program has been in its 2nd year of implementation.

To complete both S1 and S2 program in Fast Track Program, students should attain 170 SKS in 5 years, instead of 144 SKS for S1 and 41 SKS for S2 in regular program.

Fast-Track (S1 and S2) Electrical Engineering Program Curriculum

MAJOR TELECOMMUNICATION ENGINEERING

Curriculum S1			Curriculum S2	
No	Semester	Courses (CREDIT)	Courses (CREDIT)	Semester
1.	7	Elective (6)	Advanced Mobile Broadband System (3)	1
			Radar Systems (3)	
		Seminar (2)		
		Engineering Entrepreneurship (2)		
		Coding and Modulation Techniques (3)		
		Antennas and Propagation (3)		
		Optical Communications (3)		
	Total CREDIT (19)		Total CREDIT (6)	
	Total CREDIT for Fast-track Program (19)			
2.	8	Elective (9)	Advanced Communication Systems (3)	2
			Optical Communication Networks (3)	
			Advanced Antenna (3)	
		Final Project (4)		
		Wireless Communications (3)		
		Communication System Device (3)		
	Total CREDIT (19)		Total CREDIT (9)	
	Total CREDIT for Fast-track Program (19)			
3.			Applied Mathematics (3)	3
			Digital Signal Processing (3)	
			Wireless Medical System Engineering (3)	
			Advanced RF Engineering (3)	
			Pre-Thesis (3)	
			Total CREDIT (15)	
	Total CREDIT for Fast-track Program (14)			
4.			Modeling and System Engineering (3)	4
			Thesis (8)	
			Total CREDIT (11)	
	Total CREDIT for Fast-track Program (11)			

MAJORING ELECTRICAL POWER ENGINEERING

Curriculum S1			Curriculum S2	
No	Semester	Courses (CREDIT)	Courses (CREDIT)	Semester
1.	7	Elective (6)	Power Generation Operation and Control (3)	1
			Electrical Power System Quality (3)	
		Seminar (2)		
		Engineering Entrepreneurship (2)		
		Electric Power Systems and Laboratory (3)		
		Electric Energy Conversion (3)		
		High Voltage and Current Engineering and Laboratory (3)		
	Total CREDIT (19)		Total CREDIT (6)	
	Total CREDIT for Fast-track Program (19)			

2.	8	Elective (9)	Energy Management and Economics (3)	2
			Industrial Power Electronics (3)	
			Elective (3)	
		Final Project (4)		
		Electric Power Transmission and Distribution (3)		
		Electric Power System Protection (3)		
	Total CREDIT (19)		Total CREDIT (9)	
	Total CREDIT for Fast-track Program (19)			
3.			Applied Mathematics (3)	3
			New and Renewable Energy (3)	
			Electrical Power System Planning (3)	
			Elective (3)	
			Pre-Thesis (3)	
			Total CREDIT (15)	
	Total CREDIT for Fast-track Program (15)			
4.			Modeling and System Engineering (3)	4
			Thesis (8)	
			Total CREDIT (11)	
	Total CREDIT for Fast-track Program (11)			

MAJORING ELECTRONICS ENGINEERING

Curriculum S1			Curriculum S2	
No	Semes-ter	Courses (CREDIT)	Courses (CREDIT)	Semes-ter
1.	7	Elective (6)	Electronics Physics (3)	1
			Photonic Devices (3)	
		Seminar (2)		
		Engineering Entrepreneurship (2)		
		Photonic Devices and Optional Laboratory (3)		
		VLSI (3)		
		Fundamental of Nanoelectron-ics (3)		
	Total CREDIT (19)		Total CREDIT (6)	
	Total CREDIT for Fast-track Program (19)			
2.	8	Elective (9)	Solid State Device (3)	2
			Heterostructure Devices (3)	
			Applied Microelectronics (3)	
		Final Project (4)		
		Solar Cell (3)		
		MEMS and Microsensors (3)		
	Total CREDIT (19)		Total CREDIT (9)	
	Total CREDIT for Fast-track Program (19)			

3.			Applied Mathematics (3)	3
			Integrated Circuit Theory (3)	
			Elective (3)	
			Elective (3)	
			Pre-Thesis (3)	
			Total CREDIT (15)	
	Total CREDIT for Fast-track Program (14)			
4.			Modeling and System Engineering (3)	4
			Thesis (8)	
			Total CREDIT (11)	
	Total CREDIT for Fast-track Program (11)			

MAJORING CONTROL ENGINEERING

Curriculum S1			Curriculum S2	
No	Semester	Courses (CREDIT)	Courses (CREDIT)	Semester
1.	7	Elective (6)	Analog and Digital Control (3)	1
			Measurement and Process Control (3)	
		Seminar (2)		
		Engineering Entrepreneurship (2)		
		Robotics (3)		
		Electric Drive Control Systems (3)		
		Modeling and System Identification (3)		
	Total CREDIT (19)		Total CREDIT (6)	
	Total CREDIT for Fast-track Program (19)			
2.	8	Elective (9)	Intelligent Robotics (3)	2
			Adaptive and Optimal Control (3)	
			Elective (3)	
		Final Project (4)		
		Mechatronics (3)		
		Knowledge Based System (3)		
	Total CREDIT (19)		Total CREDIT (9)	
	Total CREDIT for Fast-track Program (19)			
3.			Applied Mathematics (3)	3
			Multivariable Control Systems (3)	
			Model Predictive Control (3)	
			Elective (3)	
			Pre-Thesis (3)	
			Total CREDIT (15)	
	Total CREDIT for Fast-track Program (15)			
4.			Modeling and System Engineering (3)	4
			Thesis (8)	
			Total CREDIT (11)	
	Total CREDIT for Fast-track Program (11)			

Course Structure of Undergraduate Programme in Electrical Engineering (International)

Year 1	Semester 1 UI	
CODE	Subject	Credit
ENGE610003	Basic Physics 1	4
UIGE610002	Academic Writing	3
UIGE610003	Sports/Arts	1
ENGE610001	Calculus	4
ENGE610008	Health, Safety & Environment	2
ENEE610001	Introduction to Digital System	2
ENEE610002	Introduction to Digital System Laboratory	1
	Subtotal	17

Year 1	Semester 2 UI	
CODE	Subject	Credit
ENGE610004	Basic Physics 2	4
ENEE610016	Electrical Materials	2
ENGE610002	Linear Algebra	4
ENEE610007	Electronic Devices	2
ENEE610003	Fundamental of Electrical Engineering	3
ENCE610003	Basic Computer	3
ENCE610004	Basic Computer Laboratory	1
	Subtotal	19

Year 2	Semester 3 UI	
CODE	Subject	Credit
ENEE610026	Algorithm and Programming	3
ENEE610004	Electric Circuit	3
ENEE610005	Electric Circuit Laboratory	1
ENEE610006	Engineering Mathematics 1	3
ENEE610017	Electrical Power Engineering	3
ENEE610018	Electrical Power Engineering Laboratory	1
ENEE610024	Telecommunication Engineering	3
ENEE610025	Telecommunication Engineering Laboratory	1
	Subtotal	18

Year 2	Semester 4 UI	
CODE	Subject	Credit
ENEE610010	Probability and Stochastic Process	3
ENEE610011	Engineering Mathematics 2	3
ENEE610012	Electronic Circuits	3
ENEE610013	Electronic Circuits Laboratory	1
ENEE610014	Electromagnetic	3
ENEE610015	Signals and Systems	3
ENEE610027	Electrical Measurements	2
ENEE610028	Electrical Measurements Laboratory	1
	Subtotal	19

Year 3	Semester 5 UI	
CODE	Subject	Credit
ENEE610031	Numerical Computation	2
ENEE610019	Control Systems	3
ENEE610020	Control Systems Laboratory	1
ENEE610021	Microprocessor and Microcontroller	4
ENEE610022	Microprocessor and Microcontroller Laboratory	1
UIGE610001	Integrated Character Building Subject A (Science, Tehnology & Health)	6
ENEE610201	Power Electronic	3
	Subtotal	20

Year 3	Semester 6 UI	
CODE	Subject	Credit
ENEE610023	Internship	2
UIGE610004	Integrated Character Building Subject B (Social & Humanities)	6
UIGE610005-9	Religion	2
ENEE610401	Digital Control Systems	3
ENEE610307	MEMS and Microsensor	3
ENEE610204	Electric Energy Conversion	3
ENEE610103	Coding and Modulation Techniques	3
	Subtotal	22

Year 4	Semester 7 UI	
CODE	Subject	Credit
ENEE610029	Seminar	2
ENCE611023	Engineering Entrepreneurship	2
ENEE610303	Photonic Devices and Optional Laboratory	3
ENEE610102	Communication Networks	3
ENEE610402	Process Control Systems	3
ENEE610206	Electric Power Transmission and Distribution	3
	Subtotal	16

Year 4	Semester 8 UI	
CODE	Subject	Credit
ENEE610030	Final Project	4
ENEE610305	Fundamental of Nano Electronics	3
ENEE610105	Optical Communications	3
ENEE610405	Modelling and System Identification	3
	Subtotal	13

Course Structure of Electrical Engineering at QUT

For July Intake

Year 3	Semester 5 (QUT) July	
Code	**Course Title**	**Credit**
ENB340	Power Systems and Machines	12
ENB342	Signals, Systems and Transforms	12
MAB233	Engineering Mathematics 3	12
	Electives / Minor	12
	Subtotal	**48**

Year 3	Semester 6 (QUT) Feb	
Code	**Course Title**	**Credit**
ENB244	Microprocessors and Digital Systems	12
ENB245	Introduction To Design and Professional Practice	12
ENB343	Fields, Transmission and Propagation	12
	Electives / Minor	12
	Subtotal	**48**

Year 4	Semester 7 (QUT) July	
Code	**Course Title**	**Credit**
ENB241	Software Systems Design	12
ENB301	Instrumentation and Control	12
ENB346	Digital Communications	12
	Subtotal	**36**

Year 4	Semester 8 (QUT)	
Code	**Course Title**	**Credit**
BEB801	Project 1	12
ENB344	Industrial Electronics	12
ENB345	Advanced Design and Professional Practice	12
	Electives / Minor	12
	Subtotal	**48**

Course Structure of Electrical Engineering at University of Queensland

For July Intake

Year 3	Semester 5 (UQ) July	
Code	**Course Title**	**Credit**
MATH2010	Analysis of Ordinary Differential Equation	1
STAT2201	Analysis of Engineering and Scientific Data	1
	Part B1 Introductory Elective	2
	Part B1 Introductory Elective	2
	General Elective	2
	Subtotal	**8**

Year 3	Semester 6 (UQ) March	
Code	**Course Title**	**Credit**
ENGG2800	Team Project 1	2
ELEC3002	Computational Techniques in Electrical Engineering	2
	Part B1 Introductory Elective	2
	General Elective	2
	Subtotal	**8**

Year 4	Semester 7 (UQ) July	
Code	**Course Title**	**Credit**
ENGG4802	Thesis Project	4
ENGG3800	Team Project 2	2
	Part B2 Advanced Elective	2
	General Elective	2
	Subtotal	**10**

Year 4	Semester 8 (UQ)	
Code	**Course Title**	**Credit**
ENGG4802	Thesis Project	4
	Part B2 Advanced Elective	2
	Part B2 Advanced Elective	2
	General Elective	2
	Subtotal	**10**

List of Electives at UQ (is called Part B Electives)

B1 - Introductory Electives

Code	Course Title	Credit
COMS3100	Introduction to Communications	2
CSSE3000	Digital System Design	2
ELEC3100	Fundamentals of Electromagnetic Fields & Waves	2
ELEC3300	Electrical Energy Conversion & Utilisation	2
ELEC3400	Electronic Circuits	2
ELEC3600	Signal & Image Processing I	2
METR3200	Introduction to Control Systems	2

B2 - Advanced Electives

Code	Course Title	Credit
COMS4100	Digital Communications	2
COMS4103	Photonics	2
COMS4104	Microwave Subsystems & Antennas	2
CSSE4001	Computer System Design Project	2
ELEC4300	Power Systems Analysis	2
ELEC4400	Advanced Electronic & Power Electronics Design	2
ELEC4600	Signal & Image Processing II	2
METR4202	Advanced Control & Robotics	2

B3 - Coverage Electives

Code	Course Title	Credit
COMP2303	Network & Operating Systems Principles	2
COMP2304	Programming for Engineering Systems	2
COMP4702	Machine Learning	2
COMS3200	Computer Networks I	2
CSSE2002	Programming in the Large	2
ELEC3401	Medical & Industrial Instrumentation	2
ELEC3601	Introduction to Image Formation	2
ELEC4302	Power System Protection	2
ELEC4320	Modern Asset Management and Condition Monitoring in Power System	2
ELEC4601	Medical Imaging	2
ENGG4000	Introduction to Systems Engineering	2
ENGG4800	Project Management	2

B4 - Other Electives

Code	Course Title	Credit
MATH1050	Mathematical Foundations	2

Course Structure of Electrical Engineering at Curtin University

Curtin provides 3 streams to choose: (i) Electrical Power Engineering, (ii) Electronics and Communication Engineering, (iii) Computer Engineering. There will be slight change in the structure of curriculum of the first 2 years at UI for students who are interested to continue to Curtin.

308711 Electrical Power Engineering Stream

Year 3	Semester 5 (Curtin) July	
Code	Course Title	Credit
308784	Power Systems Protection	25
11500	Electrical Machines	25
12835	Power Electronics	25
307667	Engineering Project Management	12.5
307664	Engineering Law	12.5
	Subtotal	**100**

Year 3	Semester 6 (Curtin) Feb	
Code	Course Title	Credit
12831	Power Systems Analysis	25
300786	Renewable Energy Principles	25
308798	Control Systems	25
12855	Embedded Systems Engineering	25
	Subtotal	**100**

Year 4	Semester 7 (Curtin) July	
Code	Course Title	Credit
12844	Engineering Project	25
308787	Instrumentation and Control	25
301302	Electric Power Transmission & Distribution	25
	Elective from List II	25
	Subtotal	**100**

Year 4	Semester 8 (Curtin)	
Code	Course Title	Credit
12838	Engineering Project	25
308785	Power Electronic and Drives	25
307675	Engineering Economics	12.5
307660	Engineering Sustainable Development	12.5
	Elective from List I	25
	Subtotal	**100**

Elective List II (Curtin, Electrical Power Engineering)

Year 4	Semester 7 (Curtin) July	
Code	Course Title	Credit
12861	Renewable Energy Systems	25
12834	Digital Signal Processing	25

Elective List I (Curtin, Electrical Power Engineering)

Year 4	Semester 8 (Curtin) Feb	
Code	Course Title	Credit
302915	Electric Utility Engineering	25
12856	Microprocessors	25

308710 Electronic and Communications Engineering Stream

Year 3	Semester 5 (Curtin) July	
Code	Course Title	Credit
12845	Communications Engineering	25
9415	Electronic Design	25
12834	Digital Signal Processing	25
307667	Engineering Project Management	12.5
307664	Engineering Law	12.5
	Subtotal	**100**

Year 3	Semester 6 (Curtin) Feb	
Code	Course Title	Credit
10165	Communications Engineering	25
9414	Electronic Design	25
308798	Control Systems	25
12855	Embedded Systems Engineering	25
	Subtotal	**100**

Year 4	Semester 7 (Curtin) July	
Code	Course Title	Credit
12844	Engineering Project	25
12847	Data Communication and Computer Networks	25
12849	Mobile Radio Communications	25
	Elective from List II	25
	Subtotal	**100**

Year 4	Semester 8 (Curtin)	
Code	Course Title	Credit
12838	Engineering Project	25
308795	Communication Signal Processing	25
307660	Engineering Sustainable Development	12.5
307675	Engineering Economics	12.5
	Elective from List I	25
	Subtotal	**75**

Elective List II (Curtin, Electronic and Communications Eng.)

Year 4	Semester 7 (Curtin) July	
Code	Course Title	Credit
308797	Information Theory and Error Control Coding	25
308787	Instrumentation and Control	25
308791	Computer Systems Engineering	25

Elective List I (Curtin, Electronic and Communications Eng.)

Year 4	Semester 8 (Curtin) Feb	
Code	Course Title	Credit
308785	Power Electronics and Drives	25
308796	Electromagnetic Propagation	25
12856	Microprocessors	25

308709 Computer Systems Engineering Stream

Year 3	Semester 5 (Curtin) July	
Code	**Course Title**	**Credit**
308791	Computer Systems Engineering	25
12847	Data Communication and Computer Networks	25
308794	Embedded Software Engineering	25
12834	Digital Signal Processing	25
	Subtotal	**100**

Year 3	Semester 6 (Curtin) Feb	
Code	**Course Title**	**Credit**
308790	Foundations of Computer Engineering	25
308792	Real Time Operating Systems	25
308798	Control Systems	25
12855	Embedded Systems Engineering	25
	Subtotal	**100**

Year 4	Semester 7 (Curtin) July	
Code	**Course Title**	**Credit**
12844	Engineering Project	12.5
307667	Engineering Project Management 301	25
12859	Computer Structures	25
307664	Engineering Law	12.5
	Elective	25
	Subtotal	**100**

Year 4	Semester 8 (Curtin)	
Code	**Course Title**	**Credit**
12838	Engineering Project	25
308793	Theory of Computation	25
12856	Microprocessors	25
307660	Engineering Sustainable Development	12.5
307675	Engineering Economics	12.5
	Subtotal	**100**

Elective List II
(Curtin, Computer Systems Engineering)

Year 4	Semester 7 (Curtin) July	
Code	**Course Title**	**Credit**
302497	Advanced Computer Engineering	25
12845	Instrumentation and Control	25

Course Structure of Electrical Engineering at Uni Sydney

Electrical Engineering

Year 3	Semester 5 (Uni Sydney) July	Credit
Code	**Course Title**	
	Select from Adv Recommended Electives	24
	Subtotal	24

Year 3	Semester 6 (Uni Sydney) Feb	Credit
Code	**Course Title**	
	Select from Adv Recommended Electives	24
	Subtotal	24

Year 4	Semester 7 (Uni Sydney) July	Credit
Code	**Course Title**	
ELEC4702	Practical Experience	0
ELEC4710	Engineering Project A	6
	Select from Adv Recommended Electives	18
	Subtotal	24

Year 3	Semester 8 (Uni Sydney) Feb	Credit
Code	**Course Title**	
ELEC4711	Engineering Project B	6
	Select from Adv Recommended Electives	18
	Subtotal	24

Electrical Engineering (Power)

Year 3	Semester 5 (Uni Sydney) July	Credit
Code	**Course Title**	
ELEC3206	Electrical Energy Conversion Systems	6
ELEC3304	Control	6
	Select from Adv Recommended Electives	12
	Subtotal	24

Year 3	Semester 6 (Uni Sydney) Feb	Credit
Code	**Course Title**	
ELEC3203	Electricity Networks	6
ELEC3204	Power Electronics and Applications	6
	Select from Adv Recommended Electives	12
	Subtotal	24

Year 4	Semester 7 (Uni Sydney) July	Credit
Code	**Course Title**	
ELEC4702	Practical Experience	0
ELEC4710	Engineering Project A	6
ELEC5205	High Voltage Engineering	6
	Select from Adv Recommended Electives	12
	Subtotal	24

Year 3	Semester 8 (Uni Sydney) Feb	Credit
Code	**Course Title**	
ELEC4711	Engineering Project B	6
ELEC5204	Power Systems Analysis and Protection	6
	Select from Adv Recommended Electives	12
	Subtotal	24

Electrical Engineering (Telecom)

Year 3	Semester 5 (Uni Sydney) July	Credit
Code	Course Title	
ELEC3405	Communications Electronics and Photonics	6
ELEC3506	Data Communications and the Internet	6
	Select from Adv Recommended Electives	12
	Subtotal	24

Year 3	Semester 6 (Uni Sydney) Feb	Credit
Code	Course Title	
ELEC3305	Digital Signal Processing	6
ELEC3505	Communications	6
	Select from Adv Recommended Electives	12
	Subtotal	24

Year 4	Semester 7 (Uni Sydney) July	Credit
Code	Course Title	
ELEC4702	Practical Experience	0
ELEC4710	Engineering Project A	6
	Select from Adv Recommended Electives	18
	Subtotal	24

Year 3	Semester 8 (Uni Sydney) Feb	Credit
Code	Course Title	
ELEC4711	Engineering Project B	6
ELEC4505	Digital Communication Systems	6
	Select from Adv Recommended Electives	12
	Subtotal	24

Electrical Engineering (Computer)

Year 3	Semester 5 (Uni Sydney) July	Credit
Code	Course Title	
ELEC3506	Data Communications and the Internet	6
ELEC3608	Computer Architecture	6
	Select from Adv Recommended Electives	12
	Subtotal	24

Year 3	Semester 6 (Uni Sydney) Feb	Credit
Code	Course Title	
ELEC3607	Embedded Systems	6
	Select from Adv Recommended Electives	18
	Subtotal	24

Year 4	Semester 7 (Uni Sydney) July	Credit
Code	Course Title	
ELEC4702	Practical Experience	0
ELEC4710	Engineering Project A	6
	Select from Adv Recommended Electives	18
	Subtotal	24

Year 3	Semester 8 (Uni Sydney) Feb	Credit
Code	Course Title	
ELEC4711	Engineering Project B	6
	Select from Adv Recommended Electives	18
	Subtotal	24

Note: Students with ISWAM of 65% or greater are eligible for Honours pathway and can replace ELEC4710 with ELEC4712.

Note: Students with ISWAM of 65% or greater are eligible for Honours pathway and can replace ELEC4711 with ELEC4713

List of Advanced Recommend Electives - July

Code	Course Title	Credit
ELEC3405	Communications Electronics and Photonics	6
ELEC3506	Data Communications and the Internet	6
ELEC3608	Computer Architecture	6
ELEC3609	Internet Software Platforms	6
ELEC3702	Management for Engineers	6
ELEC3803	Bioelectronics	6
ELEC5101	Antennas and Propagation	6
ELEC5203	Topics in Power Engineering	6
ELEC5205	High Voltage Engineering	6
ELEC5206	Sustainable Energy Systems	6
ELEC5207	Advanced Power Conversion Technologies	6
ELEC5508	Wireless Engineering	6
ELEC5510	Satellite Communications Systems	6
ELEC5512	Optical Networks	6
ELEC5514	Networked Embedded Systems	6
ELEC5617	Topics in Software Engineering	6
ELEC5619	Object Oriented Application Frameworks	6
ELEC5620	Model Based Software Engineering	6
ELEC5621	Digital Systems Design	6
ELEC5701	Technology Venture Creation	6

List of Advanced Recommend Electives - Feb

Code	Course Title	Credit
ELEC3104	Engineering Electromagnetics	6
ELEC3204	Power Electronics and Applications	6
ELEC3305	Digital Signal Processing	6
ELEC3404	Electronic Circuit Design	6
ELEC3505	Communications	6
ELEC3607	Embedded Systems	6
ELEC3610	E-Business Analysis and Design	6
ELEC3802	Fundamentals of Biomedical Engi-neering	6
ELEC4505	Digital Communication Systems	6
ELEC4706	Project Management	6
ELEC5204	Power Systems Analysis and Protec-tion	6
ELEC5208	Intelligent Electricity Networks	6
ELEC5303	Computer Control System Design	6
ELEC5402	Digital Integrated Circuit Design	6
ELEC5403	Radio Frequency Engineering	6
ELEC5507	Error Control Coding	6
ELEC5509	Mobile Networks	6
ELEC5511	Optical Communication Systems	6
ELEC5614	Real Time Computing	6
ELEC5615	Advanced Computer Architecture	6
ELEC5616	Computer and Network Security	6
ELEC5618	Software Quality Engineering	6

Description of Subjects

UIGE600001
UIGE610001
MPKT A / INTEGRATED CHARACTER BUILDING A
6 SKS
Refer to Page 74

UIGE600004
UIGE610004
MPKT B / INTEGRATED CHARACTER BUILDING B
6 SKS
Refer to Page 74

UIGE600002
ENGLISH
UIGE610002
ACADEMIC WRITING
3 SKS
Refer to Page 74

UIGE600003
UIGE610003
SPORTS / ARTS
1 SKS
Refer to Page 77

ENGE600001
ENGE610001
CALCULUS
4 SKS
Refer to Page 74

ENGE600010
ENGE610010
BASIC CHEMISTRY
Refer to Page 75

ENGE600003
ENGE610003
BASIC PHYSICS 1
4 SKS
Refer to Page 75

ENGE600004
BASIC PHYSICS 2
4 SKS
Refer to Page 77

ENGE600002
ENGE610002
LINEAR ALGEBRA
4 SKS
Refer to Page 75

UIGE600005-9
UIGE610005-9
RELIGIOUS STUDIES
2 SKS
Refer to Page 76-77

ENGE600008
ENGE610008
HEALTH, WORK SAFETY, AND ENVIROMENT
2 SKS
Refer to Page 78

ENEE600001
ENEE610001
INTRODUCTION TO DIGITAL SYSTEM
2 SKS
Learning Objectives: This courses is intended to make students to understand various levels of digital system design and implementation either using simple logic gates to utilizing Programmable Logic Devices. This course includes several laboratory practices in design, implementation and verification of digital logic circuits. Tools such as Xilinx and other digital circuit simulation software will be used.
Syllabus: Introduction to logic gates AND, OR and NOT; Multiple combinational switches, Combinational Logics with Multiplexers and Decoder: Full Adder, binary memory unit: SR latch, D and JK flip-flops: Ripple Counter, Register and Counter: Universal Shift register, Ring counter and BCD counter, VHDL, design, simulation and implementation of integrated digital circuit using programmable logic devices.
Prerequisites: None
Text Books:
1. M. Morris Mano, "Digital Design", 4th Edition (International Edition), Prentice-Hall, 2007
2. Robert Dueck, "Digital Design with CPLD Applications and VHDL", Delmar Cengage Learning; 2nd Edition, 2004, ISBN-10: 1401840302, ISBN-13: 978-1401840303
3. M.M. Mano and C.R. Kime," Logic and Computer Design Fundamentals", 3rd Edition (International Edition), Prentice-Hall, 2004

ENEE600002
ENEE610002
INTRODUCTION TO DIGITAL SYSTEM LABORATORY
1 SKS
Learnig Objectives: the completion of the subject, students are expected to be able to design a finite state machine and able to implement a simple digital circuit design.
Syllabus: Boolean algebra and logic gates. Decoder, Encoder, Multiplexer, and Demultiplexer. Digital Arithmetic (Half Adder, Full Adder, and Comparator. Flip-Flop and Counter. Register and Serial/Parallel Operations.

Prerequisites: None
Text Books:
1. Introduction to Digital System Laboratory Workbook – Digital Laboratory
2. M. Morris Mano, "Digital Design", 4th Edition (International Edition), Prentice-Hall, 2007

ENEE600003
ENEE610003
FUNDAMENTAL OF ELECTRICAL ENGINEERING
3 SKS
Learning Objectives: This courses is intended to introduce electrical engineering students the fundamental of electrical engineering. At the completion of the subject, students will develop skills in designing and analyzing AC and DC circuits which are the base of electrical engineering equipments. The method of analyzing the subjects are based on physical laws and mathematics routinely required by engineering students which are raised in limited and self contained manner, and are not assumed or required as prerequisite background.
Syllabus: Introduction, resistive circuits, dependent sources and op. amps, analysis methods, energy–storage elements, first–order circuits, second–order circuits, sinusoidal sources and phasors, AC steady–state analysis, AC steady–state power.
Prerequisites: Calculus
Text Books:
1. David E. Johnson, Johnny R. Johnson, John L. Hilburry, Peter D. Scott, "Electric Circuit Analysis", 3rd Edition, Prentice Hall International, Inc., 1997. (Chapter 1-9)
2. James W. Nilsson, Susan A. Riedel, "Electric Circuits", 6th Edition, Prentice Hall International Inc., 2000. (Chapter 1-10)

ENEE600004
ENEE610004
ELECTRIC CIRCUIT
3 SKS
Learning Objectives: : At the completion of this course, students are expected to be able to use star and delta circuits, calculate phase current, conductor, three phase system power, complex frequency of a electric circuit, and use Laplace and Fourier transform also with its inverse in electric circuit.
Syllabus: Balanced three phase circuit, complex frequency, magnetic coupled circuit; Laplace transform, laplace transform circuit, selection of frequency, active filter circuit, two port circuit; Fourier series review, circuit with fourier transform, resistif circuit, dependent sources and op amp, analysis method, energy stored element, first order circuit, second order circuit, sinusoidal sources and phasor, AC steady state analysis, AC steady state power.
Prerequisites: Fundamental of Electrical Engineering.
Text Books:
1. James W. Nilsson, Susan A. Riedel, "Electric Circuits", 6th Edition, Prentice Hall International Inc., 2000 (Chapter 11-18)
2. David E. Johnson, Johnny R. Johnson, John L. Hilburry, Peter D. Scott, "Electric Circuit Analysis", 3rd Edition, Prentice Hall International, Inc., 1997 (Chapter 10-17)

ENEE600005
ENEE610005
ELECTRIC CIRCUIT LABORATORY
3 SKS
Learning Objectives: : At the completion of this course, students are expected to be able to understand basic circuit and logic concept of electrical and eletronic.
Syllabus: Analysis and design of DC voltage and current source using : superposition network reduction technique, Thevenin Norton equivalent circuit. Loop and node equations in sinusoidal source equations.
Prerequisites: Fundamental of Electrical Engineering.
Text Books:
Electric Circuit Laboratory Workbook – High Voltage And Electrical Measurement Laboratory

ENEE600006
ENEE610006
ENGINEERING MATHEMATICS 1
3 SKS
Learning Objectives: At the completion of the subject, students will be able to use complex functions in electric circuits, to apply Cauchy Riemann method in Laplace and Poisson equation, to use Cauchy integral method in the integral of cartesius and polar coordinate.
Syllabus: Complex numbers and functions, polar form, de Moiv're theorem, dot and cross product, limit of complex functions, Derivative, del, gradient, divergence, curl of complex function, analytic and harmonic function, Cauchy-Riemann equations, Laplace and Poisson, complex integration, Cauchy integral and residue integration, real integrals using complex functions, vector in 2-space and 3-space, vector operation, dot and cross. Differential and Integral Vector Green, Gauss and Stoke Theorem.
Prerequisites: Calculus.
Text Books:
1. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, Wiley Publisher 2006
2. Glyn James, "Advanced Modern Engineering Mathematics", 2nd Edition, Prentice Hall Publisher 1999

ENEE600007
ENEE610007
ELECTRONIC DEVICES
3 SKS
Learning Objectives: At the completion of this course, students are expected to be able to understand principle of electronic devices.
Syllabus: Modelling microelectronic devices, basic microelectronic device analysis and design, phisical electronics of semiconductor junction dan MOS devices, relation of electrical behaviour to internal physical process, and understand the uses and limitations of various models. The course uses incremental and large signal techniques to analyze and design bipolar and field effect transistor. Semiconductor physics, Semiconductor devices. Physics-based models.
Prerequisites: None
Text Books:
1. Howe, R. T., and C. G. Sodini, "Microelectronics: An Integrated Approach". Upper Saddle River, NJ: Prentice Hall, 1996
2. Fonstad, C. G. "Microelectronic Devices and Circuits", New York, NY: McGraw-Hill, 1994

ENEE600008
BASIC COMPUTER
3 SKS
Learning Objectives: At the completion of this course, students are able to explain computer either its utilization or danger, software or hardware, also benefit of use of computer network includes internet, able to design simple algorithm in flowchart and able to implement the algorithm in program by using programming language.
Syllabus: Introduction to computer, introduction to computer hardware, introduction to computer software, introduction to basic computer network, algorithm, flowchart, introduction to C language, program control in C language, structured program in C language.
Prerequisites: Introduction to Digital System
Text Books:
1. Alan Evans, Kendall Martin, Mary Anne Poatsy, Technology in Action (TiA), 2nd Edition, Prentice-Hall, 2006
2. Gary B. Shelly and Misty E. Vermaat, Discovering Computers 2011: Living in a Digital World, Course Technology, Cengage Learning, 2011
3. Deitel And Deitel, C How to Program, 5th Edition, Pearson Education, 2007

ENEE600009
BASIC COMPUTER LABORATORY
1 SKS
Learning Objectives: At the completion of this course, students are expected to be able to identify any operation in computer peripheral, able to design a simple program by using high level programming language, and able to identify troubleshooting in computer network system.
Syllabus: Introduction to computer hardware and software, basic programming, introduction to computer network trouble shooting.
Prerequisites: Introduction to Digital System
Text Books:
Basic Computer Laboratory Workbook – Digital Laboratory

ENEE600010
ENEE610010
PROBABILITY AND STOCHASTIC PROCESS
3 SKS
Learning Objectives: Students are expected to be able to elaborate the probability and stochastic concepts; to use probability and stochastic concepts to solve engineering problems in general and electrical engineering problems in specific.
Syllabus: Probability concepts, random variable and probability distributions, mathematical expectation, probability distribution function, probability transforms, stochastic process concepts, random walk, spectrum, mean square estimation, entropy, Markov process, central limit theorem.
Prerequisites: None
Text Books:
1. Guojun Lu, "Communication and Computing for Distributed Multimedia Systems," John Wiley and Sons
2. Luis Correia, "Mobile Broadband Multimedia Networks," Elsevier, UK, 2006

ENEE600011
ENEE610011
ENGINEERING MATHEMATICS 2
3 SKS
Learning Objectives: At the completion of the subject, students are expected to be able to apply, to determine the convergence of series, to convert a function into Taylor MacLaurin and Fourier series, and use for function linearization, to use Laplace, Fourier and Z transform.
Syllabus: Definition of order, series and series type, series test, ratio test, integral test, comparison test, root test, Raabe test, Gauss test, Taylor and Maclaurin series, Fourier and Fourier series in complex form, Laplace, Fourier and Z transform.
Prerequisites: Engineering Mathematics 1.
Text Books:
1. Erwin Kreyszig, "Advanced Engineering Mathematics" 9th Edition, Wiley Publisher 2006
2. Glyn James, "Advanced Modern Engineering Mathematics", 2nd Edition, Prentice Hall

Publisher 1999

ENEE600012
ENEE610012
ELECTRONIC CIRCUITS
3 SKS
Learning Objectives: At the completion of the subject, students will be able to describe, characterize diode, FET, JFET, MOSFET, VMOS, CMOS, and MESFET; able to analyze BJT application circuits : small-signal and large-signal models in electronic circuits and able to analyze FET application circuits.
Syllabus: Basic principles of diode, transistor, FET, JFET, MOSFET, VMOS, CMOS, MESFET circuits; BJT *common source*, *common base*, *common emitter* and *common collector* circuits, BJT applications, small signal and large signal model BJT; Current and voltage amplifier; MOSFET depletion and enhancement types, FET applications.
Prerequisites: Electronic Devices, Electric Circuits.
Text Books:
Boylestad R, Nashhelsky L, "Electronic Devices and Circuit Theory 9th Edition", Prentice Hall, New Jersey, USA, 2006

ENEE600013
ENEE610013
ELECTRONIC CIRCUITS LABORATORY
1 SKS
Learning Objectives: At the completion of this course, students are expected to be able to design one stage, two stages, multi stages amplifier circuit and multi vibrator, oscillator, and op amp circuit.
Syllabus: Experiment determination of device characteristics, diode circuits, one stage amplifier, compound transistor stages, multivibrator circuit, oscillator circuit, op amp circuit.
Prerequisites: Electronic Devices, Electric Circuits.
Text Books:
Electronic Circuits Laboratory Workbook – Electronics Laboratory

ENEE600014
ENEE610014
ELECTROMAGNETIC
3 SKS
Learning Objectives: At the completion of this course, students are expected to be able to implement Maxwell Law 1, 2, 3, and 4.
Syllabus: Static electric, magnetic field, Maxwell equations, elektromagnetic wave, wave propagatin, wave properties in different mediums, wave transmission, matching impedance, radiation.
Prerequisites: Engineering Mathematics 1
Text Books:
1. Stuart M. Wentworth, "Fundamentals of Electromagnetics with Engineering Applications", John Wiley, 2005
2. Fawwaz T Ulaby, "Fundamental of Applied Electromagnetics", Prentice Hall Publications, 2001

ENEE600015
ENEE610015
SIGNALS AND SYSTEMS
3 SKS
Learning Objectives: This course is intended to introduce students about the tools and techniques for analyzing analog and digital signals. At the completion of the subject, students are expected to be able to process and transform the signals into Fourier, Laplace and Hilbert function, able to design simple filters, sampling signals into discrete (Z transform), able to design IRR and FIR filters of continuous systems.
Syllabus: Fourier Transformation and its properties, Discrete Time Fourier Transformation and its properties, continuous time systems, Laplace Transform and its properties. System functions, windows, filter design. Hilbert Transformation. Discrete time signals, sampling, theorem reconstruction, Z-Transformation and its properties. System functions, discrete time simulation of continuous systems, windows, design of IIR and FIR filters.
Prerequisites: Engineering Mathematics 1
Text Books:
1. Simon Haykin And Barry Van Veen, "Signals and System", 2nd Edition John Wiley & Sons Publisher, 2003
2. Alan V. Oppenheim, Ronald W. Schafer, and John R. Buck, "Discrete-Time Signal Processing", Prentice Hall; 2nd Edition, 1998

ENEE600016
ENEE610016
ELECTRICAL MATERIALS
2 SKS
Learning Objectives: The course is intended to make students to be able to identify electrical materials basic properties and explain atomic bonding concept, and to identify atomic bonding in solid material, dielectric polarization, dielectric losses, electric material classifications, isolation materials, and isolation damages.
Syllabus: Introduction to material properties, conspectus of bonding, solid atom, dielectric polarization, dielectric losses, electric material classifications : solid, cramic, and polimer, isolation material : gas and liquid, isolation damage.
Prerequisites: Basic Physics 2
Text Books:

Rudy Setiabudy, “Material Teknik Listrik”, UI Press, 2007

ENEE600031
ENEE610031
NUMERICAL COMPUTATION
3 SKS
Learning Objective: Able to solve problem with computational method.
Syllabus: Binary computing system, Computer memory, Algorithm and system efficiency, dynamic and MonteCarlo, Stocastic and random, Error and error reduction.
Prerequisite: -
Text Books:

ENEE600017
ENEE610017
ELECTRICAL POWER ENGINEERING
3 SKS
Learning Objectives: The course is intended to make students to be able to identify basic concept of electrical power system, use power system component in electric power system analysis, and able to implement power and frequency control concept, voltage and reactive power control concept, power flow methods, and stability method in electric power system.
Syllabus: Energy and electric power problem phenomenon, special and new topic of energy and electric ppower problem, power electronic problem, data processing that is used in design, control system, in energy and electric power.
Prerequisites: Electric Circuit
Text Books:
S. J. Chapman, “Electric Machinery and Power System Fundamentals”, McGraw-Hill Science/ Engineering/Math, 2001.

ENEE600018
ENEE610018
ELECTRICAL POWER ENGINEERING LABORATORY
1 SKS
Learning Objectives: The laboratory is intended to introduce electric power basic concept to electrical engineering students **:** motor and generator includes DC or AC transformator.
Syllabus: Watt meter, volt meter, amp meter and transformer. Motor & generators DC. Reading of 3 phase circuit power either with balanced or unbalanced load. One and three phase circuit testing for Y & Δ. Power Transformer, solving by using open loop and closed loop circuit test. Autotransformer.
Prerequisites: Electric Circuit
Text Books:
Electrical Power Engineering Laboratory Workbook – Electric Power Energy Conversion Laboratory.

ENEE600019
ENEE610019
CONTROL SYSTEMS
3 SKS
Learning Objectives: The course is intended to make students to sketch static or dynamic response of first, second, or higher order system, determine pole and zero system, and dominant pole of higher order system, explain Routh-Hurwitz, Nyquist diagram, TKA, and creating Bode diagram.
Syllabus: Continue system characteristic order 1, 2, and approximation for higher order, linear continue system stability analysis methods.
Prerequisites: Signals and Systems
Text Books:
1. N. Nise, “Control Systems Engineering”, 4th Edition, Wiley, 2005
2. Katsuhiko Ogata, “Modern Control Engineering” 4th Edition, Prentice Hall, 2002

ENEE600020
ENEE610020
CONTROL SYSTEMS LABORATORY
1 SKS
Learning Objectives: The laboratory is intended to introduce control system concept to electrical engineering students : Analyze control system performance.
Syllabus: Frequency response of first, second, and higher order system. Root-locus, Nyquist, Bode and polar plots. Modelling & solving of electric system by using differential equations. Basic control components. System design with given specifications. Stability and Routh-Hurwitz criterion. Control system of pressure process rig 38–14 with root locus. Control design of coupled-tank control apparatus PP-100 by using Bode diagram.
Prerequisites: Signals and Systems
Text Books:
Control System Laboratory Workbook - Control Laboratory.

ENEE600021
ENEE610021
MICROPROCESSOR AND MICROCONTROLLER
4 SKS
Learning Objectives: In this course, students learn the microprocessor and microcontroller technology. After completing this course, students are expected to be able to program 16 bits and 32 bits Intel Microprocessor and 8051 Microcontroller (8 bits) using low level language and also able to design microcontroler 8051 based embedded system.
Syllabus: Microprocessor: Introduction to Microprocessor, Microprocessor Hardware Specification, Microprocessor Internal Architecture, Addressing Modes, Assembly Language Programming, Data Movement Instruction, Arithmetic and Logic Instruction, Program Control Instruction,

Programming the Microprocessor, Memory and I/O Interfacing. Microcontroller: Introduction to Microcontroller, 8051 Microcontroller Architecture, Programming the 8051 Microcontroller, 8051 Addressing Modes, I/O Port Programming and Interfacing, Arithmetic and Logic Instruction, Introduction to Embedded System Design using 8051 Microcontroller

Prerequisites: Basic Computer, Basic Computer Laboratory, Electronic Circuits.

Text Books:

1. The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium IV Architecture, Programming, and Interfacing, Seventh Edition, Brey, Barry, B., PHI Inc, USA, 2006
2. The 8051 Microcontroller and Embedded Systems, Second Edition, Muhammad Ali Mazidi, Prentice Hall, 2006

ENEE600022
ENEE610022
MICROPROCESSOR AND MICROCONTROLLER LABORATORY
1 SKS

Learning Objectives: : In this course, students learn microprocessor and microcontroller technology in a practical way. After completing this course, students are expected to be able to program the 16 bit and 32 bit Intel Microprocessor and 8051 Microcontrollers and able to design simple Microcontroller 8051 based embedded systems.

Syllabus: Assembly Programming for 8086/8088 Intel Microprocessor, Assembly Programming and Interfacing Microcontroller to LED, Switch, LCD, Keypad, Assembly Programming and Interfacing Microcontroller Stepper Motor. UTS Project: Development of Assembly Language Program for Microprocessors 8086/8088. UAS Project: Development of Microcontroller Based Embedded Systems 8051

Text Books:

1. Digital Laboratory, "Microprocessor and Microcontroller Laboratory Modules"
2. The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium IV Architecture, Programming, and Interfacing, Seventh Edition, Brey, Barry, B., PHI Inc, USA, 2006
3. The 8051 Microcontroller and Embedded Systems, Second Edition, Muhammad Ali Mazidi, Prentice Hall, 2006

ENEE600023
ENEE610023
INTERNSHIP
2 SKS

Learning Objectives: In this course, students will do internship work in a computer engineering related industry, institution or lab. After completing this course, students are expected to be able to combine and implement their previously learned technical knowledge with the new knowledge given by their supervisor. Students are also expected to be able to show professional conduct such as teamwork, discipline, responsible, initiative & interest, leadership, commendable attitude/behavior, and improvement prospect.

Syllabus: None

Prerequisites: Earned 90 SKS. The internship place is a electrical engineering related industry, institution or lab which has a supervisor or a responsible person who can supervise students on a daily basis. Selection of company or lab shall begin with administrative process in the Departement of Electrical Engineering.

Text Books: None

ENEE600024
ENEE610024
TELECOMMUNICATION ENGINEERING
3 SKS

Learning Objectives: This course is designed to give students a comprehensive understanding of the telecommunication systems. At the completion of the subject, students are expected to be able to identify the telecommunication systems, telecommunication networks, and various communication systems in global.

Syllabus: Introduction to telecommunication. Analog & digital communication system. Channel and modulation characteristics. Telecommunication networks: basic telephony, switching, signaling, and queuing concepts. Circuit & packet switched, IP, Internet. Line transmission, radio & microwave communication systems. Optical fiber communication systems and application.

Prerequisites: Engineering Mathematics 2

Text Books:

1. Simon Haykin, "Communication Systems", 5th Edition, John Wiley & Sons Inc., 2008
2. Roger L. Freeman, "Telecommunication Systems Engineering", 4th Edition, John Wiley & Sons Inc., 2004

ENEE600025
ENEE610025
TELECOMMUNICATION ENGINEERING LABORATORY
1 SKS

Learning Objectives: This course is intended to give the students experiences in conducting experiments which analyze and demonstrate telecommunication engineering concepts. At the completion of the subject, students are expected to be able to describe basic concepts of telecommunication, to hand on measurement and

analysis of signalling, switching and transmission basic tools.
Syllabus: A series of experiments and a project demonstrating the fundamentals of modern electronic communication systems, microphone, transmission line, including amplitude, single-sideband, frequency, pulse modulation, frequency and time division multiplexing. Spectral & noise analysis, digital modulation. Baseband transmission & bandpass modulation. Transmission system: wire cable, optical cable and wireless. Antenna & wave propagation.
Prerequisites: Engineering Mathematics 2
Text Books:
Telecommunication Engineering Laboratory Workbook–Telecommunication Engineering Laboratory.

ENEE600026
ENEE610026
ALGORITHM AND PROGRAMMING
3 SKS
Learning Objectives: The course is intended to make students to implement basic and advanced algorithm into programming language.
Silabus: Function, data structure introduction, modular pemrograman, array, searching and sorting, stack and queue, link list and recursion.
Prerequisites: Basic Computer
Text Books :
1. Deitel & Deitel, "C How to Program", 5th Edition, Pearson International Edition, 2007
2. Robert Kruse, C. L. Tondo & Bruce Leung, "Data Structure & Program Design in C", 2nd Edition, Prentice Hall, 1997

ENEE600027
ENEE610027
ELECTRICAL MEASUREMENTS
2 SKS
Learning Objectives: The course is intended to make students to be able to identify analog instrument measurement, sensor / transducer basic measurement, ADC and sampling system, sampling theory elements, digital instrumentation measurement, able to design simple coding instruction for ADC / DAC, able to identify data acquisition system.
Syllabus: Analog instrumentation: PMMC (movement), DC current, DC voltage, and resistance measurement, bridges for DC and AC measurement, oscilloscope, signal conditioning, elektronic measurement. Sensors/Transducers: transducers basic characteristic, selected example of transducers (temperature, pressure, etc.). Analog-to-Digital (ADC) conversion and basic sampling : digital vs analog processing, Digital-to-Analog (DAC) conversion techniques and the problem. Sampling theory element, ADC selected technique, speed vs hardware trade off. Digital instrumentation. Basic Computer (Control): basic computer instruction to control ADC and DAC, relevant computer basic programming. Data acquisition system: ADC component needed, comparison and selection of DAS.
Prerequisites: Electronic Circuits
Text Books:
1. Rudy Setiabudy, "Pengukuran Besaran Listrik", LP-FEUI, 2007
2. Klaas B. Klaassen, "Electronic Measurement and Instrumentation", Cambridge University Press, 1996

ENEE600028
ENEE610028
ELECTRICAL MEASUREMENTS LABORATORY
1 SKS
Learning Objectives: The laboratory is intended to make students to be able to use measurement tools to measure frequency, votage, current, and wave form of a electric power device, analyze transient respon and frequency, use precise operational instrumentation : oscilloscope and multivibrator.
Syllabus: Analog instrumentation: PMMC (movement), DC current, DC voltage, and resistance measurement, bridges for DC and AC measurement, oscilloscope, signal conditioning, elektronic measurement. Sensors/Transducers: transducers basic characteristic, selected example of transducers (temperature, pressure, etc.). Analog-to-Digital (ADC) conversion and basic sampling : digital vs analog processing, Digital-to-Analog (DAC) conversion techniques and the problem. Sampling theory element, ADC selected technique, speed vs hardware trade off. Digital instrumentation. Basic Computer (Control): basic computer instruction to control ADC and DAC, relevant computer basic programming. Data acquisition system: ADC component needed, comparison and selection of DAS.
Prerequisites: Electronic Circuits
Text Books:
Electrical Measurements Laboratory Workbook – High Voltage And Electrical Measurement Laboratory.

ENEE600029
ENEE610029
SEMINAR
2 SKS
Learning Objectives: In this course, students are directed to apply previously learned knowledge into a fully guided research by a lecturer. After completing this course, students are expected to be able to design and analyze under a supervised research, and able to write their research findings in a systematic scientific writing in form of seminar book. Students are also expected to present their research findings in front of their

lecturer.
Syllabus: None
Prerequisites: Completing 90 SKS
Text Books:
1. Technical Guidance for Universitas Indonesia Students' Final Project
2. IEEE Citation Reference
3. IEEE Transactions on Parallel And Distributed Systems, Vol. 21, No. 2, February 2010, "How To Write Research Articles in Computing and Engineering Disciplines"

ENCE601023
ENGINEERING ENTREPRENEURSHIP
2 SKS
Refer to Page 207

ENEE600030
ENEE610030
FINAL PROJECT
4 SKS
Learning Objectives: In this course, students are directed to apply previously learned knowledge into a fully guided research by a lecturer. After completing this course, Students are expected to be able to make a research concept by applying existing theories. Under the direction of the lecturer, students are expected to integrate and implement their concept, and write their research findings in a systematic scientific writing in the form of undergraduate theses book. Students are also expected to present and defend their concepts and findings in front of examiner in the final defense council. Students are also expected to create and publish scientific papers in scientific journals.
Syllabus: None
Prerequisites: Completing 120 SKS
Text Books:
1. Technical Guidance for Universitas Indonesia Students' Final Project
2. IEEE Citation Reference
3. IEEE Transactions on Parallel And Distributed Systems, Vol. 21, No. 2, February 2010, "How To Write Research Articles in Computing and Engineering Disciplines"

MAJORING TELECOMMUNICATION ENGINEERING

ENEE600101
BROADBAND MULTIMEDIA COMMUNICATIONS
3 SKS
Learning Objectives: Students are expected to be able to elaborate multimedia concepts, broadband networks, and QoS and its mechanism; to analyze the performance of broadband multimedia systems.
Syllabus: Multimedia concepts, TC/IP technologies, network protocols, resource management, ATM, frame relay, MPLS, broadband wireless access technologies, metro Ethernet, NGN, and IMS, QoS, working mechanism and its quality assurance.
Prerequisites: Telecommunication Engineering
Text Books:
1. Guojun Lu, "Communication and Computing for Distributed Multimedia Systems," John Wiley and Sons
2. Luis Correia, "Mobile Broadband Multimedia Networks," Elsevier, UK, 2006

ENEE600102
ENEE610102
COMMUNICATION NETWORKS
3 SKS
Learning Objectives: Students are expected to be able to elaborate communication networks as unity end-to-end systems; to understand the traffic in communication networks and its implication to performance and capacity of networks; to understand the queuing theory and the parameters in communication systems; to understand QoS mechanism and security in communication networks.
Syllabus: Networking mathematics, communication network concepts (layerization), circuit switch and packet switch, communication traffic concepts (Erlang B, Erlang C, Engset, Bernoulli, etc.), queuing theories (M/M/1, M/M/c, M/G/1, M/G/c, etc.) Markov chain concepts, QoS mechanism and assessment concepts.
Prerequisites: Telecommunication Engineering
Text Books:
1. James R. Boucher, "Traffic System Design Handbook," IEEE Press,1993
2. Piet Van Mieghem, "Performance Analysis of Communication Networks and Systems", Cambridge University Press, 2006,USA
3. Jean Walrand, "An Introduction to Queueing Networks," Prentice-Hall Int'l, USA, 1988

ENEE600103
ENEE610103
CODING AND MODULATION TECHNIQUES
3 SKS
Learning Objectives: Students are expected to be able to explain coding techniques, digital modulation techniques, and multiple access techniques; to design, calculate, and implement them in communication systems.
Syllabus: Probability review, coding techniques: source coding, channel coding, linear block coding, convolutional coding, nonbinary and concatenated coding, TCM, turbo codes. Digital communication: sampling, multiplexing, PCM, characteristics of communication channels (noisy, noiseless, fading channels). Bandpass modulation (MPSK, MQAM, MFSK, TCM), multiple access (spread spectrum, multichannel, and

multicarrier). Signal design for band-limited channel.

Prerequisites: Telecommunication Engineering

Text Books:

1. Bernard Sklar, "Digital Communications, Fundamentals and Applications: Second Edition," Prentice Hall International, Inc. 2001
2. Tommy Oberg, "Modulation, Detection, and Coding," John Wiley & Sons, LTD, 2001. Timothy Pratt, Charles Bostia, and Jeremy Allnutt, "Satellite Communications: Second edition," John Wiley & Sons, 2003

ENEE600104
ANTENNAS AND PROPAGATION
3 SKS

Learning Objectives: Students are expected to be able to elaborate the wave propagations and transmission systems and also its implications to the performance of communication systems; to elaborate types of antenna as a device to transmit signals.

Syllabus: Radio wave propagations (surface, ionosphere, microwave, and millimeter waves, etc.), concepts of fading, radiation from small antennas, linear antenna characteristics, arrays of antenna, impedance concepts and measurements, matching impedance, multi-frequencies antennas, aperture antennas.

Prerequisites: Electromagnetic

Text Books:

1. Constantine A. Balanis, "Antenna Theory, Analysis and Design", Second Edition, John Willey and Son, Inc., 1997.
2. Saunders R Simon, "Antennas and Propagation for Wireless Communication Systems", 1st Edition, John Wiley and Son, Inc., 1999.

ENEE600105
ENEE610105
OPTICAL COMMUNICATIONS
3 SKS

Learning Objectives: Students are expected to be able to explain the wired/optical fiber transmission media and their working principles; to analyze the performance of optical communication systems.

Syllabus: Structure and waveguide optical fiber, signal degradation in optical fibers, optical source, optical components, coherent optical fiber communications, advanced systems and techniques, coding theory and techniques, characterizing, measuring, and calculating performance of optical communications.

Prerequisites: Telecommunication Engineering

Text Books:

1. Govind P. Agrawal, "Fiber-Optic Communication Systems", 3rd Edition, Wiley Interscience, 2002
2. G. Keiser, "Optical Fiber Communications", 3rd Edition, McGraw Hill, 2000

ENEE600106
WIRELESS COMMUNICATIONS
3 SKS

Learning Objectives: Students are able to explain the principles of cellular and satellite communications; to analyze the performance of mobile terrestrial and satellite communication technologies.

Syllabus: Wireless technologies, propagation and channel models, cellular concepts, capacity of cellular systems, digital modulation techniques for cellular communications, diversity equalization, coding (error-control) techniques for cellular communications, multiple access technologies, link budget, concept of emerging wireless technology (WCDMA, WLAN, Mobile Adhoc, WBAN).

Prerequisites: Telecommunication Engineering

Text Books:

1. Theodore S. Rappaport, "Wireless Communications, Principles and Practice, Second Edition," Prentice Hall, 2002
2. Andrea Goldsmith, "Wireless Communications," Cambridge University Press, 2005.
3. Dennis Roddy, "Satellite Communications: Third edition," McGraw Hill, 1989

ENEE600107
COMMUNICATION SYSTEM DEVICE
3 SKS

Learning Objectives: Students are able to elaborate and analyze communication system sub-devices based on passive and active components; to design the radio wave communication sub-system based on passive/microstrip and active components.

Syllabus: Basic components of microwave systems including amplifier, oscillator, mixer, detector, and electronics switches, system performances of microwave system, design LNA, amplifier, oscillator, design of planar passive components and their applications, design mixer, filter, and detector, design simple antenna. Electronic components, communication sub-system devices and their working principles, amplifier design, oscillator design, active-component based mixer design, active filter design, PLL design, AGC design.

Prerequisites: Electronic Circuits, Telecommunication Engineering

Text Books:

1. D. M. Pozar, "Microwave Engineering", Addison-Wesley, 1998
2. Cotter W Sayre, "Complete Wireless Design", 2nd Edition, McGraw Hill, 2008

ENEE600108
SPECIAL COURSE (TELECOMMUNICATION 1)
3 SKS

Learning Objectives: Students are expected to be able to keep updating the latest telecommunication technologies, businesses, and regulations.

Syllabus: Latest issues in telecommunication technology, application, business, and regulatory aspects.
Prerequisites: None
Text Books: None

ENEE600109
SPECIAL COURSE (TELECOMMUNICATION 2)
3 SKS
Learning Objectives: Students are expected to be able to keep updating the latest telecommunication technologies, businesses, and regulations.
Syllabus: Latest issues in telecommunication technology, application, business, and regulatory aspects.
Prerequisites: None
Text Books: None

MAJOR ELECTRICAL POWER ENGINEERING

ENEE600201
ENEE610201
POWER ELECTRONICS AND LABORATORY
3 SKS
Learning Objectives: This one semester course is intended to teach power electronics fundamentals for applications and design of power electronic devices for final year Electrical Engineering students. A huge market for power electronic equipment exits and the demand for engineers with knowledge in power electronics is likely to exist. Laboratory practice: to provide Electrical Engineering students the knowledge of Power Electronics used in Electric Motor Drives.
Syllabus: Introduction. Power Semiconductor diode. Diode Circuit & Rectifier. Thyristors. Controlled rectifier. AC Voltage Controllers. Thyristor Commutation Techniques. Power Transistors. DC Choppers. PWM Inverters. Resonant Pulse Converters. Static Switches. Power Supplies. DC Drives. AC Drives. Protection of Devices and Circuits. Laboratory practice: Provide Electrical Engineering students the knowledge of Power Electronics used in Electric Motor Drives.
Prerequisites: Electronic Devices, Electrical Power Engineering
Text Books:

1. Muhammad H. Rashid, "Power Electronics Circuit, Devices and Applications", Prentice Hall 2nd Edition, 1993
2. Power Electronics Laboratory Workbook - Electrical Energy Conversion Laboratory

ENEE600202
ENGINEERING ECONOMY AND MANAGEMENT
3 SKS
Learning Objectives: This one semester course is intended to teach final year Electrical Engineering students to rationally select an engineering design with the most favorable economic results, also the possible management aspects encountered by an engineering professional.
Syllabus:
Book No.1) Engineering Economy
Introduction, Cost Concepts and Design Economics, Cost Estimation Techniques, Money-Time Relationships and Equivalence, Applications of Money-Time Relationships, Comparing Alternatives, Depreciation and Income Taxes, Price Changes and Exchange Rates, Replacement Analysis, Dealing with Uncertainty, Evaluating Projects with the Benefit-Cost Ratio Method, Probability Risk Analysis, Capital Financing and Allocation, Dealing with Multi attributed Decisions.
Book No.2) Engineering Management
Business Basics, Management of Quality, Materials Management, Managing Design and New Product Development, Human Resource Management, Maintenance Management, Project Management, Inventory Management, Management of the Supply System.
Prerequisites: None
Text Books:

1. William G. Sullivan, Elin M. Wicks, James T.Luxhoj, "Engineering Economy", 13th Edition, Pearson Education International, 2006.
2. Andrew C. Paine, John V. Chelsom, Lawrence R.P. Reavill, "Management for Engineers", John Wiley and Sons, 1996.

ENEE600203
ELECTRIC POWER SYSTEMS AND LABORATORY
3 SKS
Learning Objectives: This one semester course is intended to teach the basic essentials of power system operation and analysis for final year Electrical Engineering students. The emphasis is on the consideration of the system as a whole rather than on the engineering details of its constituents, and the treatment presented is aimed at practical conditions and situations rather than theoretical nicety. Laboratory practice: to provide Electrical Engineering students an introduction to basic Electrical Power Systems concepts. Understand power flow of three phase system, protection, power system dynamics and capable of fault current calculations.
Syllabus: Introduction, Basic Concepts, Components of a Power System, Control of Power and Frequency, Control of Voltage and Reactive Power, Load Flows, Fault Analysis, System Stability. Laboratory practice: Fundamental Components of a Power System, Basic Power System Simulator Operation, Systems Protection, Joints and Circuit Breakers, Relays Override, Test Points, Transducers and Instrumentations, Relays Remote

Access.
Prerequisites: Engineering Mathematics
Text Books:
1. B.M. Weedy, B.J. Cory, "Electric Power Systems", John Wiley and Sons, 4th Edition, Reprinted Nov. 2001
2. Electric Power Systems Laboratory Workbook - Power System Laboratory

ENEE600204
ENEE610204
ELECTRIC ENERGY CONVERSION
3 SKS
Learning Objectives: This one semester course is intended to teach Electrical Engineering students Electric Power Generation in various fossil or non fossil Power Plants.
Syllabus:
Book No.1): Introduction, Electric Power Generation Plant Installations, Operation problems at Electric Power Generation Plants, Generation at Interconnected Systems, Electric Power Generation Development, Electric Power Generation Management.
Book No.2): General, Electric Power Generation Plant types, Main Electric Power Equipment, Electric Power Generation Plants Operation, Protection.
Prerequisites: Electrical Power Engineering
Text Books:
1. Djiteng Marsudi, "Pembangkitan Energi Listrik", Penerbit Erlangga, 2005
2. Abdul Kadir, "Pembangkitan Tenaga Listrik", Penerbit UI, 1996

ENEE600205
HIGH VOLTAGE AND CURRENT ENGINEERING AND LABORATORY
3 SKS
Learning Objectives: This one semester course is intended to teach Electrical Engineering Students High Voltage (and Current) Technology which applications are intimately linked to electric power utilities and industrial practice. Laboratory practice: to provide Electrical Engineering students basic concept of high voltage and currents usually encountered in electrical power system.
Syllabus: Generating Techniques & Testing for Low Frequency of Alternating Voltage. Generating Techniques & Testing for Impulse of High Voltage. Generating Techniques & Testing for High Frequency of Alternating Voltage. Isolation Techniques of testing without damage. Testing of Electrical Equipment High Voltage. Coordinating Isolation. Isolation materials. Problems on High Voltage. Laboratory practice: Generating and testing of A.C. High Voltage, Generation and testing of D.C. High Voltages, testing of liquid isolators, testing of Voltage Wave Shapes in Air Breakdowns.
Generation of High Voltages, Measurements of High Voltages, Electrostatic Fields and Field Stress Control, Electrical Breakdown in Gases, Solids and Liquids, Non-Destructive Insulation Test Techniques, Over voltages and Insulation Coordination.
Prerequisites: Electromagnetic
Text Books:
1. Artono Arismunandar, "Teknik Tegangan Tinggi", Pradnya Paramita, Jakarta, Cetakan ke-7, 1994
2. E. Kuffel, W.S. Zaengl, "High Voltage Engineering Fundamentals", Pergamon Press, 1984
3. High Voltage and Current Engineering Laboratory Workbook – High Voltage and Electrical Measurement Laboratory.

ENEE600206
ENEE610206
ELECTRIC POWER TRANSMISSION AND DISTRIBUTION
3 SKS
Learning Objectives: This one semester course is intended to teach Electrical Engineering Students Electric Power Transmission and Distribution in a practical, down to earth manner. The Design of Electric Power Transmission and Distribution Equipments, are also given in this course, thereby preparing students at their work as an electrical power engineer.
Syllabus: Introduction, Basic Concepts, Three Phase and Per Unit, Basic Considerations and Distribution Systems Layout, Distribution Transformers, Distribution Equipment, Distribution Line Construction, Transmission Systems Overview, Transmission Line Parameters, Transmission Line Fault Current Calculation, Protection and Bulk Power Substations.
Prerequisites: High Voltage and Current Engineering
Text Books:
1. Luces M. Faulkenberry, Walter Coffer, "Electric Power Distribution and Transmission", Prentice Hall, 1996
2. Iwa Garniwa, "Perancangan Peralatan Distribusi (dan Transmisi) Tenaga Listrik", Penerbit-Laboratorium Tegangan Tinggi dan Pengukuran Listrik, Departemen Teknik Elektro, FTUI, 2008

ENEE600207
ELECTRIC POWER SYSTEM PROTECTION
3 SKS
Learning Objectives: This one semester course is intended to teach Electrical Engineering Students the importance of Electrical Faults Protection in Power Generating, Transmission and Distribution Systems. In this course the use of static relays, static protection schemes and new developed switch gears will also be emphasized.
Syllabus: Transmission Network Protection, Power

Transformer Protection, Generator Protection, Induction Motor Protection, Substation Protection, Distribution Network Protection, Load Shedding, New Trends in Power System Protection.
Prerequisites: Electric Power Systems, High Voltage and Current Engineering
Text Books:
Protective Relays Application Guide, G.E.C.Alsthom, U.K., 1987

ENEE600208
ELECTRICAL POWER SYSTEM QUALITY
3 SKS
Learning Objectives: This one semester course is intended to teach Electrical Engineering students how to analyze operation of Electric Power by observe the requirement to maintenance stability and quality of electrical power system.
Syllabus: Transients, Overvoltage, Undervoltage, Interruptions, Sags, Swells, Voltage Imbalance, Voltage Fluctuations, Waveform Distortion, Power Frequency Variations, Harmonic distortion, Voltage vs Current Distortion, Harmonics vs Transients, Controlling Harmonics, Filter Design, Power Quality Benchmarking, Distributed Generation and Power Quality, Wiring and Grounding, Power Quality Monitoring.
Prerequisites: Electromagnetics, Electric Power Engineering.
Text Books:
Roger C. Dugan, Mark F.Mc. Granaghan, Surya Santoso, H. Wayne Beaty, Electrical Power System Quality, 2nd ed., Mc. Graw Hill, 2002.

ENEE600209
ELECTRIC POWER UTILIZATION
3 SKS
Learning Objectives: This one semester course is intended to teach Electrical Engineering students Electric Power Utilization in buildings, industries and other facilities, like traction.
Syllabus: Industrial Drives. Traction. Illumination. Industrial Heating & Miscellaneous utilities. Single phase and Special purposes motors. Refrigerator and Air conditioning. Electronic Control of Commutator and Non Commutator Type Machines. Control Applications of Electric Motors the non classic motors. The electric automobile. Electrical Equipment and Systems. Electrical Design & Wiring Considerations.
Prerequisites: Electric Power Engineering
Text Books:
1. William K.Y.Tao, Richard R. Janis, “Mechanical and Electrical Systems in Buildings”, Prentice Hall Inc., 1997
2. R.K. Garg, “Electric Power Utilization”, Khanna Publishers, Delhi, 1991

ENEE600210
SPECIAL COURSE (ELECTRICAL POWER)
3 SKS
Learning Objectives: This course is intended to broaden the knowledge of student and introduce the development of power system technology nowadays and it’s application in daily life.
Syllabus: the topics are adjusted with up to date issue discussed in the world, and could be delivered by invited lecturer.
Prerequisites: None
Text Books: None

MAJOR ELECTRONICS ENGINEERING

ENEE600301
CMOS ANALOG DESIGN
3 SKS
Learning Objectives: This course gives general overview of CMOS technology and its design characteristics.
Syllabus: Intoduction to CMOS Design. The Well. The Metal Layers. The Active and Poly Layers. Resistors, Capacitors, MOSFETs. MOSFET Operation. CMOS Fabrication by Jeff Jessing. Electrical Noise : An Overview. Models for Analog Design. Current Mirrors. Amplifiers. Differential Amplifiers. Voltage References. Operational Amplifiers 1. Dynamic Analog Circuits. Operational Amplifiers II.
Prerequisites: Electronic Circuits
Text Books:
1. R. Jacob Baker, “CMOS : Circuit Design, Layout, and Simulation”, John Wiley & Sons, Inc. 2nd Edition. 2005
2. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, and Robert J. Meyer, “Analysis and Design of Analog Integrated Circuits”, McGraw Hill, 2001

ENEE600302
PROCESSING TECHNOLOGY AND LABORATORY
3 SKS
Learning Objectives: This course introduces the theory and technology of micro/nano fabrication. Lectures and laboratory sessions focus on basic processing techniques such as diffusion, oxidation, photolithography, chemical vapor deposition, and more. Through team lab assignments, students gain an understanding of these processing techniques, and how they are applied in concert to device fabrication. Laboratory practice: to give the expertise and hands on experience, on device fabrication mainly on silicon bases.
Syllabus: Overview/Safety/Lab Assignment. IC Lab-Overview. Diffusion. Implantation. Vacuum System. CVD. Sputtering. Evaporation. Lithography. Soft Lithography. Etching. Laboratory practice: The software consists of auto-cad, BCID, and Supreme. Step of fabrication: cleaning wafer, oxidation, etching, deposition, and metallization.
Prerequisites: Electronic Devices

Text Books:

1. Peter Van Zant, "Microchip Fabrication", 5th Edition, International Edition, McGraw-Hill, 2000
2. Plummer, James, Michael Deal, and Peter Griffin, "Silicon VLSI Technology: Fundamentals, Practice, and Modeling", Upper Saddle River, NJ: Prentice Hall, 2000, ISBN: 9780130850379
3. Processing Technology Workbook Laboratory – Electronics Laboratory

ENEE600303
ENEE610303
PHOTONIC DEVICES AND OPTIONAL LABORATORY
3 SKS

Learning Objectives: This course explores the fundamentals of optical and optoelectronic phenomena and devices based on classical and quantum properties of radiation and matter culminating in lasers and applications. Fundamentals include: Maxwell's electromagnetic waves, resonators and beams, classical ray optics and optical systems, quantum theory of light, matter and its interaction, classical and quantum noise, lasers and laser dynamics, continuous wave and short pulse generation, light modulation; examples from integrated optics and semiconductor optoelectronics and nonlinear optics. Optional laboratory practice: to provide experience and knowledge to students within fiber optics metro technology duplex and improvement of SDFA as well as damping of noise

Syllabus: Introduction. Maxwell's Equations of Isotropic Media (Review). Electromagnetic Waves and Interfaces I (Review). Electromagnetic Waves and Interfaces. Mirrors, Interferometers and Thin-Film Structures. Gaussian Beams and Paraxial Wave Equation. Ray Optics and Optical Systems. Optical Resonators. Integrated Optics: Waveguides. Integrated Optics: Coupled Mode Theory. Optical Fibers. Anisotropic Media: Crystal Optics and Polarization. Quantum Nature of Light and Matter. Coherent States. Rate Equations, Dispersion, Absorption and Gain. Optical Amplifiers and Lasers. Homogenous and In-homogenous Broadening and Related Effects. Optional laboratory practice: experiment in fiber optic metro duplex communication and EDFA experiment as well as noise damping.

Prerequisites: Electronic Devices

Text Books:

1. B.E.A. Saleh and M.C. Teich, "Fundamentals of Photonics", New York, NY: John Wiley and Sons, 1991. ISBN: 0471839655.
2. D. Griffiths, "Introduction to Quantum Mechanics", 2nd Edition, Upper Saddle River, NJ: Prentice Hall, 1995, ISBN: 0131118927.
3. Optional Laboratory Workbook - Electronics Laboratory

ENEE600304
VLSI
3 SKS

Learning Objectives: To give students the basic of design integrated circuit based on CMOS technology and to develop a function/computation.

Syllabus: Introduction to VLSI, Scaling, Transistor Fabrication, Design Rules/Layout/Extraction, Logic, Micro Polygon Rendering, Properties of Logic: Area-Power-Delay, Timing Optimization, Sequential Machines, Validation, Coding for Synthesis, Regular VLSI structures, High-level Design Optimization, Asynchrony, Packaging / IO, Design for Manufacturing / Fault Modeling / Test, Scaling and the Future.

Prerequisites: Introduction to Digital System, Electronic Circuits

Text Books:

N. Weiste & Kamran Eshraghian, "Principles of CMOS VLSI Design: A perspective", 2nd Edition, Addison Wesley 2002

ENEE600305
ENEE610305
FUNDAMENTAL OF NANOELECTRONICS
3 SKS

Learning Objectives: The goal of this course is to give an update of the current state of the art in the field of nanoelectronics. This course is a compact reference source for students in various fields including electronic devices, solidstate physics and nanotechnology.

Syllabus: Small MOSFETs. Practical CMOS Scaling. The Scaling Limit of MOSFETs due to Direct Source-Drain Tunneling. 3.2 EJ-MOSFETs. Quantum Effects in Silicon Nanodevices. Ballistic Transport in Silicon Nanostructures. Resonant Tunneling in Si Nanodevices. Silicon Single-Electron Transistor and Memory. Silicon Memories Using Quantum and Single-Electron Effects. Few Electron Devices and Memory Circuits. Single-Electron Logic Devices

Prerequisites: Electronic Devices

Text Books:

Shunri Oda and David Ferry, "Silicon Nanoelectronics", Taylor & Francis Group, LLC, 2006

Massimiliono Di Ventra, Stephane Evoy and James R. Heflin Jr, "Introduction to Nanoscale Science and Technology"

ENEE600306
SOLAR CELL
3 SKS

Learning Objectives: This course gives student general overview of solar cell technology and it fabrication.

Syllabus: Introduction to Photovoltaic. Properties of Sunlight. Semiconductors and P-N Junctions. Efficiency Limits, Losses, and Measurement. Solar cell Operation. Design of Silicon Solar Cells.

Manufacturing Silicon Solar Cells. Other Device Structures. Other Semiconductor Materials.
Prerequisites: Electronic Circuits
Text Books:
Marten A. Green, “Solar Cells Operating Principles, Technology and System Applications”, UNSW, 1998.

ENEE600307
ENEE610307
MEMS AND MICROSENSORS
3 SKS
Learning Objectives: This course gives student general overview development of technology in microelectronics including MEMS, broaden the knowledge to understand fabrication process of MEMS dan Microsensor, beside provide information to understand the principal of microsensor and smart device working process.
Syllabus: introduction and development of MEMS, electronics devices and its fabrication, MEMS device and its fabrication, standard microelectronics technology, bulk silicon micromachining, surface silicon micromachining, microstereolithografi MEMS, micro sensor, SAW devices, SAW on solid state, parameter measurement of IDT micro sensor, IDT micro sensor fabrication, IDT Micro sensor, smart sensor and MEMS.
Prerequisites: Electronic Circuits
Text Books:
1. Nadim Maluf & Kirt William, “An Introduction to Microelectromechanical Systems Engineering, Second Edition, Artech House Inc, 685 Canton Street Norwrod, MA02062, USA, 2004
2. Mohamed Gad El Hak, MEMS Handbook, CRC Press LLC, 222 Rosewood Drive - Denvers, MA01423, USA, 2004

ENEE600308
OPTICAL ENGINEERING AND LABORATORY
3 SKS
Learning Objectives: This course gives student general overview and provide a foundation for analyzing and designing both optic and optoelectrotechnic measurement. Laboratory practice: An introduction to basic optical phenomena, laser and optical fiber properties.
Syllabus: General principle of optics, optics phenomenon, laser, fiber optics and laser application. Laboratory practice: Diffraction, interference, laser and fiber optics properties.
Prerequisites: None
Text Books:
1. Warren J Smith, “Modern Optical Engineering”, Mc. Graw-Hill
2. E. Heelers, “Optics”, Addison Wesley
3. Optical Engineering Laboratory Workbook - Electrotechnics Laboratory

ENEE600309
RFIC DESIGN
3 SKS
Learning Objectives: On completion of class, the student will be able to design a simple transceiver with standar fabrication technology of MOSFET.
Syllabus: Introduction to RF. Modulation and Detection. Multiple Access Techniques and Wireless Standards. Transceiver Architectures. Low-Noise Amplifiers and Mixers. Oscillators. Frequency Synthezisers. Power Amplifiers.
Prerequisites: Electronic Circuits, Algorithm and Programming, Telecommunication Engineering
Text Books:
1. Behzad Razawi. “RF Microelectronics”. New Jersey : Prentice Hall. 1998.

MAJOR CONTROL ENGINEERING

ENEE600401
ENEE610401
DIGITAL CONTROL SYSTEM
3 SKS
Learning Objectives: To introduce basic concept of digital control system and to analysis, simulate and design for digital control system.
Syllabus: Data Acquisition, A/D conversion, sample/hold, Z Transform, Solution of Difference Equations, Signal reconstruction, Discrete time transfer functions, Realization of discrete time control systems, Mapping between s plane and z plane, Testing for absolute stability in the z plane, Transient and steady state response, root locus in the z plane, Root locus based design, Frequency response methods, State space representation, Discrete time state equations, Canonical forms, Solution of the State Equations, Controllability, Observability, Transformations to observable and controllable canonical forms, Controller design by pole placement, Design of state observers.
Prerequisites: Control Systems
Text Books:
Ogata, K. “Discrete Time Control Systems”, Prentice Hall, 2002

ENEE600402
ENEE610402
PROCESS CONTROL SYSTEM
3 SKS
Learning Objectives: To give students knowing on the application of control system in chemical industries including their instrumentation & equipments used, tuning system and its problem including how to solve its problems in multivariable systems.
Syllabus: Introduction to chemical industrial process. Process characteristic and its problems. Method of process measurement, sensor

and transmitter, signal conditioning and its installation. Final control element and actuator. PID Controller, controllers parameter tuning method, disturbance problem in process, Forward Control System, Cascade control system. Multivariable system concept. State equation description and Transfer matrix. Method for decoupling of multivariable system.
Prerequisites: Control Systems
Text Books:
1. Curtis D. Johnson, "Process Control and Instrumentations", 5th Edition, Prentice Hall Inc. 1997
2. Carlos A.Smith and Armando B.Corripio, "Principles and Practice of Automatic Process Control", John Wiley & Sons, Inc. 1985

ENEE600403
ROBOTICS
3 SKS
Learning Objectives: Introducing the robotics and automation concept and the application of control system basic principles in an automation process and robotics using program simulation OpenGL based on C-programming language.
Syllabus: Introduction to automation and robotics, control system in robotics, robotics design technique, motor/actuator, sensor, robotics control system principles, position and speed control, active force control, robot low-level programming and OpenGL simulation. High-level robotics control, Kinematics, dynamic, Jacobian, 2-axle planar robot.
Prerequisites: Control System, Algorithm & Programming.
Text Books:
1. Endra Pitowarno, "Robotika: Desain, Kontrol, dan Kecerdasan Buatan", Penerbit Andi, 2006
2. John Craig, "Introduction to Robotics: Mechanics and Control", 2nd Edition, 1989

ENEE600404
ELECTRIC DRIVE CONTROL SYSTEM
3 SKS
Learning Objectives: Understand how to control an electric drive system, power transfer circuit (3 phase PWM Inverter), servo motor DC brushless, position and speed control, speed sensorless control, creating a software in electric drive system.
Syllabus: Electric drive system, power transfer circuit (3 phase PWM inverter), servo motor DC brushless, position and speed control, speed sensorless control, software in electric drive system.

Prerequisites: Control Systems
Text Books:
1. Peter Vas, "Electrical Machines and Drives: A Space-Vector Theory Approach", Oxford University Press UK, 1993
2. Peter Vas, "Sensorless Vector and Direct Torque Control", Oxford University Press, 1998

ENEE600405
ENEE610405
MODELING AND SYSTEM IDENTIFICATION
3 SKS
Learning Objectives: Students are able to derive dynamic models based on physical knowledge of the real system; stressed on the internal system energy balance and experiment data.
Syllabus: Physical modeling, dynamic system description, non-parametric model identification, identification test design and data pre-processing, prediction error identification method: least-square method, extended least-squares, generalized least-squares method, instrumental variable method; real-time identification, system simulation, model validation, non-linear model identification: Hammerstein and Wiener model, application in channel equalization, interference cancellation, object and voice recognition, self-tuned system.
Prerequisites: Control Systems
Text Books:
1. R. Johansson, "System Modeling and Identification", Prentice Hall, 1993
2. Yucai Zhu, "Multivariable System Identification for Process Control", Pergamon Press, 2001

ENEE600406
MECHATRONICS
3 SKS
Learning Objectives: Introducing the mechatronic concept and its application in advanced motion control on automation and robotics both using simulation and the real robots.
Syllabus: Introduction to mechatronics, mechatronics design, interface system, instrumentation and control system, control system in embedded system, electromechanical system modeling, sensor, actuator and their characteristics, design and development an application software. Compliant control, Telerobotics, Bilateral control.
Prerequisites: Control System, Algorithm & Programming.
Text Books:
Robert Bishop, "Mechatronics and Introduction", 2006

ENEE600407
KNOWLEDGE BASED SYSTEM
3 SKS
Learning Objectives: This course will discuss how to solve a problem using non-conventional method based on an exact mathematical values. The method discussed covers algorithms which

tolerant to “imprecision”, “uncertainty”, and “limited knowledge” about the system. The goal is to achieve a system which works effectively using the expert knowledge trained in the system.

Syllabus: Introduction to artificial intelligence system, concept and definition of fuzzy logic, fuzzy sets, fuzzy relations, fuzzy number operation, linguistic description, fuzzy inference and fuzzy algorithm. Fuzzy control system, basic concept of Artificial Neural Network (ANN), ANN training, back-propagation algorithm, other ANN algorithms, application ANN in fuzzy system, genetic algorithm, applications.

Prerequisites: Engineering Mathematics, Algorithm and Programming

Text Books:

1. Lefteri H.,Tsoukalas and Robert E. Uhrig, “Fuzzy and Neural Approaches in Engineering”, John Wiley & Sons, Inc., Singapore, 1997
2. John Yen and Reza Langari, “Fuzzy Logic, Intelligence, Control and Information”, Prentice Hall, Inc. New Jersey, 1999

ENEE600408
ADAPTIVE AND PREDICTIVE CONTROL SYSTEM
3 SKS

Learning Objectives: Students are able to understand basic concept of adaptive control system, design adaptive controller based on the combination of parameter estimation and controller synthesis, and understand the characteristics of non-linear system and analysis.

Syllabus: Discrete system model, recursive parameter estimation, pole-position method, minimum variance method, dynamic matrix control, algorithmic control model, generalization of prediction control, application of self-tuned controller, non-linear system characteristics, phase controller analysis, Lyapunov stability analysis.

Prerequisites: Control Systems

Text Books:

1. P.E. Wellstead and M.B. Zarrop, “Self-tuning Systems: Control and Signal Processing”, John Wiley and Sons, 1991
2. J.J.E. Slotine and W. Li, “Applied Non-linear Control”, Prentice Hall, 1991
3. A. Subiantoro, “Diktat Sistem Kendali Adaptif”, Departemen Teknik Elektro FTUI, 2003

ENEE600409
SPECIAL COURSE (CONTROL ENGINEERING)
3 SKS

Learning Objectives: to broaden the knowledge of student and introduce the development of control technology nowadays and its application in society and industry.

Syllabus: the topics are adjusted with up to date issue discussed in the world, and could be delivered by invited lecturer.

Prerequisites: None

Text Books: None

4.6. UNDERGRADUATE PROGRAM IN COMPUTER ENGINEERING

Program Specification

1.	**Awarding Institution**	Universitas Indonesia	
2.	**Teaching Institution**	Universitas Indonesia	
3.	**Programme Tittle**	Undergraduate Program in Computer Engineering	
4.	**Class**	Regular	
5.	**Final Award**	Sarjana Teknik (S.T)	
6.	**Accreditation / Recognition**	BAN-PT: B - accredited AUN-QA	
7.	**Language(s) of Instruction**	Bahasa Indonesia and English	
8.	**Study Scheme (Full Time / Part Time)**	Full Time	
9.	**Entry Requirements**	High school /equivalent AND pass the entrance exam.	
10.	**Study Duration**	Designed for 4 years	
	Type of Semester	Number of Semester	Number of weeks / semester
	Regular	8	17
	Short (optional)	3	8
11.	**Graduate Profiles:** Bachelor of Engineering who has the capability to design basic information networks and embedded systems with the support of information and communication technology and to conduct research in the corresponding fields in a systematic and practical way, based on technology advancement and comply to professional ethics.		
12.	Expected Learning Outcomes: • Able to implement managerial and marketing concept of IT projects • Able to implement professionalism and ethics concept in engineering field • Able to apply knowledge through a guided research • Able to design simple information communication infrastructures • Able to design embedded systems • Able to analyze a digital information processing • Able to implement digital system • Able to implement algorithm to solve computer engineering problem • Able to describe hardware and software functions and components of an information network • Able to describe hardware and software functions and components of a computer system • Able to implement mathematic, physic, and statistic basic principal in electrical engineering problem solving • Able to give alternative problem solutions to any problem that arise in environment, society, nation, and state • Able to use spoken and written language in Indonesian and English language well to support academic and non academic activities • Able to identify variety entrepreneurial effort characterized by innovation and independence based on ethics • Able to utilize communication information technology • Able to think critical, creative, and innovative and has intellectual curiosity to solve problems at level of individual and group		

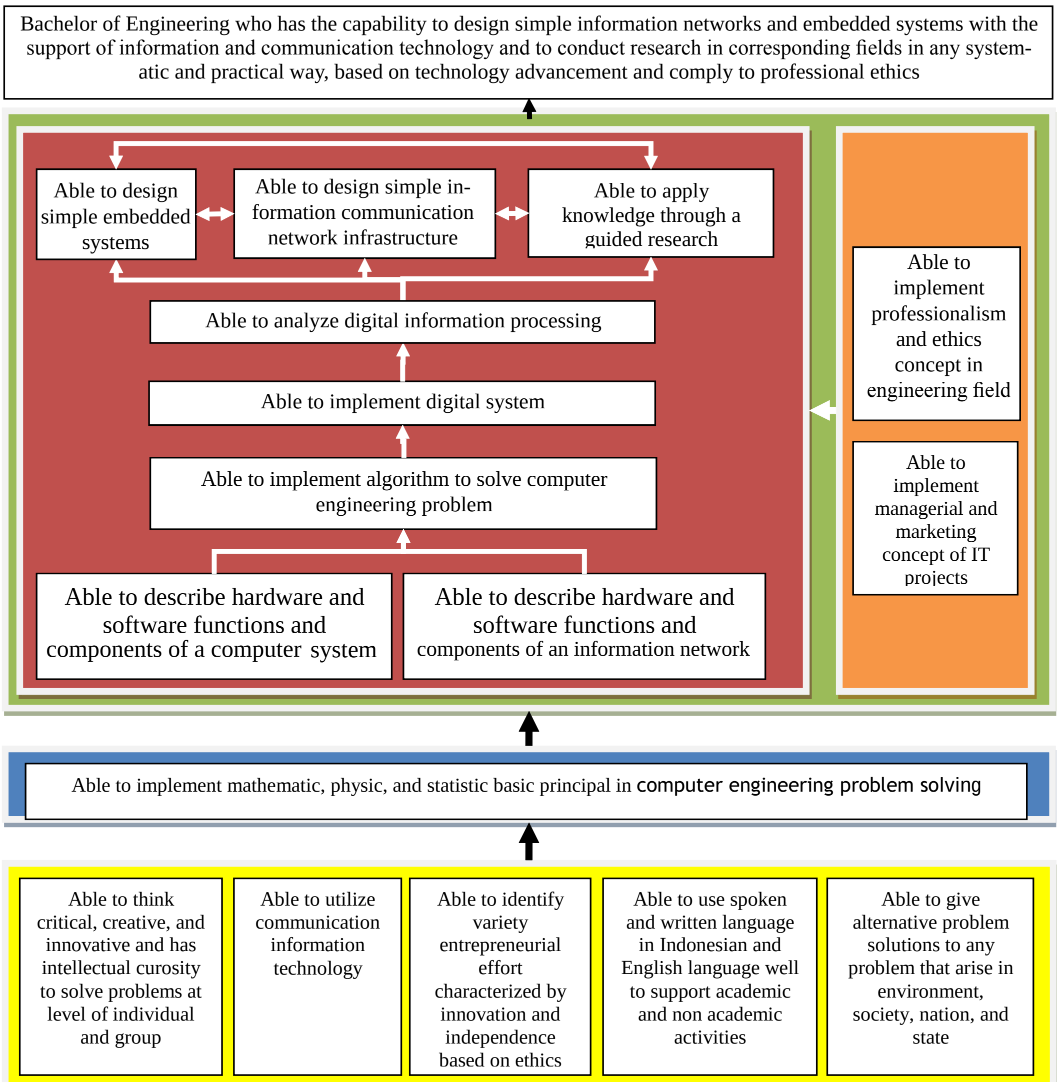
13	Classification of Subjects		
No.	Classification	Credit Hours (SKS)	Percentage
i	University General Subjects	18	12,50 %
ii	Basic Engineering Subjects	19	13,19 %
iii	Electrical Engineering Subjects	21	14,58 %
iii	Core Subjects	63	43,75 %
iv	Elective Subjects	15	10,42 %
v	Internship, Seminar, Undergraduate Thesis, Project	8	5,56 %
	Total	144	100 %
14.	Total Credit Hours to Graduate		144 SKS

Career Prospects

The program graduates are needed in almost all fields of work, e.g. industry, services, banking and all fields requiring the application IT (Information technology).

Some professional profiles that are suited to this program's graduate are IT Manager, Project Manager, Program Manager, Programmer, System Analyst, Software Developer, Data Analyst, Product Specialist, Software Engineer, Computer Hardware Engineer, System Administrator, IT Support, etc.

Learning Outcomes Flow Diagram



UI Competence

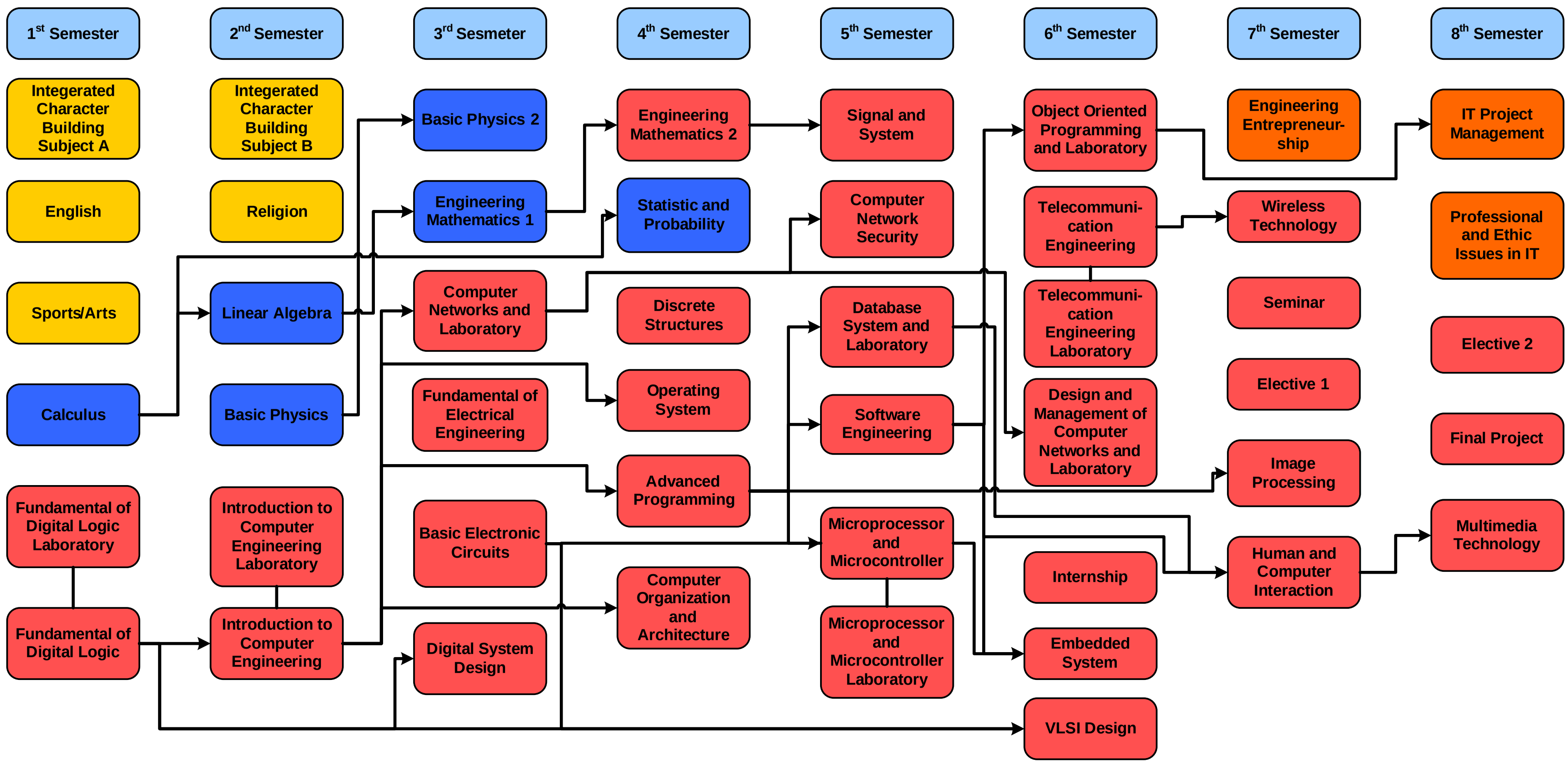
FT Competence

CE UI Competence

CE UI Core Competence

CE UI Supporting Competence

Flow Diagram of Subjects



Course Structure of Undergraduate Program in Computer Engineering

KODE	MATA KULIAH	SUBJECT	SKS
	Semester 1	**1st Semester**	
UIGE600004	MPKT-B	Integrated Character Building Subject B	6
UIGE600002	Bahasa Inggris	English	3
UIGE600003	Olahraga / Seni	Sports/Arts	1
UIGE600004	Kalkulus	Calculus	4
ENCE600001	Teknik Dijital	Fundamentals of Digital Logic	3
ENCE600002	Praktikum Teknik Dijital	Fundamentals of Digital Logic Laboratory	1
		Sub Total	**18**
	Semester 2	**2nd Semester**	
UIGE600001	MPKT-A	Integrated Character Building Subject A	6
UIGE600006-9	Agama	Religious Studies	2
ENGE600001	Aljabar Linier	Linear Algebra	4
ENGE600002	Fisika Dasar 1	Basic Physics 1	4
ENCE600003	Pengantar Teknik Komputer	Introduction to Computer Engineering	2
ENCE600004	Praktikum Pengantar Teknik Komputer	Introduction to Computer Engineering Laboratory	1
		Sub Total	**19**
	Semester 3	**3rd Semester**	
ENGE600003	Fisika Dasar 2	Basic Physics 2	4
ENCE600005	Jaringan Komputer dan Praktikum	Computer Networks and Laboratory	4
ENCE600006	Dasar Rangkaian Elektronika	Basic Electronic Circuits	2
ENCE600007	Perancangan Sistem Dijital	Digital System Design	2
ENEE600003	Dasar Teknik Elektro	Fundamental of Electrical Engineering	3
ENEE600006	Matematika Teknik 1	Engineering Mathematics 1	3
		Sub Total	**18**
	Semester 4	**4th Semester**	
ENGE600004	Statistik dan Probabilitas	Statistics and Probability	2
ENCE600008	Organisasi dan Arsitektur Komputer	Computer Organization and Architecture	3
ENCE600009	Sistem Operasi	Operating System	3
ENEE600011	Matematika Teknik 2	Engineering Mathematics 2	3
ENCE600010	Pemrograman Lanjut	Advanced Programming	3
ENCE600011	Struktur Diskrit	Discrete Structures	2
		Sub Total	**16**
	Semester 5	**5th Semester**	
ENEE600021	Mikroprosesor dan Mikrokontroler	Microprocessor and Microcontroller	4
ENEE600022	Praktikum Mikroprosesor dan Mikrokontroler	Microprocessor and Microcontroller Laboratory	1
ENCE600012	Sistem Basis Data dan Praktikum	Database System and Laboratory	3
ENCE600013	Rekayasa Perangkat Lunak	Software Engineering	3
ENEE600015	Sinyal dan Sistem	Signal and Systems	3
ENCE600014	Keamanan Jaringan Komputer dan Praktikum	Computer Network Security and Laboratory	3
		Sub Total	**17**

	Semester 6	6th Semester	
ENCE600015	Pemrograman Berorientasi Objek dan Praktikum	Object Oriented Programming and Laboratory	3
ENCE600016	Perancangan VLSI	VLSI Design	2
ENEE600024	Teknik Telekomunikasi	Telecommunication Engineering	3
ENEE600025	Praktikum Teknik Telekomunikasi	Telecommunication Engineering Laboratory	1
ENCE600017	Desain dan Manajemen Jaringan Komputer dan Praktikum	Design and Management of Computer Networks and Laboratory	4
ENCE600018	Sistem Embedded	Embedded System	3
ENCE600019	Kerja Praktek	Internship	2
		Sub Total	**18**
	Semester 7	**7th Semester**	
ENCE600020	Interaksi Manusia dan Komputer	Human and Computer Interaction	2
ENCE600021	Pengolahan Citra	Image Processing	3
ENCE600022	Teknologi Nirkabel	Wireless Technology	3
ENCE601023	Rekayasa dan Kewirausahaan	Engineering Entrepreneurship	2
	Pilihan 1	Elective 1	6
ENCE600024	Seminar	Seminar	2
		Sub Total	**18**
	Semester 8	**8th Semester**	
ENCE600025	Manajemen Proyek Teknologi Informasi	IT Project Management	3
ENCE601026	Profesionalisme dan Etika dalam Teknologi Informasi	Professional and Ethic Issues in IT	2
ENCE600027	Teknologi Multimedia	Multimedia Technology	2
	Pilihan 2	Elective 2	9
ENCE600028	Skripsi	Final Project	4
		Sub Total	**20**
		Total	**144**

MATA KULIAH PILIHAN/ELECTIVES

KODE	MATA KULIAH	SUBJECT	SKS
Semester Gasal/Odd Semester			
ENCE600029	Topik Khusus Teknik Komputer 1	Special Topic in Computer Engineering 1	3
Semester Genap/Even Semester			
ENCE600030	Topik Khusus Teknik Komputer 2	Special Topic in Computer Engineering 2	3

Fast Track Program

This program integrates the S1 and S2 for 5 years. In the 4th year of their study (7th and 8th semester), students are able to choose the fast track subjects in S2 semester 1 and 2 as the electives. While in 5th year, students can concentrate on completing S2 subjects and ends with the thesis. In Universitas Indonesia, especially in the Department of Electrical Engineering, for the academic year 2014/2015, this program has been in its 4th year of implementation.

To complete both S1 and S2 program in Fast Track Program, students should attain 170 SKS in 5 years, instead of 144 SKS for S1 and 41 SKS for S2 in regular program.

Fast-Track (S1 and S2) Computer Engineering Program Curriculum

Kurikulum S1			Kurikulum S2	
No	Semester	Mata Kuliah (SKS)	Mata Kuliah (SKS)	Semester
1.	7	Pilihan (6)	Rekayasa Perangkat Lunak Berorientasi Objek (3)	1
			Arsitektur Komputer Lanjut (3)	
		Seminar (2)		
		Rekayasa dan Kewirausahaan (2)		
		Interaksi Manusia dan Komputer (3)		
		Pengolahan Citra (3)		
		Teknologi Nirkabel (3)		
	Total SKS (19)		Total SKS (6)	
	Subtotal SKS for Fast Track Program 19 SKS (6 SKS taken from S2)			
2.	8	Pilihan (9)	Komputasi Multimedia (3)	2
			Sistem Embedded Lanjut (3)	
			Pemodelan dan Simulasi Lanjut (3)	
		Skripsi (4)		
		Manajemen Proyek Teknologi Informasi (3)		
		Profesionalisme dan Etika dalam Teknologi Informasi (2)		
		Teknologi Multimedia (2)		
	Total SKS (19)		Total SKS (9)	
	Subtotal SKS for Fast Track Program 19 SKS (9 SKS taken from S2)			
3.			Matematika Terapan (3)	3
			Jaringan Informasi Lanjut (3)	
			Keamanan dan Kehandalan Pada Jaringan (3)	
			Pilihan (3)	
			Seminar (3)	
			Total SKS (15)	
	Subtotal SKS for Fast Track Program 15 SKS			
4.			Simulasi Jaringan Berbasis Komputer (3)	4
			Tesis (8)	
			Total SKS (11)	
	Subtotal SKS for Fast Track Program 11 SKS			
Total SKS for Fast Track Program 144 SKS + 26 SKS = 170 SKS				

Description of Subjects

UIGE600001
UIGE610001
MPKT A / INTEGRATED CHARACTER BUILDING A
6 SKS
Refer to Page 74

UIGE600004
UIGE610004
MPKT B / INTEGRATED CHARACTER BUILDING B
6 SKS
Refer to Page 74

UIGE600002
ENGLISH
UIGE610002
ACADEMIC WRITING
3 SKS
Refer to Page 74

UIGE600003
UIGE610003
SPORTS / ARTS
1 SKS
Refer to Page 77

ENGE600001
ENGE610001
CALCULUS
4 SKS
Refer to Page 74

ENGE600010
ENGE610010
BASIC CHEMISTRY
Refer to Page 75

ENGE600003
ENGE610003
BASIC PHYSICS 1
4 SKS
Refer to Page 75

ENGE600004
BASIC PHYSICS 2
4 SKS
Refer to Page 77

ENGE600002
ENGE610002
LINEAR ALGEBRA
4 SKS
Refer to Page 75

UIGE600005-9
UIGE610005-9
RELIGIOUS STUDIES
2 SKS
Refer to Page 76-77

ENGE600005
ENGE610005
STATISTICS AND PROBABILITY
2 SKS
Refer to Page 78

ENGE600008
ENGE610008
HEALTH, WORK SAFETY, AND ENVIROMENT
2 SKS
Refer to Page 78

ENCE600001
FUNDAMENTALS OF DIGITAL LOGIC
3 SKS
Learning Objectives: In this course, students will learn all phases of design and implementation of simple digital systems. At the completion of their subject, students expected to analyze and design a circuit system using digital components. Students will learn how to implement the design by using a PLD (Programmable Logic Devices). This course also involves some practical activities in the laboratory to perform the design, implementation and verification of digital logical system. Some software like Xilinx and simulation software for digital circuits will be used.
Syllabus: Binary number, Introduction to the gates AND, OR and NOT, etc; Combinational Logic circuit with Multiplexers and Decoders: Full Adder circuit, binary memory unit: SR latch, D and JK flip-flops: Sequential Circuit, Ripple Counter, and Counter Register: Universal shift registers, ring counter and the BCD counters, VHDL, design, simulation and implementation of complete digital systems using programmable logic devices (programmable logic devices).
Prerequisites: None
Text Books:
1. M. Mano and C. R. Kime, “Logic and Computer Design Fundamentals”, 4nd Ed. (International Ed.), Prentice-Hall, 2008
2. M. Mano , “Digital Design”, 4nd Ed. (International Ed.), Prentice-Hall, 2007

ENCE600002
FUNDAMENTALS OF DIGITAL LOGIC LABORATORY
1 SKS
Learning Objectives: At the completion of the subject, students are expected to be able to design a finite state machine and able to implement a simple digital circuit design.
Syllabus: 1: Boolean Algebra and Logic Gates Elementary, 2: Decoder, Encoder, Multiplexer, and Demultiplexer, 3: Digital Arithmetic (Half Adder, Full Adder and Comparator), 4: Flip-Flop and Counter, 5: Register and Operation Serial / Parallel.
Prerequisites: None
Text Books:
1. Digital Laboratory, “Fundamental of Digital Logic Laboratory Modules”
2. M. Mano and C. R. Kime, “Logic and Computer Design Fundamentals”, 4nd Ed. (International Ed.), Prentice-Hall, 2008
3. M. Mano , “Digital Design”, 4nd Ed.

(International Ed.), Prentice-Hall, 2007
4. R. Dueck, "Digital Design with CPLD Applications and VHDL", Delmar/Thomson Learning

ENCE600003
ENCE610003
INTRODUCTION TO COMPUTER ENGINEERING
2 SKS
Learning Objectives: At the completion of the subject, students are able to explain computer hardware and software, as well as designing a simple algorithm in pseudocode and able to implement it into a program using a particular programming language.
Syllabus: Introduction to computer, Introduction to computer hardware, Introduction to computer software, Algorithm, Pseudocode, Introduction to C, Program control in C, Structured program development in C.
Prerequisites: None
Text Books:
1. A. Evans, K. Martin, and M. A. Poatsy, "Technology in Action (TiA)," 2nd Edition, Prentice-Hall, 2006.
2. G. B. Shelly and M. E. Vermaat, "Discovering Computers 2011: Living in a Digital World," Course Technology, Cengage Learning, 2011.
3. Deitel & Deitel, "C How to Program," 5th Edition, Pearson Education, 2007.

ENCE600004
ENCE610004
INTRODUCTION TO COMPUTER ENGINEERING LABORATORY
1 SKS
Learning Objectives: In this course, students are expected to be able to explain the functionality and operate multiple operating systems and popular applications in computer laboratory.
Syllabus: Popular basic operating systems (Microsoft Windows, Unix/Linux), Software application.
Prerequisites: Fundamental of Digital Logics
Text Books:
1. Digital Laboratory, "Introduction To Computer Engineering Laboratory Modules"
2. A. Evans, K. Martin, and M. A. Poatsy, "Technology in Action (TiA) Introductory," 7th Edition, Prentice-Hall, 2011.
3. G. B. Shelly and M. E. Vermaat, "Discovering Computers 2011: Living in a Digital World," Course Technology, Cengage Learning, 2011.
4. Deitel & Deitel, "C How to Program," 5th Edition, Pearson Education, 2007.

ENCE600005
COMPUTER NETWORKS AND LABORATORY
4 SKS
Learning Objectives: In this course students learn topics on computer networks which are discussed in a comprehensive manner from layer 1 to layer 7. After completing this course, students are able to outline the benefits of computer networks, explain 7 OSI layer, identifying the difference between OSI and TCP/IP, explaining the function of each layer of the OSI and TCP/IP, design a simple network with subnets, describe Ethernet technology, outlines wiring on a network, describes the existing protocols in TCP/IP including routing algorithms, network design with the addressing scheme and VLSM /CIDR, and be able to outline the role of QoS in Internet networks.
Syllabus: Computer Network Model (OSI & TCP / IP): application layer, presentation, session, transport, data link, physical, IP addressing and subnetting scheme, the Ethernet Technology, Standard cabling and media networking, TCP / IP protocols and basic routing.
Prerequisites: Introduction to Computer Engineering
Text Books:
1. "CISCO Networking Academy Program: Network Fundamentals, CCNA-Exploration ver 4, http://cisco.netacad.net
2. A. Tanenbaum, "Computer Networks", Prentice Hall, Fourth Eds, 2003

ENCE600006
BASIC ELECTRONIC CIRCUITS
2 SKS
Learning Objectives: In this course, students learn the components and the basic circuitry of electronics. After completing this course, students are expected to able to explain the function of diode and transistor in an electronic circuit, explaining the working principle of FET, JFET, MOSFET, VMOS, CMOS, and MESFET. Students are also expected to be able to explain the uniqueness and the application of the Zenner diodes and LEDs, capable of analyzing the design of the diode applications in an electronic device and circuit current and voltage amplifier.
Syllabus: Introduction to electronic circuit with diodes and transistors, The basic principle of FET, JFET, MOSFET, MESFET, VMOS, and CMOS, Zenner diodes and LED, Application of diode circuits, Voltage and current amplifier circuitry.
Prerequisites: None
Text Books:
R. Boylestad, L.Nashhelsky, "Electronic Devices and Circuit Theory", 9th Edition, Prentice Hall, 2006

ENCE600007
DIGITAL SYSTEM DESIGN
2 SKS
Learning Objectives: In this course student learns how to digital circuit design based on timing and state diagram using simulator software. After completing this course students are expected to be able describe the fungction of timing and state diagram, be able to make system documentation, illustrate timing and state diagram and analyze timing and state diagram from simple system.
Syllabus:

Device programming by using several methods, programming based on timing and state diagram, programming using VHDL, Emulator use to analyze the program.

Text Books:
1. J.F. Wakerly, "Digital Design, Principles & Practices", Prentice Hall, 1997
2. M.D. Ciletti, "Advanced Digital Design with the Verilog HDL", Prentice Hall of India, 2005.

ENEE600003
FUNDAMENTAL OF ELECTRICAL ENGINEERING
2 SKS
Refer to Page 176

ENEE600006
ENGINEERING MATHEMATICS 1
3 SKS
Refer to Page 176

ENCE600008
COMPUTER ORGANIZATION AND ARCHITECTURE
3 SKS
Learning Objectives : After completing this course, the students are expected to be able to **analyze** the computer architecture, in particular the instruction-set design (e.g. addressing methods and modes), correlation between clock-speed and CPU performance and the effect of busing structures to computing speed. The students are also expected to be able to **differentiate** the meaning of computer organization and and computer architecture. In addition, the students are also expected to be able to **elaborate** the role of cache memory in improving the memory access time, including it's organization and updating methods. The student is required to be able to **elaborate** semiconductor memories organization. The students are else expected to be able to **develop** small program using basic instruction set of a hypothetical processor (assembly level), and also be able to **elaborate** the influence of programming technique to computing speed. Finally, the students are expected to be able to **elaborate** advanced technique of processor design to improve computing performance such as pipelining, parallel processor and multicore processor.
Syllabus : Clock and it's influence to performance, the difference between computer organization and computer architecture, top level overview of a computer system, interactions between subsystems, cache organizations and update mechanism and it's influence to performance; semiconductor memories, DRAM and SDRAM, 2D organization of DRAM; instruction set of processors, programming techniques and it's influence to performance, pipelining processors, data, address and branch conflicts, instruction re-ordering to improve computing, load distribution and balancing and it's influence to processing performance, introduction to multicore processors.
Prerequisites: Introduction to Computer Engineering

Textbooks:
W. Stallings, "Computer Organization and Architecture", 8th edition, Pearson International, 2010
or newer edition of the book.

ENCE600009
OPERATING SYSTEMS
3 SKS
Learning Objectives: In this course students learns basic principles of earlier and the latest Operating System. After completing this course students are expected to describe basic principles of Operating System in managing process and thread on computer system, Memory Management, and input/output device management.
Syllabus: The Function of Operating System, Operating system main component, interrupt, design principle of operating system, introduction of process and thread togheter with the security, Application Programming Interface, Concurency and Mutex: deadlock, semaphores, monitors, condition variable, Producer – Consumer program and synchronization, Multiprocessor problem, Preemptive and non-preemptive schedulling, Memory Management, Virtual Memory : Placement and Replacement policy, thrashing, caching.
Prerequisites : Introduction to Computer Engineering
Text Books:
1. A. Silberschatz, "Operating Systems Concepts", John Wiley & Sons, 8th ed. 2009
2. W. Stallings, "Operating Systems: Internal Design Principles", Prentice Hall International, Fourth Edition 2004
3. Tanenbaum, "Operating Systems: Design and Implementation", Prentice Hall, Third Edition, 2006

ENEE600011
ENGINEERING MATHEMATICS 2
3 SKS
Refer to Page 177

ENCE600010
ADVANCE PROGRAMMING
3 SKS
Learning Objectives: In this course students learns high level language programming. After completing this course students are expected to describe the function of programming language, describe the data type on programming language, making simple modular programming and algorithm implementation on programming language.
Syllabus : The function, data structure introduction, modular programming, array, searching and sorting, stack and queue, link list and recursive
Prerequisites : Introduction of Computer Engineering
Text Books :
1. Deitel & Deitel, "C How to Program", 5th Edition, Pearson International Edition, 2007
2. R. Kruse, C.L. Tondo & B. Leung, "Data Structure & Program Design in C", 2nd Edi-

tion, Prentice Hal, 2007

ENCE600011
DISCRETE STRUCTURES
2 SKS
Learning Objectives: In this course, students will learn about basic principles of discrete mathematic and its application in computer engineering. At the completion of the subject, students will be able to describe the basic principles of discrete mathematics and to be able to use them to inspect and study modern computation techniques and to build foundation to analyze problem in computer engineering and develop solutions.
Syllabus: Basic mathematical notation for set, relation, and function. Logical operation, logical proposition, truth table, equivalence and limits. Predicate logic, relevance with the contexts in computer engineering and proof techniques. Inference, Mathematical Induction, recursion, program correctness. Algorithm analysis: Big-O, Big-Theta. Mathematical concepts of graphs and trees. Combinatorics and discrete probability.
Prerequisites: None
Text Books:
1. K. H. Rosen, "Discrete Mathematics and Its Applications", McGraw-Hill Science/Engineering/Math; 6th Edition (July 26, 2006), ISBN-10: 0073229725, ISBN-13: 978-0073229720
2. R. Johnsonbaugh, "Discrete Mathematics", 7th Edition, Pearson Intl. Edition, Prentice-Hall, NJ, 2009

ENEE600021
MICROPROCESSOR AND MICROCONTROLLER
4 SKS
Refer to Page 179

ENEE600022
MICROPROCESSOR AND MICROCONTROLLER LABORATORY
1 SKS
Learning Objectives: : In this course, students learn microprocessor and microcontroller technology in a practical way. After completing this course, students are expected to be able to program the 16 bit and 32 bit Intel Microprocessor and 8051 Microcontrollers and able to design simple Microcontroller 8051 based embedded systems.
Syllabus: Assembly Programming for 8086/8088 Intel Microprocessor, Assembly Programming and Interfacing Microcontroller to LED, Switch, LCD, Keypad, Assembly Programming and Interfacing Microcontroller Stepper Motor. UTS Project: Development of Assembly Language Program for Microprocessors 8086/8088. UAS Project: Development of Microcontroller Based Embedded Systems 8051
Prerequisites: Introduction to Computer Engineering, Basic Electronic Circuits
Text Books:
1. Digital Laboratory, "Microprocessor and Microcontroller Laboratory Modules"
2. B.B. Brey, "The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium IV Architecture, Programming, and Interfacing," 7th Edition, PHI Inc, USA, 2006.
3. M.A. Mazidi, "The 8051 Microcontroller and Embedded Systems," Second Edition, Prentice Hall, 2006.

ENCE600012
DATABASE SYSTEMS AND LABORATORY
3 SKS
Learning Objectives: In this course, students will learn about database systems concepts and application. At the completion of the subject, students are expected to be able to describe database systems concepts, able to design and implement them in application.
Syllabus: Relational database modeling: algebra, calculus, entity relation diagram and table normalization techniques. Design of logical database and physical database. Concept implementation with DBMS application and SQL introduction. Referential integrity, data transaction, object locking, and synchronization. Administration and security on database. Database implementation. Working in groups to implement a web based database application project.
Prerequisites: Object Oriented Programming
Text Books:
1. A. Silberschatz et al., "Database System Concepts", 5th Edition, McGraw-Hill, 2005
2. Hoffer, Prescott & McFadden, "Modern Database Management", 7th Edition, Prentice-Hall, 2005

ENCE600013
SOFTWARE ENGINEERING
3 SKS
Learning Objectives: In this course, students will learn about object oriented software design and software life cycle. At the completion of the subject, students are expected to be able to design a software using UML diagram and implement the software life cycle in creating an embedded system.
Syllabus: Software design for object oriented analysis principle, Software architecture paradigm, Mastering Unified Modeling Language, Software process model including waterfall approach, prototyping, incremental, evolutionary development and other various alternative models. Software Project management: scheduling, cost estimation, configuration management, metric usage. Software Requirements Engineering: analysis, definition and specification, design for reusability, adaptability and maintainability. Implementation: working onwards from design to coding, verification methods, testing plan, testing/evaluation process.
Prerequisites: Introduction to Computer Engineering.
Text Books:
1. R. Pressman, "SoftwareEngineering: a Practitioner's Approach", McGraw-Hill, 7th

Eds, 2009.
2. Sommerville, "Software Engineering", Addison Wesley, 9th Ed, 2010
3. Harvey & Paul Deitel, "Java How to Program", 7th Edition, Prentice Hall Inc, 2007.
4. Sponsored Curriculum by Sun Microsystems and Cisco Networking Academy, "Fundamentals of Java Programming."
5. Sun Microsystems, "The Java 2 API Docummentation."

ENEE600015
SIGNAL AND SYSTEMS
3 SKS
Refer to Page 178

ENCE600014
COMPUTER NETWORK SECURITY AND LABORATORY
3 Credits
Learning Objectives: Able to elaborate basic security concepts, threat, vulnerability and attack in computer network; encrypt and decrypt data; utilize cryptography software for public key infrastructure (PKI) and digital signature; implement security using SSL and TLS; elaborate and implement authentication; elaborate secure email and web technologies; elaborate how intrusion detection and recovery works; securing virtual private network; elaborate function and mechanism of firewall; elaborate operating system security issues in Windows and UNIX; implement wireless network security.
Syllabus: Introduction to network security, basic concept of security, threats, weaknesses and attacks, encryption, cryptography systems: public key infrastructure and digital signature, IP network security, SSL and TLS, authentication, email and web security, policy, intrusion detection and recovery, virtual private networks, frewalls, operating system security (Windows & UNIX), wireless network security.
Prerequisites: Computer Networks
Text Books:
1. W. Stallings, "Network Security Essentials: Application and Standards," Prentice Hall, 2000.
2. J.E.Canavan, "Fundamental of Network Security," Artech House, 2001.
3. S. Garfnkel and G. Spafford, "Practical UNIX and Internet Security", O'Reilly & Assoc. Inc., 1996.

ENCE600015
OBJECT ORIENTED PROGRAMMING AND LABORATORY
3 Credits
Learning Objectives: Able to elaborate object-oriented programming concepts; design object-based application; analyze object-oriented application design; explain the concept of incremental programming, type-safety, polymorphism, encapsulation and abstraction; able to use Java language to create object-oriented application especially for embedded system; understand and implement multithread concept; use object-oriented approach for handling input/output especially in embedded system.
Syllabus: object-oriented programming concept; object-oriented analysis and design technique; incemental programming; type-safety; polymorphism, encapsulation and abstraction; implementing object-oriented programming in Java programming language; multithreaded programming; I/O handling.
Prerequisites: Advanced Programming, Software Engineering
Text Books:
1. Deitel & Deitel, "Java How to Program", 7th Edition, Prentice Hall Inc., 2007
2. "The Java 2 API Docummentation", Sun microsystems

ENCE600016
VLSI DESIGN
2 Credits
Learning Objectives: Able to explain and elaborate the process of CMOS design, implement scale of Lambda into design, evaluate performance and characteristic of power transistor circuit and digital CMOS, and explain high-level design optimization techniques.
Syllabus: Processing technology in CMOS, rule of design: scale of lambda, characteristic and performance estimation of power transistor circuit, high-level design optimization.
Prerequisites: Fundamental of Digital Logic
Text Books:
N. Weiste & K.Eshraghian, "Principles of CMOS VLSI Design: A perspective", 2nd Eds, Addison Wesley 2002

ENEE600024
TELECOMMUNICATION ENGINEERING
3 SKS
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ENEE600025
TELECOMMUNICATION ENGINEERING LABORATORY
1 SKS
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ENCE600017
DESIGN AND MANAGEMENT OF COMPUTER NETWORK AND LABORATORY
4 Credits
Learning Objectives: Able to implement appropriate routing protocol; understand basic principle of link state routing protocol; analyze routing issues such as routing loop, summary address and autonomous system (AS); troubleshooting network based on OSI/TCP-IP reference model; interpreting network topology (both physical and logical); elaborate maintenance and upgrading procedures of the operating system (IOS); configure wireless LAN, access point and access router; implement security, DHCP and DNS on router; computer network verification and monitoring and preventive maintenance; implement network policy and access control

list (ACL).
Syllabus: Router configuration concept; distance vector routing protocol: RIPv1, RIPv2, EIGRP; Link-state routing protocol: OSPF; routing protocol issues: routing loop, summary address, and autonomous systems (AS); network troubleshooting based on OSI/TCP-IP reference model; interpreting network topology (both physical and logical); elaborate maintenance and upgrading procedures of the operating system (IOS); configure wireless LAN, access point and access router; implement security, DHCP and DNS on router; computer network verification and monitoring and preventive maintenance; implement network policy and access control list (ACL).
Lab. Practice: based on laboratory module from *Cisco Networking Academy - Exploration*
Project: designing computer network for an enterprise.
Prerequisites: Computer Networks
Text Books:
1. CCNA-Exploration 2, "CISCO Networking Academy Program: LAN Switching dan Wireless", Version 4, http://cisco.netacad.net
2. James D. McCabe, "Analisis Jaringan, Arsitektur dan Desain", 2nd Edition, Morgan Kaufmann, 2003

ENCE600018
EMBEDDED SYSTEM
2 SKS
Learning Objectives: In this course, students will learn to implement the applications of embedded system. At the completion of the subject, students will be able to describe the concept of embedded system development and implement embedded system application using programming languages such as assembly, C, and other programming language.
Syllabus: Embedded Systems Specification and Modelling, Sensor and Actuator, Programming Language for Embedded Systems, Operating System for Embedded Systems, Embedded Systems Evaluation and Validation, Embedded Systems Evaluation and Optimization.
Prerequisites: Microprocessor and Microcontroller, Microprocessor and Microcontroller Laboratory, Software Engineering, OS.
Text Books:
1. J. Liu, "Real-time Systems" , Prentice Hall, 2000.
2. P. A. Laplante, "Real-Time Systems Design and Analysis–An Engineer's Handbook", Second Edition, IEEE Press, 1997.

ENCE600019
INTERNSHIP
2 SKS
Learning Objectives: In this course, students will do internship work in a computer engineering related industry, institution or lab. After completing this course, students are expected to be able to combine and implement their previously learned technical knowledge with the new knowledge given by their supervisor. Students are also expected to be able to show professional conduct such as teamwork, discipline, responsible, initiative & interest, leadership, commendable attitude/behavior, and improvement prospect.
Syllabus: None
Prerequisites: Earned 90 SKS. The internship place is a computer engineering related industry, institution or lab which has a supervisor or a responsible person who can supervise students on a daily basis. Selection of company or lab shall begin with administrative process in the Department of Electrical Engineering.
Text Books: None

ENCE600020
HUMAN AND COMPUTER INTERACTION
3 SKS
Learning Objectives: In this course, students will learn and apply an analytical approach and able to use HCI theory in producing a high quality, effective and efficient HCI prototype. At the completion of the subject, students will be able to design, create and evaluate an interactive computer system in order to be user friendly.
Syllabus: Introduction to Human and Computer Interaction; Computer; Interaction; Basic of Interaction Design; Design Rules; Human and Computer Interaction in Software Life Cycle; Design Style; Evaluation Technique; Universal Design; User Support; HCI Project.
Prerequisites: Software Engineering, Database System.
Text Books:
1. A.J. Dix, J.E. Finlay, G.D. Abowd and R. Beale, "Human-Computer Interaction", Third Edition, Prentice Hall, USA, 2003
2. B. Shneiderman and C. Plaisant, "Designing The User Interface: Strategies for Effective Human Interaction", Fifth Edition, Prentice Hall, 2009

ENCE600021
IMAGE PROCESSING
3 SKS
Learning Objectives: This course is intended to introduce the students about image processing basic processes and using MATLAB™ for image processing. After completing this course, students are able to describe the basics of digital image processing and able to utilize MATLAB™ to perform basic image processing simulation and familiar with the functions in MATLAB™ image processing toolbox.
Syllabus: Introduction; visual and digital image; image transformation; color representation; image enhancement (spatial domain); image enhancement (frequency domain); convolution and correlation; image segmentation; object property feature; image compression; pattern recognition; image restoration; image morphology; Wavelet transformation.
Prerequisites: Advanced Programming.
Text Books:
1. R.C. Gonzalez and R.E. Woods, "Digital Image Processing", 2nd Edition, Prentice-Hall,

2002
2. R.C. Gonzalez, R.E. Woods, and S.L. Eddins, "Digital Image Processing using MATLAB", 2nd Edition, Gatesmark Publishing, 2009.

ENCE600022
WIRELESS TECHNOLOGY
3 SKS
Learning Objectives: In this course, students will learn about basic of wireless technology including working principles, techniques and standardization of wireless network. At the completion of the subject, students will be able to describe wireless technology basics, various techniques in wireless network, IEEE 802.11, 802.15 and 802.16 technology standard and future wireless technology projection.
Syllabus: Wireless technology standardization, radio transmission, SIR and SNR, modulation and coding, Multiplexing, Medium access control, IEEE 802: 802.11, 802.15, 802.16, Mobility handover, future technology of wireless network, policy and ethics in frequency spectrum use.
Prerequisites: Telecommunication Engineering, Telecommunication Engineering Laboratory.
Text Books:
B.H. Walke, S. Mangold, "IEEE 802 Wireless System", Wiley

ENCE601023
ENGINEERING ENTREPRENEURSHIP
2 SKS
Learning Objectives: In this course, students learn the basic concepts of project management and marketing specific to the field of Information Technology. After completing this course, students are expected to be able to outline the concept of marketing IT products, IT organizations according to business concepts, explaining the concept of accounting and financial management in the IT organization, and be able to perform the analysis in an IT project. Students are also expected to describe the concept of entrepreneurship, marketing and analyze the risks in an IT project.
Syllabus: Introduction to basic concepts of marketing, Business organization, Accounting management, Business Finance, Business Analysis for new project proposals, Introduction of the concept of entrepreneurship, Marketing risk analysis.
Prerequisites: None
Text Book: None (Lecture presented by professionals in the field of Information Technology)

ENCE600024
SEMINAR
2 SKS
Learning Objectives: In this course, students are directed to apply previously learned knowledge into a fully guided research by a lecturer. After completing this course, students are expected to be able to design and analyze under a fully supervised research, and able to write their research findings in a systematic scientific writing in form of seminar book. Students are also expected to present their research design in front of their lecturer.
Syllabus: None
Prerequisites: Completing 90 SKS
Text Books:
1. Technical Guidance for Universitas Indonesia Students' Final Project
2. IEEE Citation Reference
3. IEEE Transactions on Parallel And Distributed Systems, Vol. 21, No. 2, February 2010, "How To Write Research Articles in Computing and Engineering Disciplines"

ENCE600025
IT PROJECT MANAGEMENT
3 SKS
Objective: Introduction to the project management with IT context principles, tools and techniques. Conceptual material given in the course is enriched with practical application related to IT context oriented software development project. The project will be defined using a set of modeling procedures and going through a series of evaluation phases of analysis and development as a real framework to represent time, cost and expenses on the consumed resources.
Syllabus: IT project introduction, make a great team software builder, technology innovation management, Information System Software, the roles of project management, developments in the project, IT product closing and marketing.
Prerequisites : None
Text Books:
1. K. Schwalbe, "Information Technology Project Management", 3rd Edition, Course Technology, 2004
2. W.S. Humphrey, "Introduction to the Team Software Process", Addison Wesley 2000
3. H.T.Tavani, "Ethics & Technology: Ethical Issues in an Age of Information and Communication Technology", John Wiley & Sons, 2004.

ENCE601026
PROFESSIONAL ISSUES IN INFORMATION TECHNOLOGY
2 SKS
Learning Objectives: By the end of the course, students should be able to **analyze** the current issues related to code of ethics in Information Technology (IT), impact of IT on humanity and environment. The students are expected to be able to **elaborate** the principles of professional ethics, including bussiness ethics, the role of professional organizations and it's code of ethics, job classification, professional certifications and it's ethical responsibilities; and intellectual property rights. In addition the students are expected to be able to **elaborate** the importance of posessing the right ethical beliefs and values, since confronting issues frequently arise at the work place. The students are able to **analyze** what it means to take social responsibility while working with IT. Furthermore, the students are expected to **develop** the personal development

tools, enable them to work under pressure (or under a certain guidelines of ethical conduct) in a global competitive world.
Syllabus: Penetration of IT in human life, the notions of how IT could influence the safety of the global society : indonesian netters attacking the internet, definitions of ethics, philosophy and science; ethics and morality; ethics and law. The development of ethics in IT, including internet ethics, some example of IT ethical violation in the past; definition of professionalism, professionalism in IT, job classification in IT, professional organizations in general and professional organizations in IT, professional organization code of ethics; function and it's impacts to global society; intelectual property rights and patents, property right/patents "war" and abuse; licenced and unlicenced software; personal ethical responsibility as an IT experts
Prerequisites: None
Text Books:
1. Teguh Wahyono, Etika Komputer dan Tanggung Jawab Profesional di Bidang Teknologi Informas, Andi Offset, Yogyakarta, 2006
2. Deborah G Johnson & Helen Nissenbaum, Computer Ethics and Social Values, Prentice Hall, 1995
3. Tim Lindsey, Eddy Damian, Simon Butt, Tomi Suryo Utomo, Hak Kekayaan Intelektual : Suatu Pengantar, PT Alumni, 2013
4. Widodo, Memerangi Cybercrime : Karakteristik, Motivasi dan Strategi Penanganannya dalam Perspektif Kriminologi, Aswaja Pressindo, 2013

ENEE600027
MULTIMEDIA TECHNOLOGY
2 SKS
Learning Objectives: In this course, students learn technology in multimedia and Web technology to support information delivery through the internet. After completing this course, students are expected to be able to describe multimedia file components, multimedia file compression techniques, real time delivery of multimedia file, multimedia QoS in computer networks, and also able to describe basic of Web technology and it's relation with multimedia file distribution through the Internet.
Syllabus: Introduction to Multimedia Networking, Digital Speech & Audio Coding, Digital Image Coding, Digital Video Coding, Multimedia Quality of service of IP Networks, Web in Multimedia Streaming Architectures. Projects: Authoring a multimedia file and Implementing to Multimedia Network.
Prerequisites: Telecommunication Engineering
Text Books:
1. J.N. Hwang, "Multimedia Networking: From Theory to Practice. "Cambridge University Press, 2009.
2. G. Lu, "Communication & Computing for Distributed Multimedia Systems", Artech House, 1998.

ENCE600028
FINAL PROJECT
4 SKS
Learning Objectives: In this course, students are directed to apply previously learned knowledge into a fully guided research by a lecturer. After completing this course, Students will be able to make a research concept by applying existing theories. Under full supervision from the lecturer, students are expected to integrate and implement their concept, and write their research findings in a systematic scientific writing in the form of undergraduate theses book. Students are also expected to present and defend their concepts and findings in front of examiner in the final defense council.
Syllabus: None
Prerequisites: Completing 120 SKS
Text Books:
1. Technical Guidance for Universitas Indonesia Students' Final Project
2. IEEE Citation Reference
3. IEEE Transactions on Parallel And Distributed Systems, Vol. 21, No. 2, February 2010, "How To Write Research Articles in Computing and Engineering Disciplines"

ENCE600029
SPECIAL TOPIC IN COMPUTER ENGINEERING 1
3 SKS
Learning Objectives: In this course students will learn the latest topics in computer engineering industry. After completing this course students are expected to follow and understand specific topic in computer engineering industry and the problems it faces in general. The material discussed in this subject is different from the material discussed in Special Topics Computer Engineering 2.
Syllabus: Special topics in the field of computer networks, will be defined later
Prerequisites: None
Text Books: None (will be defined later)

ENCE600030
SPECIAL TOPIC IN COMPUTER ENGINEERING 2
3 SKS
Learning Objectives: In this course students will learn the latest topics in computer engineering industry. After completing this course students are expected to follow and understand specific topic in computer engineering industry and the problems it faces in general. The material discussed in this subject is different from the material discussed in Special Topics Computer Engineering 1.
Syllabus: Special topics in the field of computer networks, will be defined later
Prerequisites: None
Text Books: None (will be defined later)

4.7. UNDERGRADUATE PROGRAM IN METALLURGY & MATERIALS ENGINEERING

Program Specification

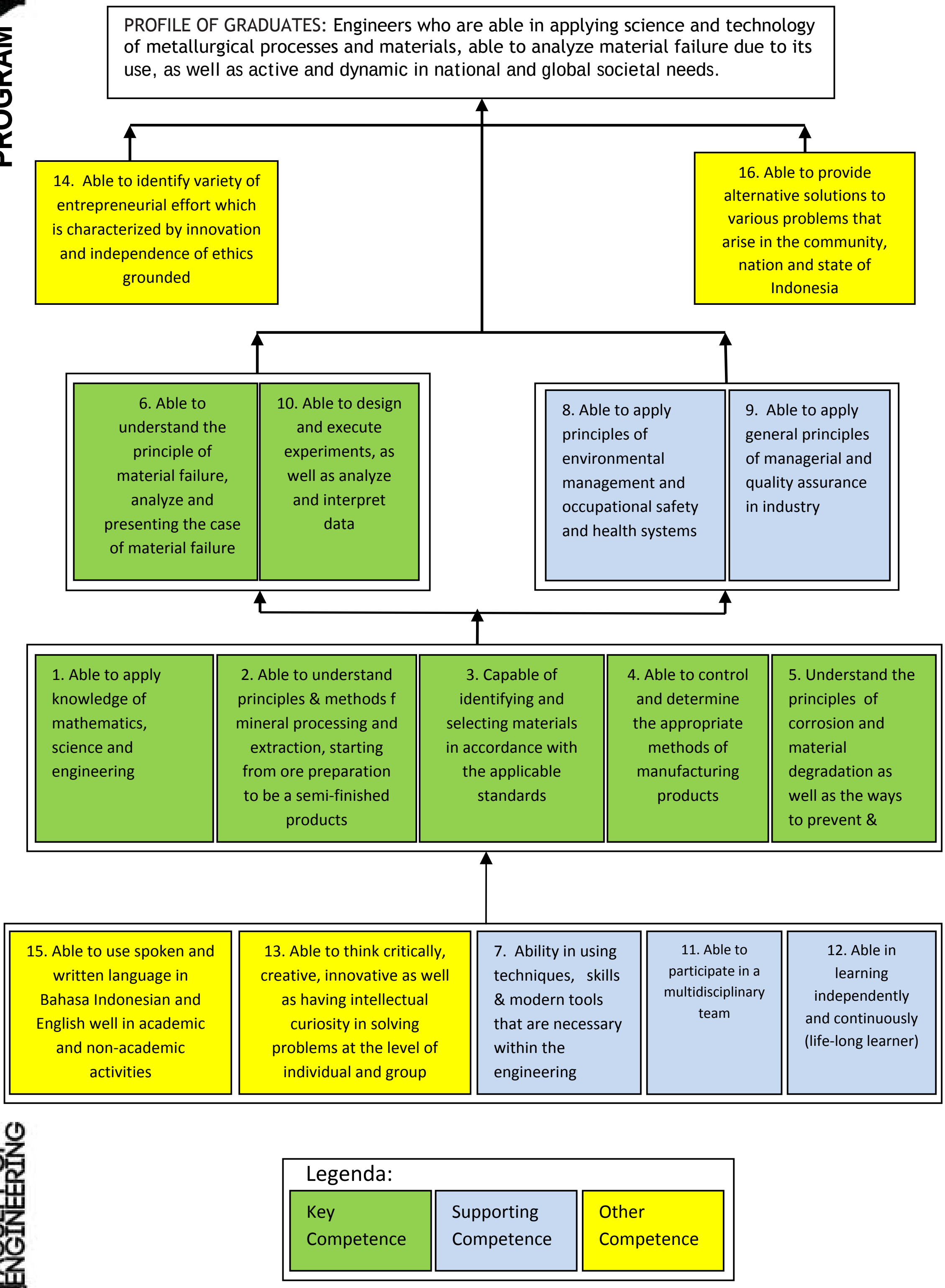
1	**Awarding Institution**		Universitas Indonesia Double degree : Universitas Indonesia & partner universities
2	**Teaching Institution**		Universitas Indonesia Double degree : Universitas Indonesia & partner universities
3	**Programme Title**		Undergraduate Program in Metallurgy and Materials Engineering
4	**Class**		Regular, Parallel, International
5	**Final Award**		Sarjana Teknik (S.T) Double Degree : Sarjana Teknik (S.T) and Bachelor of Engineering (B.Eng)
6	**Accreditation / Recognition**		BAN-PT : “A” Grade AUN-QA : “A” Grade
7	**Language(s) of Instruction**		Bahasa Indonesia and English
8	**Study Scheme (Full Time / Part Time)**		Full Time
9	**Entry Requirements**		High school /equivalent, or D3 / Polytechnique / equivalent, AND pass the entrance exam.
10	**Study Duration**		Designed for 4 years
	Type of Semester	Number of semester	Number of weeks /semester
	Regular	8	17
	Short (optional)	3	8
11	**Graduate Profiles:** Engineers who are able in applying science and technology of metallurgical processes and materials, able to analyze material failure due to its use, as well as active and dynamic in national and global societal needs.		
12	**Expected Learning Outcomes :** 1. Able in applying basic science, basic engineering science and knowledge in the field of metallurgy and materials 2. Have ability to identify problems, design, analysis, and problem solving through research activities. 3. Having the ability to communicate effectively in the community clumps similar science, multidisciplinary, and the general public. 4. Understand the responsibility and professional ethics, resourceful and have the leadership. 5. Have the capability of lifelong learning to the development of science and technology and its application in society		

13	Classification of Subjects		
No	Classification	Credit Hours (SKS)	Percentage
i	University General Subjects	18	12,5 %
ii	Basic Engineering Subjects	25	17 %
iii	Core Subjects	82	57 %
iv	Elective Subjects	12	8 %
v	Internship, Seminar, Undergraduate Thesis, Project	7	5 %
	Total	144	100 %
14	**Total Credit Hours to Graduate**		**144 SKS**

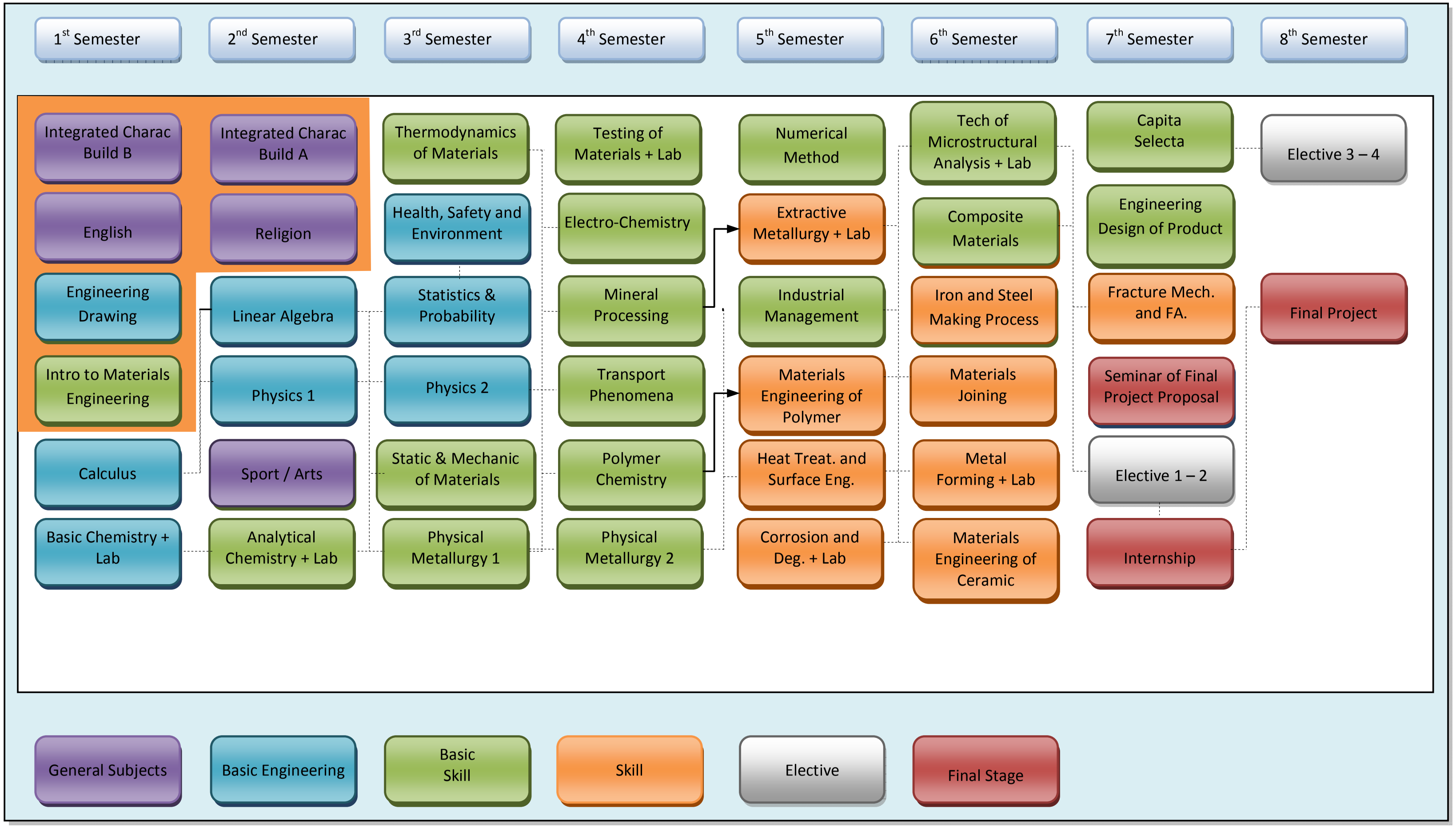
Employment Prospects

Bachelor of Metallurgy and Materials Engineering graduates can work in various sectors, both private and government, like industry, automotive, manufacturing, heavy equipment, mining, material consultant, oil and gas, research and development institutions, academia, and others both within and abroad.

Learning Outcomes Flow Diagram



Flow Diagram of Subjects.



List of Competencies

a) Key Competencies
1. Being able to understand the principles of mineral processing methods and extraction from ore preparation to be a semi-finished products
2. Able to identify and select appropriate material design, engineering and standards
3. Being able to master the material and determine the appropriate manufacturing methods to make quality products
4. Be able to understand the principles of corrosion and material degradation and ways of prevention and mitigation
5. Be able to understand the principle of material failure, the analysis in cases of material failure as well as presenting
6. Able to apply basic principles of mathematics, chemistry, physics and basic engineering

b) Supporting Competencies
1. Able to apply principles of environmental management and occupational safety and health systems
2. Able to apply general principles of managerial and quality assurance in the industry
3. Ability to utilize information communication technology
4. Being able to identify a range of entrepreneurial effort is characterized by innovation and independence of ethics grounded

c) Other Competencies
1. Capable of critical thinking, creative, and innovative and have the intellectual curiosity to solve the problem at the level of individual and group
2. Being able to use spoken language and written in Bahasa Indonesian and English with both for academic and non academic activities
3. Being able to provide alternative solutions to various problems that arise in the neighborhood, community, nation and state of Indonesia

The significances between competencies and courses are shown in the table below :

No.	Courses	Competencies		
		Key	Supporting	Other
1st Semester				
1	Integrated Character Building Subject B (MPKT B)	6		
2	English			2
3	Calculus	6		
4	Engineering Drawing	6		
5	Introduction to Engineering Material	2, 6		
6	Basic Chemistry	6		
7	Basic Chemistry Laboratory	6		
2nd Semester				
1	Integrated Character Building Subject A (MPKT A)			1, 3
2	Religious Studies			1, 3
3	Sport / Art			3
4	Linear Algebra	6		
5	Basic Physics 1	6		
6	Analytical Chemistry	6		
7	Analytical Chemistry Laboratory	6		
3rd Semester				
1	Basic Physics 2	6		
2	Health, Safety & Environment		1	
3	Statistics and Probability	6		
4	Static & Mechanic of Materials	6		
5	Thermodynamics of Materials	1		
6	Physical Metallurgy 1	2		

4th Semester				
1	Testing of Materials	2, 5		
2	Testing of Materials Laboratory	2, 5		
3	Polymer Chemistry	6		
4	Electro-Chemistry	4		
5	Transport Phenomena	2		
6	Physical Metallurgy 2	2		
7	Mineral Processing	1		
5th Semester				
1	Numerical Computation	3, 6		
2	Industrial Project Management		2	
3	Corrosion & Degradation of Materials	4		
4	Corrosion & Degradation of Materials Lab	4		
5	Extractive Metallurgy	1		
6	Extractive Metallurgy Lab	1		
7	Heat Treatment and Surface Eng.	3		
8	Polymer Technology	2		
6th Semester				
1	Tech. of Microstructural Analysis	2, 5		
2	Tech. of Microstructural Analysis Lab	2		
3	Composite Materials	2		
4	Ceramic Technology	2		
5	Iron & Steel Making Process	3		
6	Metal Forming	3		
7	Metal Forming Laboratory	3		
8	Materials Joining	3		
7th Semester				
1	Capita Selecta		3, 4	
2	Engineering Design of Product	2		
3	Fracture Mechanics & Failure Analysis	5		
4	Internship (KP) *		2, 3	1, 2, 3
5	Seminar of Final Project Proposal *		4	1, 2, 3
6	Elective 1			
7	Elective 2			
8th Semester				
1	Final Project *		3	1, 2, 3
2	Elective 3			
3	Elective 4			
Elective Courses				
	Special Steels & Super Alloys	2		
	Nanotechnology	3		
	Additive & Adhesive Materials	3		
	Quality Management System		2	
	Industrial Mechanic Equipment	3		
	Advanced Extractive Metallurgy	1		
	High Temperature Corrosion	4		

COURSE STRUCTURE OF UNDERGRADUATE PROGRAM IN METALLURGY AND MATERIALS ENGINEERING (REGULAR & PARALLEL)

KODE	MATA AJARAN	SUBJECT	SKS
	Semester 1	**1st Semester**	
UIGE 6 0 0004	MPK Terintegrasi B	Integrated Character Building Subject B	6
UIGE 6 0 0002	Bahasa Inggris	English	3
ENGE 6 0 0001	Kalkulus	Calculus	4
ENGE 6 0 0009	Menggambar Teknik	Engineering Drawing	2
ENMT 6 0 0001	Pengantar Material Teknik	Introduction to Engineering Material	2
ENGE 6 0 0010	Kimia Dasar	Basic Chemistry	2
ENMT 6 0 0036	Praktikum Kimia Dasar	Basic Chemistry Laboratory	1
		Sub Total	**20**
	Semester 2	**2nd Semester**	
UIGE 6 0 0001	MPK Terintegrasi A	Integrated Character Building Subject A	6
UIGE 6 0 0006-9	Agama	Religious Studies	2
UIGE 6 0 0003	Olah Raga / Seni	Sports / Arts	1
ENGE 6 0 0002	Aljabar linier	Linear Algebra	4
ENGE 6 0 0003	Fisika Dasar 1	Basic Physics 1	4
ENMT 6 0 0002	Kimia Analitik	Analytical Chemistry	2
ENMT 6 0 0003	Praktikum Kimia Analitik	Analytical Chemistry Laboratory	1
		Sub Total	**20**
	Semester 3	**3rd Semester**	
ENGE 6 0 0004	Fisika Dasar 2	Basic Physics 2	4
ENGE 6 0 0008	Kesehatan, Keselamatan Kerja & Lindung Lingkungan	Health, Safety & Environment	2
ENGE 6 0 0005	Statistik dan Probabilitas	Statistics and Probability	2
ENMT 6 0 0004	Statika & Mekanika Material	Static & Mechanic of Materials	3
ENMT 6 0 0005	Termodinamika Material	Thermodynamics of Materials	3
ENMT 6 0 0006	Metalurgi Fisik 1	Physical Metallurgy 1	4
		Sub Total	**18**
	Semester 4	**4th Semester**	
ENMT 6 0 0007	Pengujian Material	Testing of Materials	2
ENMT 6 0 0008	Prakt. Pengujian Material	Testing of Materials Laboratory	1
ENMT 6 0 0009	Kimia Polimer	Polymer Chemistry	4
ENMT 6 0 0010	Elektrokimia	Electro-Chemistry	3
ENCH 6 0 0009	Peristiwa Perpindahan	Transport Phenomena	3
ENMT 6 0 0012	Metalurgi Fisik 2	Physical Metallurgy 2	3
ENMT 6 0 0013	Pengolahan Mineral	Mineral Processing	4
		Sub Total	**20**

	Semester 5	5th Semester	
ENEE 6 0 0031	Permodelan Numerik	Numerical Computation	2
ENIE 6 0 0020	Manajemen Proyek Industri	Industrial Project Management	2
ENMT 6 0 0016	Korosi dan Degradasi Material	Corrosion & Degradation of Materials	3
ENMT 6 0 0017	Praktikum Korosi	Corrosion & Degradation of Materials Lab	1
ENMT 6 0 0018	Metalurgi Ekstraksi	Extractive Metallurgy	3
ENMT 6 0 0019	Praktikum Metalurgi Ekstraksi	Extractive Metallurgy Lab	1
ENMT 6 0 0020	Perlakuan Panas & Rekayasa Permukaan	Heat Treatment and Surface Eng.	3
ENMT 6 0 0021	Teknologi Polimer	Polymer Technology	4
		Sub Total	**19**
	Semester 6	**6th Semester**	
ENMT 6 0 0022	Analisis Struktur Material	Tech. of Microstructural Analysis	2
ENMT 6 0 0023	Praktikum Analisis Struktur Mate-rial	Tech. of Microstructural Analysis Lab	1
ENMT 6 0 0024	Material Komposit	Composite Materials	2
ENMT 6 0 0025	Teknologi Keramik	Ceramic Technology	4
ENMT 6 0 0026	Proses Pembuatan Besi Baja	Iron & Steel Making Process	2
ENMT 6 0 0027	Pembentukan Logam	Metal Forming	4
ENMT 6 0 0028	Praktikum Pembentukan Logam	Metal Forming Laboratory	2
ENMT 6 0 0029	Penyambungan Material	Materials Joining	3
		Sub Total	**20**
	Semester 7	**7th Semester**	
ENMT 6 0 0030	Kapita selekta	Capita Selecta	2
ENMT 6 0 0031	Disain Rekayasa Produk	Engineering Design of Product	2
ENMT 6 0 0032	Mekanika Perpatahan & Analisis Kegagalan	Fracture Mechanics & Failure Analysis	4
ENMT 6 0 0033	Kerja Praktek (KP)*	Internship *	2
ENMT 6 0 0034	Seminar *	Seminar of Final Project Proposal *	1
	Pilihan 1	Elective 1	3
	Pilihan 2	Elective 2	3
		Sub Total	**17**
	Semester 8	**8th Semester**	
ENMT 6 0 0035	Skripsi (Tugas Akhir)*	Final Project *	4
	Pilihan 3	Elective 3	3
	Pilihan 4	Elective 4	3
		Sub Total	**10**
		Total	**144**

Note *) : Special Courses are available in both semesters (Odd & Even)

Elective Courses			
NO.	**KETERANGAN**	**REMARKS**	**SKS**
1	Dapat Diambil dari MK Pilihan Prog. S2 DTMM FTUI	it can be taken from Elective Subject - S2 Prog. DTMM UI	12
2	Dapat Diambil dari Lintas Departemen/Fakultas di UI	it can be taken from across Depts / Faculty at UI	

Elective Courses can be taken from the elective courses at Master Degree programs or from other department

Elective Courses (Odd Semester)			
No	**Code**	**Courses**	**SKS**
1.	ENMT800001	Special Steels & Super Alloys	3
2.	ENMT801002	Additive & Derivative of Polymers	3
3.	ENMT800003	Industrial Mechanic Equipment	3
4.	ENMT801004	High Temperature Corrosion	3
5.	ENMT800005	Quality Management System	3
6.	ENMT800006	Advanced Material	3
	----------	And cross-department / cross-faculty elective courses	

Elective Courses (Even Semester)			
No	**Code**	**Courses**	**SKS**
1.	ENMT801007	Machining & Polymer Recycling Technology	3
2.	ENMT801008	Advanced Surface Engineering	3
3.	ENMT800009	Advanced Extractive Metallurgy	3
4.	ENMT800010	Advanced Polymer Product Processing	3
5.	ENMT800011	Project Management	3
6.	ENMT800012	Nanotechnology	3
	----------	And cross-department / cross-faculty elective courses	

Fast Track Program is available for high-achiever students to directly continue to Master Program in Metallurgy and Materials Engineering. At their 7th and 8th semesters, Fast Track students should take electives from the compulsory or elective subjects of the Master Program. The Bachelor and Master Program should be completed in 10 semesters (5 years).

COURSE STRUCTURE OF UNDERGRADUATE PROGRAM IN METALLURGY AND MATERIALS ENGINEERING (INTERNATIONAL)

CODE	SUBJECT	CP
	1st Semester	
ENGE 6 1 0001	Calculus	4
UIGE 6 1 0002	Academic Writing	3
ENGE 6 1 0003	Basic Physics 1	4
ENGE 6 1 0010	Basic Chemistry	2
ENMT 6 1 0036	Basic Chemistry Laboratory	1
ENEE 6 0 0031	Numerical Computation	2
ENGE 6 1 0009	Engineering Drawing	2
ENMT 6 1 0001	Introduction to Engineering Materials	2
	Sub Total	**20**
	2nd Semester	
ENGE 6 1 0002	Linear Algebra	4
ENGE 6 1 0004	Basic Physics 2	4
ENMT 6 1 0010	Electro-chemistry	3
ENGE 6 1 0008	Health, Safety & Environment	2
ENMT 6 1 0009	Polymer Chemistry	4
ENMT 6 1 0002	Analytical Chemistry	2
ENMT 6 1 0003	Analytical Chemistry Laboratory	1
	Sub Total	**20**
	3rd Semester	
ENGE 6 1 0005	Statistics and Probability	2
ENCH 6 0 0009	Transport Phenomenon	3
ENMT 6 1 0004	Static & Mechanic of Materials	3
ENMT 6 1 0005	Thermodynamics Materials	3
ENMT 6 1 0006	Physical Metallurgy 1	4
ENMT 6 1 0021	Polymer Technology	4
	Sub Total	**19**
	4th Semester	
ENIE 6 0 0020	Industrial Project Management	2
ENMT 6 1 0007	Testing of Materials	2
ENMT 6 1 0008	Testing of Materials Lab.	1
ENMT 6 1 0012	Physical Metallurgy 2	3
ENMT 6 1 0022	Tech. of Microstructural Analysis	2
ENMT 6 1 0023	Tech. of Microstructural Analysis Laboratory	1
ENMT 6 1 0020	Heat Treatment and Surface Eng.	3
ENMT 6 1 0013	Mineral Processing	4
ENMT 6 1 0026	Iron & Steel Making Process	2
	Sub Total	**20**

5th Semester		
UIGE 6 1 0004	Integrated Character Building Subject B	6
ENMT 6 1 0024	Composite Materials	2
ENMT 6 1 0018	Extractive Metallurgy	3
ENMT 6 1 0019	Extractive Metallurgy Laboratory	1
ENMT 6 1 0025	Ceramic Technology	4
ENMT 6 1 0016	Corrosion & Degradation of Materials	3
ENMT 6 1 0017	Corrosion Laboratory	1
	Sub Total	**20**
6th Semester		
UIGE 6 1 0001	Integrated Character Building Subject A	6
UIGE 6 1 0005	Religious Studies	2
UIGE 6 1 0003	Sport & Art	1
ENMT 6 1 0029	Materials Joining	3
ENMT 6 1 0031	Engineering Design of Product	2
ENMT 6 1 0027	Metal Forming	4
ENMT 6 1 0028	Metal Forming Laboratory	2
	Sub Total	**20**
7th Semester		
ENMT 6 1 0030	Capita Selecta	2
ENMT 6 1 0033	Internship	2
ENMT 6 1 0034	Seminar of Final Project Proposal *	1
ENMT 6 1 0032	Fracture Mechanics & Failure Analysis	4
	Elective 1	3
	Elective 2	3
	Sub Total	**15**
8th Semester		
ENMT 6 1 0035	Final Project *	4
	Elective 3	3
	Elective 4	3
	Sub Total	**10**
Total		**144**

*) Special Subjects are opened at all semester

ELECTIVE COURSES		
CODE	**REMARKS**	**CP**
	it can be taken from other Dept under Eng. Faculty or	3
	it can be taken from Elective Subject - S2 Prog. DTMM UI	3
	2 Courses are offered to other Dept under Faculty of Eng.	
ENMT811004	High Temperature Corrosion (Odd semester)	3
ENMT811012	Nano Technology (Even Semester)	3
	Total	**12**

Curriculum Structure of Bachelor Program Metallurgy & Materials Engineering in Partner Universities

Monash University– Australia

Year 3	Semester 5 (Monash) July	
Code	**Course Title**	**Credit**
MTE3545	Functional materials and devices	6
MTE3546	Polymers and ceramics II	6
MTE3547	Materials characterisation and modelling	6
	Elective	6
	Subtotal	**24**

Year 3	Semester 6 (Monash)	Credits
CODE	Subject	
MTE3541	Materials Durability	6
MTE3542	Microstructural Design in Structural Materials	6
MTE3543	Microstructure to applications: the mechanics of materials	6
MTE3544	Management and practice in materials engineering	6
	subtotal	24

Year 4	Semester 7 (Monash)	Credits
CODE	Subject	
MTE4525	Project I	6
MTE4573	Processing and engineering of metals and ceramics	6
	Elective	6
	Elective	6
	subtotal	24

Year 4	Semester 8 (Monash)	Credits
CODE	Subject	
MTE4571	Materials Engineering Design and Practice	6
MTE4572	Polymer and Composite Processing and Engineering	6
	Elective	6
	Elective	6
	subtotal	24

List of Electives at Monash

Year 3

Code	Course Title	Credit
MTE3590	Materials modelling	6
MTE3591	Composites, thermosets and elastomers	6
MTE4593	Materials and the environment	6
MTE4594	Engineering alloys processing, design and selection	6
MTE4595	Corrosion-mechanisms and protection methods	6
MTE4596	Biomaterials II	6
	One non-engineering elective (must be approved by the course adviser)	6

Year 4

Code	Course Title	Credit
ENG4700	Engineering technology for biomedical imaging and sensing	6
ENG4616	Schools technology studies project	6
MTE4526	Project II	6
MTE4592	Advanced ceramics and applications	6
MTE4593	Materials and the environment	6
MTE4594	Engineering alloys processing, design and selection	6
MTE4595	Corrosion-mechanisms and protection methods	6
MTE4596	Biomaterials	6
MTE3590/4590	Modelling of materials	6
MTE3591 /4591	Composites, thermosets and elastomers	6
MTE4597	Nanomaterials	6

Course Structure at University of Queensland (UQ)

For July Intake

Year 3	Semester 5 (UQ) July	Credit
Code	**Course Title**	
MECH2100 MECH2210	Machine Element Design Dynamics and Orbital Mechanics	2
	Subtotal	**4**

Year 3	Semester 6 (UQ) March	Credit
Code	**Course Title**	
MATH2010	Analysis of Ordinary Differential Equation	1
STAT2201	Analysis of Engineering and Scientific Data	1
ELEC1 000	Introduction to Electrical Engineering	2
MECH3300	Finite Element Method and Fracture Mechanics	2
MECH3600	Engineering Management and Communication	2
	Subtotal	**8**

Year 4	Semester 7 (UQ) July	Credit
Code	**Course Title**	
MECH31 00	Mechanical and Space System Design	2
MECH3200	Advanced Dynamics and Vibration	2
MECH4301	Materials Selection	2
MECH3410	Fluid Mechanics	2
	Subtotal	**8**

Year 4	Semester 8 (UQ) March	Credit
Code	**Course Title**	
CHEE4301 or CHEE3305	Biomaterials in Medicine or Nanomaterials and Their Characterisation	2
MECH4500	Engineering Thesis	4
METR3200	Introduction to Control System	2
MECH4304	Net Shape Manufacturing	2
	Subtotal	**10**

Year 4	Semester 9 (UQ) July	Credit
Code	**Course Title**	
CHEE4302 MECH4500 AERO3100	Electrochemistry and Corrosion Engineering Thesis Aerospace Materials	2 4 2
	Subtotal	**8**

Course Description

UIGE600001
UIGE610001
MPKT A / INTEGRATED CHARACTER BUILDING A
6 SKS
Refer to Page 74

UIGE600004
UIGE610004
MPKT B / INTEGRATED CHARACTER BUILDING B
6 SKS
Refer to Page 74

UIGE600002
ENGLISH
UIGE610002
ACADEMIC WRITING
3 SKS
Refer to Page 74

UIGE600003
UIGE610003
SPORTS / ARTS
1 SKS
Refer to Page 77

ENGE600001
ENGE610001
CALCULUS
4 SKS
Refer to Page 74

ENGE600010
ENGE610010
BASIC CHEMISTRY
Refer to Page 75

ENGE600003
ENGE610003
BASIC PHYSICS 1
4 SKS
Refer to Page 75

ENGE600004
BASIC PHYSICS 2
4 SKS
Refer to Page 77

ENGE600002
ENGE610002
LINEAR ALGEBRA
4 SKS
Refer to Page 75

UIGE600005-9
UIGE610005-9
RELIGIOUS STUDIES
2 SKS
Refer to Page 76-77

ENGE600005
ENGE610005
STATISTICS AND PROBABILITY
2 SKS
Refer to Page 78

ENGE600008
ENGE610008
HEALTH, WORK SAFETY, AND ENVIROMENT
2 SKS
Refer to Page 78

ENGE600009
ENGE610009
ENGINEERING DRAWING
2 SKS
Refer to Page 124

ENMT600001
ENMT610001
INTRODUCTION TO ENGINERING MATERIALS
2 SKS
Objective : Students are expected to understand the processing, characteristics and application of engineering materials. structure and bonding in materials, material processing for all types of engineering materials as well as basic concept in materials testing.
Syllabus : (1) Types of engineering materials and their applications; (2) Structures of engineering materials; (3) Properties of material; (4) Manufacturing and Processing of Metallic Materials; (5) Steel and iron: production and properties; (6) Aluminium: production and properties;(7) Other non-ferrous alloys: production and properties; (8) Polymer: processing and properties; (9) Ceramic: processing and properties; (10) Composite: processing and properties
Prerequisite : -
Textbooks :
1. Bondan T. Sofyan, Pengantar Material Teknik, Penerbit Salemba Teknika, 2010
2. W.D. Callister, Materials Science and Engineering: An Introduction, 6th ed., John Wiley & Sons, 2003
3. William F. Smith, Introduction to Materials Science and Engineering

ENMT600036
ENMT610036
BASIC CHEMISTRY LAB
1 SKS
Objective : The students able to apply the principles of basic chemistry derived from a lecture to the experiments in laboratory, able to analyze as well as explain the phenomena that occur in laboratory experiments.
Syllabus : Physical and chemical properties; Separation and purification of the substance; Identification of alkali metal ions, alkaline earth, ammonium, sulfate, iodid, bromide and nitrate; acid-base titration; metal and acid reaction; Water crystals.
Prerequisite : -
Textbooks :
1. Buku Panduan Praktikum Kimia Dasar, TGP FTUI.
2. M.R. Abraham and M.J.Pavelich, Inquires into Chemistry, Illionis, Waveland Press

Inc., 1999.
3. Brown, T.L., H. E. LeMay, B. E. Bursten, Chemistry: The Central Science, 9th ed., Prentice-Hall, New Jersey, 2002.

ENMT600002
ENMT610002
ANALYTICAL CHEMISTRY
2 SKS
Objective : Students are able to explain and apply the concept of analysis and to choose the appropriate method in solving a chemical composition problem of a substance qualitatively and quantitatively.
Syllabus : Classification of analytical chemistry involving qualitative and quantitative analysis, anionic and cationic analysis, basics of quantitative chemistry, quantitative analysis method, titrimetis, electro analysis, spectrophotometry
Prerequisite : -
Textbooks :
1. Daniel C. Harris, Quantitative Chemical analysis, Seventh Edition, W.H. Freeman and Company, New York, 2007
2. R.A. Day, Jr & A.L. Underwood, Quantitative Analysis, 6th ed, Prentice Hall Inc., 1998
3. G. Svehla, Buku Teks Analisis Anorganik Kualitatif Makro dan Semimikro, Kalman Media Utama, Jakarta, 1990

ENMT600003
ENMT610003
ANALYTICAL CHEMISTRY LAB
1 SKS
Objective : Students are able to explain and analyze a substance qualitatively and quantitatively by using the appropriate method and make correct and appropriate calculation
Syllabus : Inorganic qualitative analysis, inorganic quantitative analysis using titrimetry method
Prerequisite : -
Textbooks
1. Analytical Chemistry Laboratory Guide Book
2. Daniel C. Harris, Quantitative Chemical analysis, Seventh Edition, W.H. Freeman and Company, New York, 2007
3. R.A. Day, Jr & A.L. Underwood, Quantitative Analysis, 6th ed, Prentice Hall Inc., 1998
4. G. Svehla, Buku Teks Analisis Anorganik Kualitatif Makro dan Semimikro, Kalman Media Utama, Jakarta, 1990

ENMT600004
ENMT610004
STATIC & MECHANIC OF MATERIALS
3 SKS
Objective : After completing this subject, students are expected to understand the theory and applications of engineering mechanic properties (static) and able to design and to analyze various load - bearing structures
Syllabus : General principle of mechanics, Vector and forces, Equilibrium points, Resultant of forces, Structure analysis, Center of gravity and centroid, Moment inertia, Internal forces, Friction. The concept of stress strain, Relation of stress and strain in axial loading, Twisting, Buckling, Transversals loading, Stress analysis, Design of shaft and beam, Beam deflection, Structural joints, Column and thick cylinder, Energy method.
Prerequisite : -
Textbooks :
1. Hibbeler, Russel C., Engineering mechanics, statics, 8th Ed., Macmillan Publishing Company, Inc.
2. Hibbeler, Russel C., Mechanical of Materials, Prentice Hall International Inc., 1997
3. Ferdinant L. Singer, Ilmu Kekuatan Bahan, Penerbit Erlangga, 1981
4. Beer, F.P. and Johston, E.R., Mechanics of Materials, McGraw-Hill, 1983

ENMT600005
ENMT610005
THERMODYNAMICS OF MATERIALS
3 SKS
Objective : Students are able to explain the concepts of thermodynamics and its application in materials engineering
Syllabus: Definition of thermodynamics, first, second, and third law of thermodynamics, statistical interpretation of entropy, auxiliary functions, heat capacity, enthalpy and entropy, phase equilibrium in a component, gas and solution behavior, free energy, binary system composition, reaction of pure condensation phase and gas phase, equilibrium reaction of a system in a solution component
Prerequisite : -
Textbooks : D.R. Gaskell, Introduction to the Thermodynamics of Materials, 3rd ed., Taylor and Francis, 1995

ENMT600006
ENMT610006
PHYSICAL METALLURGY 1
4 SKS
Objective: Students establishes essential knowledge of crystallography of materials, in particular in developing the ability to interpret and manipulate the Miller index and Miller Bravais notation for planes and directions in crystalline solids. Based on that, students are expected to understand concept of imperfection in crystal and to be able to manipulate the imperfection in order to strengthen materials as required.
Syllabus : (1) Definition of crystal; (2) Crystal lattice(3) Unit cell; (4) Bravais lattice; (5) Miller index for planes and direction; (6) Stereographic projection; (7) Crystal symmetry; (8) Formation of crystal; (9) Identification of crystal; (10) Crystal defects: point defects, line defects (dislocations), edge dislocations, screw dislocations, burgers vector, movement of dislocations, energy of dislocation, dislocations in FCC, BCC and HCP structures, planar defects; (11) Fatigue

and Fracture of Materials; (12) Creep of Materials; (13) Strengthening Mechanism: strain (work) hardening, grain boundary strengthening, solid solution strengthening, precipitation (two-phase) strengthening, steel alloys strengthening, composite strengthening, study case in materials strengthening.
Prerequisite: Introduction to Eng Mat (**ENMT600001)**
Textbooks
1. Borchardt - Ott, W., Crystallography, Springer, 1995
2. McKie, D., and C. McKie, Essential of Crystallography, Blackwell Scientific, 1986
3. Abbaschian, R and Reed-Hill, R.E, Physical Metallurgy Principles, 4th ed, Brooks Cole, 2008.

ENMT600007
ENMT610007
TESTING OF MATERIALS
2 SKS
Objective : After completing this course, students should be able to understand the theoretical concepts of materials testing and to apply them for practical needs in design of machinery components and structural construction.
Syllabus : Introduction to material testing, Review of mechanical behavior of materials, Data analysis and presentation of test results, Testing procedures, Testing machine and instruments, Standardization of materials testing, Destructive testing (tensile, compression, shear, fatigue, stress relaxation, and wear), Non-destructive (visual, penetrant, ultrasonic, radiography, eddy current and magnetic particle)
Prerequisite : -
Textbooks :
1. Davis, H.E., Troxell G.E. and Hauck, G. F. W., The Testing of Engineering Materials, McGraw Hill, 1982.
2. ASM, Mechanical Testing of Metals 10th Ed., ASM, 2000
3. B. Raj, T. Jaykumar, and M. Thavasimuthu, Practical Non-Destructive Testing, 2nd Ed. ASM International

ENMT600008
ENMT610008
TESTING OF MATERIALS LAB
1 SKS
Objective : Students mastering the techniques for destructive testing of materials, including the standard and data analysis to be able to interpret mechanical properties of materials.
Syllabus: Tensile test, Compressive test, Micro and Macro Hardness test, Impact Test, Wear Test
Prerequisite : -
Textbooks :
Davis, Harmer E; Teoxell, George Earl; Hauck, George F.W, The Testing of Engineering Materials, 4th edition, McGraw Hill, Inc, New-York 1982.

ENMT600009
ENMT610009

POLYMER CHEMISTRY
4 SKS
Objective : Students are able to explain and understand the concepts of organic chemistry knowing physical and chemical properties of a material.
Syllabus : Fundamentals of organic chemistry (bonding atom and molecule, polar molecules, free radicals, the nomenclature of organic compounds, isomer, conjugation and resonance). Reaction types of organic compounds, addition reactions, nucleophilic and electrophilic substitution, elimination, rearrangement, and radical reaction mechanism. Basic Properties of Polymer Chemistry
Prerequisite : -
Textbooks :
1. T.W.Graham Solomons, Organic Chemistry, Eighth Edition, John Wiley & Sons.Inc, 2004
2. Mc Mury,J., Organic Chemistry, 5th ed, Brooks Cole, Toronto, 2000
3. Fessenden R.J. and Fessenden K.S., Oganic Chemistry, 5th ed., Brooks Cole, California, 1994

ENMT600010
ENMT610010
ELECTRO-CHEMISTRY
3 SKS
Objective : able to explain the basic concepts of electrochemistry to further understanding of the science of corrosion and metal protection, as well as the science of iron ore processing with extraction methods, such as electrowinning and electrorefining
Syllabus : Basic concepts and applications of electrochemistry, and conductivity solution, Faraday's law, and their application. Electrode electrochemical cell (definition, potential, equation Nerst, electrical double layer, the polarization, the measurement of potential, free energy and electrode potential, equilibrium potential), the reference electrode,Construction Pourbaix diagram and its application. Electrochemical kinetics, electrode reaction speed, mixed potential theory, Evans-diagram, the mixed-potential diagram
Prerequisite : -
Textbooks :
1. J O M. Bockris and AKN Reddy, Modern ElectroChemistry, vol 1,2 Plennum Rosseta Edition,1997
2. Bard, Faulkner and Larry R, Electrochemical Metods FundaMentals and Application, Wiley, 1980
3. Piron. The Electrochemistry of Corrosion, NACE, 1991

ENCH600009
ENCH610009
TRANSPORT PHENOMENA
3 SKS
Refer to Page 308

ENMT600012

ENMT610012
PHYSICAL METALLURGY 2
3 SKS
Objective : Students are expected to comprehend and be able to apply the basic principles to built phase transformations in material systems in order to select materials and to design processes that yield desired microstructures and properties.
Syllabus : (1) Concept of Equilibrium: single component system, binary component system, the phase rule, binary phase diagrams; (2) Fe-Fe3C Phase Diagram; (3) Ternary Equilibrium: ternary system representation, ternary system containing 2 phase, ternary system containing 3 phase; (4) Diffusion in Materials: atomic mechanism of diffusion, interstitial diffusion, substitutional diffusion; (5) Crystal Interfaces and Microstructure: interfacial free energy, grain boundary, interphase interfaces in solids, interface migration; (6) Solidification: nucleation in pure metals, growth of a pure solid, solidification of alloy, solidification of ingots and castings, solidification of fusion welds, rapid solidification; (7) Diffusional Transformation in Solids: homogeneous and heterogeneous nucleation in solids, precipitate growth, transformation kinetics, eutectoid transformation, ordering transformation; (8) Diffusionless Transformation in Solids: theories of martensite nucleation, martensite growth, tempering of ferrous martensite, martensite transformation in nonferrous metals, case study in diffusionless transformation
Prerequisite : Physical Metallurgy 1 (ENMT600006)
Textbooks :
1. Porter, D. A and Easterling, K.E, Phase Transformation in Metals and Alloys, 3rd. ed., CRC Press, 2009.
2. Rhines, F. N., Phase Diagram in Metallurgy, McGraw-Hill, 1956.
3. West. D. R. T., Ternary Equilibrium Diagram, 2nd ed., Chapman and Hall, London, 1992.

ENMT600013
ENMT610013
MINERAL PROCESSING
4 SKS
Objective : Students are able to explain the properties of minerals and their application, to know and understand the processes of processing of mineral / ore and equipment.
Syllabus : Understanding mineralogy, classification of minerals, mineral properties, mineral that has economic value. Terminology and basic concepts of processing mineral / ore, potential sources of mineral / ore that can be processed in a technically and economically, the processes of size reduction (comminution): The process of crushing, screening, grinding, the classification process, process of separation / concentration: Gravity concentration: Concentration Heavy Jigging Flowing Film, Media Separation, Flotation process, Magnetic Separation, High Tension Separation, Dewatering and Thickening process
Prerequisite : -
Textbooks :
1. Sorell. The Rocks and Minerals of the World, Collins, 1982
2. Hulburt, Jr. Manual of Mineralogy, John Wiley and Sons, 1979
3. B.A. Wills, Mineral Processing Technology, 4th ed., Pergamon Press, 1988
4. Gilchrist J.D., Extraction Metallurgy, Pergamon Press, London, 1980
5. Gill C.B., Non Ferrous Extractive Metallurgy, John Wiley and Sons Inc., 1980

ENEE600031
NUMERICAL METHOD
2 SKS
Refer to Page 179

ENIE600020
ENIE610020
INDUSTRIAL PROJECT MANAGEMENT
2 SKS
Refer to Page 359

ENMT600016
ENMT610016
CORROSION & DEGRADATION OF MATERIALS
3 SKS
Objective : Students are able to understand the effect of the damage of metals due to corrosion and degradation of metals and materials prevention
Syllabus : Principles of corrosion, kinetics of corrosion, polarization, passivation, measurement of corrosion rate, metallurgical aspects, corrosion tests, forms of corrosion, high temperature corrosion, cathodic protection, anodic protection, coating, inhibition, materials selection and design, monitoring and inspection, analysis of corrosion driven-damage, standards related to corrosion
Prerequisite : -
Textbooks:
1. Jones, DA, Principles & Prevention of Corrosion, McMillan Pubs. Co, 1992
2. Fontana, Corrosion Engineering, 3rd ed., 1992
3. Roberge, Pierre R, Handbook of Corrosion Engineering, McGraw-Hill Handbook, 1999.

ENMT600017
ENMT610017
CORROSION & DEGRADATION OF MATERIALS LAB
3 SKS
Objective : Students are able to conduct (i) principles of corrosion, (ii) measurement of corrosion potential, (iii) cathodic protection, (iv) metal protection technique.
Syllabus: Corrosion cells, corrosion potential measurement of selected metals, polarization of stainless steel, cathodic protection, surface treatment.
Prerequisite : -

Textbooks :
Corrosion Lab Module, Laboratory of Corrosion - Dept of Metallurgical and Materials, FTUI

ENMT600018
ENMT610018
EXTRACTIVE METALLURGY
3 SKS
Objective : Students are able to understand the fundamentals and extractive methods of ferrous and non ferrous metals especially in Indonesia, such as Al, Cu, Ni, Sn, Pb, Au, and their respective alloys, their application and developments
Syllabus : Basic principles of extractive metallurgy (pyrometallurgy, hydrometallurgy and electrometallurgy). Process/treatment process of ore to be extracted. Leaching method of oxide and sulfide ores, Bayer process, Al, Au leaching by cyanidation (Leaching; precipitation techniques; ion exchange; solvent extraction; reverse osmosis). Electrometallurgy (Electro winning and electro refining). Molten salt electro winning. Hall process. Electro winning of Mg, Ti. Secondary metals. Obtaining metals from scrap and secondary sources by using pyro-, hydro-, and electrometallurgy. Pyrometallurgy, mineral separation, slag, blast furnace, raw materials, reactions, material balance, iron ore, roasting, smelting, refining of Sn, Ni, Cu, Zn, Pb.
Prerequisite : -
Textbooks :
1. Pehlke, Robert D., Unit Processes in Extractive Metallurgy, Elsevier Pub., New York, 1973
2. J. J. Moore., Chemical Metallurgy, Butterworth-Heinemann, London, 1981
3. J. D. Gilchrist., Extractive Metallurgy, Pergamon., 2nd ed., Oxford, Pergamon Press, 1980
4. W. H. Dennis., Metallurgy of the Non-ferrous Metals, Sir Isaac Pitman & Sons Ltd., London, 1954
5. B. A. Wills, Mineral Processing Technology - An Introduction to The Practical Aspects of Ore Treatment and Mineral Recovery, 5th ed - Pergamon Press, Oxford, 1992

ENMT600019
ENMT610019
EXTRACTIVE METALLURGY LAB
1 SKS
Objective : Students are able to understand selected extractive methods of metals & electrometallurgy
Syllabus : Metals extraction test and electrometallurgy (e.g. Electroplating, froth flotation)
Prerequisite : -
Textbooks : Extractive Metallurgy Lab Module, Laboratory of Corrosion - Dept. of Metallurgical and Materials Engineering

ENMT600020
ENMT610020
HEAT TREATMENT AND SURFACE ENGINEERING
3 SKS
Objective : Students are able to explain various heat treatment process and determine the appropriate process for a certain metal/material to obtain micro and mechanical properties needed, and to be able to analyze heat-treatment behavior of material
Syllabus : Definition of heat treatment, phase transformation and microstructure, TTT and CCT diagram, the influence of heating and cooling rate, stable and metastable microstructure, hardenability, the influence of alloying element, hardening, softening, temper brittleness, distortion and its prevention, carburization, nitrocarburizing, nitriding, boronizing, non-ferrous heat treatment, various heat-treating furnace and its atmosphere, deviation in heat treatment process, special heat treatment, case study of heat treatment and surface engineering
Prerequisite : -
Textbooks :
1. Bill Bryson, Heat Treatment, Selection and Application of Tool Steel, Hanser-Gardner Publication, Germany, 1997
2. ASM, ASM Handbook Vol. 4: Heat Treating, ASM, International, Ohio, USA, 1991
3. ASM, Practical Heat Treating, ASM International, 2006.

ENMT600021
ENMT610021
POLYMER TECHNOLOGY
4 SKS
Objective : Students are able to explain the specification of a polymer product, raw materials and fabrication processes. Syllabus: Review of the polymer material; relation to the behavior of the polymer crystallinity, morphology, thermal properties, mechanical and rheological; polymer rheology; mechanical behavior of polymers: structure, properties and applications of Termoplast, Thermosets and Elastomers; polymer recycling and ecology; Polymer Processing: Processing of Polymers specifically on the application: Packaging; Automotive, and Electronics; along with downstream polymer industry visits.
Syllabus :
Prerequisite : Polymer Chemistry
Textbooks :
1. Fundamentals of polymer engineering Arie Ram Plenum press 1997
2. Handbook of Thermoset Plastics 2nd, Sidney H. Goodman 1998 Noyes Publisher
3. Handbook of Modern Plastics, Charles A Harper McGraw-Hill 2000
4. An Introduction to Rubber Technology, A Ciesielski, 1999, Rapra Tech, LTD.
5. PVC Handbook, C.E. Wilkes et al,
6. Recycling of plastic materials Francesco Paolo La Mantia Chem Tech Publisher 1993

ENMT600022
ENMT610022
TECHNOLOGY OF MICROSTRUCTURAL ANALYSIS

2 SKS
Objective: On completion of this subject, students are expected to understand the techniques for observing the microstructures of materials, including the optical and electron microscope and to be able to correlate the microstructures of materials with their properties
Syllabus : Techniques of microstructure analysis, Phase formation and general characteristic of material structures, Microstructure of steel; stable and metastable phases and the formation and mechanism, Microstructure of non-ferrous alloys; aluminum, copper, titanium, Macrostructure, Sampling techniques, Samples preparation, Observation techniques with optical and electron microscopes, Special measurements; micro-hardness, coating thickness, roughness, Quantitative metallography; grain size, volume fraction of phases and precipitates.
Prerequisite:-
Textbooks
1. Der Voort, V., Metallography Principles and Practice, McGraw Hill, 1984
2. Wojnar, Leszek, image Analysis, Application in Material Eng., CRC Press LLC, 1999

ENMT600023
ENMT610023
TECHNOLOGY OF MICROSTRUCTURAL ANALYSIS LAB
1 SKS
Objective : Students are able to master the techniques of metallographic testing and reporting the results of a systematic testing in accordance with the applicable standards
Syllabus : Metallographic sample preparation (techniques of cutting, grinding, polishing and etching), micro-structural analysis techniques of metal (ferrous and non-ferrous) with an optical microscope
Prerequisite : -
Textbooks :
1. Modul Praktikum Metalografi, Laboratorium Metalografi & Heat Treatment, Departemen Teknik Metalurgi dan Material FTUI.
2. Der Voort, V., Metallography Principles and Practice, McGraw Hill, 1984
3. Wojnar, Leszek., Image Analysis, Application in Materials Engineering, CRC Press LLC, 1999

ENMT600024
ENMT610024
COMPOSITE MATERIALS
2 SKS
Objective : Students are able to explain the composite material, the development and application and be able to calculate the mechanical and physical properties of composites by using rule of mixture
Syllabus : The concept, definition and clarification of the composite, matrix and reinforcement type for composites, metal matrix composite, polymer matrix composite, ceramic matrix composite, fiber composite nature. Reinforced fibers and Whiskers, the rule of mixtures, the interface in composite materials, interfacial area, Interfacial Wettability, interfacial bonding
Prerequisite : -
Textbooks :
1. Hull, D., An Introdution to composite Materials, Cambridge Uni. Press, 1981
2. Mattew, F.L. and R.D. Rawlings, Composite Materials: Engineering and Science, Chapman Hall, 1993
3. Bryan Harris, Engineering Composites Materials, 2nd Eddtion, Institute of Materials Communication Ltd, 1999

ENMT600025
ENMT610025
CERAMICS TECHNOLOGY
4 SKS
Objective : Students are able to explain the basic concepts of ceramic material, manufacturing technology and its applications in engineering; as well as understand and explain the processes of ceramics for various applications in the fields of engineering, ceramic refractory, manufacturing technology and its use.
Syllabus : Introduction to ceramics (general), crystal structure, glass structure, phase diagrams, phase transformations. Properties of ceramics: thermal, optical, mechanical, electrical and magnetic fields, as well as the nature dielektris. Manufacture of ceramic technology and applications: conventional ceramic (aluminum-silicate; clay, glaze); cement and concrete; glass and advanced ceramics (advanced ceramics). The processes for modern ceramics, ceramic thin film, ceramic for field application of mechanical, electronic, optical and magnetic. -Based ceramic matrix composites. Refractory ceramics. Refractory raw materials, types of refractories: refractory system Alumininum - silica, silica refractories, refractory magnesite, chromite refractories, refractory carbon, special refractories. Manufacture of refractories, the use of refractory metals in the industry and others, as well as the failure mechanism of refractory.
Prerequisite : -
Textbooks :
1. Kingery, Bowen and Uhlmann, Introduction to Ceramics, 2nd ed., John Wiley and Sons, 1976.
2. Richerson, Modern Ceramic Engineering-Properties, Processing and Use in Design, Marcel Dekker, 1982.
3. Noboru Icinose, Introduction to Ceramic Engineering, John Wolley, 1987.
4. Bambang Suharno, Refraktori, Diktat Kuliah, Departemen Metalurgi dan Material FTUI, 2007
5. Refractories Handbook, The Technical Association of Refractories, Japan, 1998
6. D.N. Nandi, Handbook on Refractories, Mc Graw-Hill 1987
7. Subrata Banerjee, Monolithic Refractories, A Comprehensive Handbook, World Scientific Publishing, 1998

8. J.D. Gilchrist, Fuels, Furnace and Refractories, Pergamon Press, 1977
9. M. Barsoum, Fundamentals of Ceramics, Taylor & Francis, 2002
10. Advanced Ceramic Processing & Technology, Noyes Pub., 1990

ENMT600026
ENMT610026
IRON & STEEL MAKING PROCESS
2 SKS
Objective : Students are able to explain the process of iron and steel making, and the equipment needed: starting from the raw materials preparation to the semi-finished products
Syllabus : Classification and the development of steel (iron ores, reductor, etc.) and their preparatory process, thermodynamics and kinetics of iron and steel making process, blast furnace reduction of iron ores, direct reduction (hylsa, midrex, rotary kiln SL-RN, rotary hearth), smelting reduction, desulfurization, deoxidation, dephosphorisation, degassing, steel making in EAF (Electric Arc Furnace) and BOF (Basic Oxygen Furnace), secondary metallurgy process, continuous casting, hot and cold rolling, special steel making.
Prerequisite : -
Textbooks :
1. A. K., Biswas, Principles of Blast Furnace Iron Making, Cootha Pub., Australia, 1981
2. Robert L. Stephenson and Ralph M. Smailer, Direct Reduced Iron Technology and Economics of Production and Use, The Iron and Steel Society of AIME, USA, 1980
3. R. H. Tupkary, Introduction to Modern Steel Making, Khanna Publisher, Delhi, 1989
4. E. T. Turdogan, Fundamentals of Steel Making, Institute of Metals, 1996

ENMT600027
ENMT610027
METAL FORMING
4 SKS
Objective : Students are able to explain the principles, phenomena, basic mechanisms and metal forming technique through liquid, solid and powder phase, and able to analyze and determine the process needed to produce a product of good quality
Syllabus : The forming of metals as a part of design process and manufacture; fundamentals of metal casting (mould, molten metal, solidification), mould (sand, ceramic, metal), pouring system (pattern, riser, pressure and unpressure, chill) and its simulation, solidification of cast iron and aluminum, liquid treatment for ferrous metals (inoculation, Mg treatment) and non-ferrous (modifier, grain refiner), various methods of casting, casting defect; common principle of solid forming of a metal, techniques of metal forming through: pressing, forging, rolling, extrusion, wire drawing, sheet metal forming; thermo-mechanical processing (TMP). General principle of powder metallurgy, powder fabrication and mechanism of powder forming, powder characteristics and characterization, mechanical alloying, pre-compaction process, compaction, precursor characteristic, sintering and powder consolidation, full density processing, sintering equipment and related aspects, application of powder metallurgy products
Prerequisite : -
Textbooks :
1. Heine, R. W. et.al., Principles of Metal Casting, McGraw-Hill Pub., New Delhi, 1986
2. Surdia, T. Teknologi Pengecoran Logam, P. Paramita, 1985
3. John Campbell, Castings, Second Edition, Elsevier Butterworth-Heinemann, 2004
4. John Campbell, Castings Practice: The Ten Rules of Castings, Elsevier Butterworth-Heinemann, 2005
5. Hosford, W. F and Robert M. Caddel., Metal Forming: Mechanic and Metallurgy, Prentice-Hall Inc., 1983
6. Harris, J. N., Mechanical Working of Metals. Theory and Practice, Pergamon Press, 1983
7. Dieter, G. F., Mechanical Metallurgy, McGraw Hill, 1976
8. Lenel, Powder Metallurgy, Principles and Application, MPIF, 1980
9. German, R. M., Powder Metallurgy Science, 1987
10. Alan Lawley, Atomization: The Production of Metal Powders, Metal Powder Industry Federation, New Jersey, 2003
11. C. Suryanarayana, Mechanical Alloying and Milling, Marcel Dekker, New York, 2004

ENMT600028
ENMT610028
METAL FORMING LAB
2 SKS
Objective : Students are able to apply the theories of metal forming through solidification and plastic deformation to solve realistic metal forming process problems in laboratory scale, qualitatively and quantitatively
Syllabus (1) Sand particle size distribution, water content calculation, additive substance (bentonite) content in mould, sand flowablity, relation of water and additive content in sand with permeability, shear and compressive strength of sand, (2) utilization of simulation software in calculation and design of casting, (3) Design of inlet and riser, mould making from patterns, making of the core of the mould, melting and pouring of molten metal to the mould, analysis of casting defect, analysis of casting product related to the alloying element and casting process.
Prerequisite : -
Textbooks :
Metal Forming Lab Module, Laboratory of Metal Forming - Dept of Metallurgical and Materials, FTUI

ENMT600029

ENMT610029
MATERIALS JOINING
3 SKS
Objective : Students are able to explain and choose the appropriate procedure and methods of joining for a given application that the product obtained has a good joint
Syllabus : Principles of various material joining and its classification, adhesive bonding, mechanical joining, methods of welding: fusion welding (electric arc), electrical resistance welding, pressure welding (solid state welding), other welding process (EBW, laser welding, thermit welding, underwater welding), soldering and brazing, design of joint and welding symbol, welding metallurgy: carbon steel, low alloy steel, stainless steel, concrete steel, non ferrous, WPS and welding standards and code, weld defect and its prevention, control of joint and its testing
Prerequisite : -
Textbooks :
1. Winarto & Anis, M., Welding, Lecture Note, 2007
2. Larry F. Jeffus, Welding Principles and Applications, 5th Edition:
3. Kou, Welding Metallurgy, 2nd Edition, John Wiley and Sons, 2005
4. Easterling, K., Introduction to Physical Metallurgy of Welding, Butterworth and Co. Ltd., London, 1992
5. Jeffery D. Mouser, Welding Codes, Standards, and Specifications
6. David A. Grewell (Editor), Plastics and Composites Welding Handbook,
7. Alphonsus V. V. Pocius, Adhesion and Adhesive Technology,

ENMT600030
ENMT610030
CAPITA SELECTA
2 SKS
Objective : Students are able to (i) understanding the development and industrial issues related to the metallurgical and materials engineering (ii) Understand the non engineering aspects that need to be controlled by materials engineer in order to increase competitiveness in the world of work.
Syllabus : Specific topics that have not been included in Subjects and supplied by external resource persons which is experienced in industry
Prerequisite : -
Textbooks : -

ENMT600031
ENMT610031
ENGINEERING DESIGN OF PRODUCT
3 SKS
Objective : Students, in groups, are able to apply the principles of engineering design thoroughly in a simple engineering design project according to the acquired knowledge of metallurgy and materials
Syllabus : Introduction to Engineering Design, total design activity, group dynamics and design management, problem identification and design specification, creativity and the conception of design, modeling, optimallisation, materials and process selection, design communication and presentation.
Prerequisite : -
Textbooks :
1. Saptono, Rahmat. First Lecture on Engineering Design. Universitas Indonesia, 2006
2. Hurst, Kenneth S., Engineering Design Principles, 1st Ed., Arnold, New York, 1999
3. Pugh, Stuart, Total Design, Integrated Methods for Successful Product Engineering., Addison-Wesley Publisher Ltd., Edinburgh 1991
4. Dym, Clive L and Patrick Little, Engineering Design, A-Project-Based Introduction, John Wiley and Sons, Inc., 2000
5. Dieter, G. E., Engineering Design, A Material and Processing Approach, 2nd ed., McGraw Hill., 1991
6. Ashby, M. F, Materials Selection in Mechanical Design, 2nd ed., Cambridge Uni. Press., Oxford, 1999

ENMT600032
ENMT610032
FRACTURE MECHANICS & FAILURE ANALYSIS
4 SKS
Objective : Students are able to (i) understand the principles of a material's failure and (ii) analyze, write a report, and present the failure of a material in a given case according to the standard principles, steps, and procedures.
Syllabus : Aspects of failure engineering and its analysis, sources/factors contributing the material's failure, explanation of failure factors, types of fractures, stress system and residual stress, theories of fracture mechanics and introduction to the risk-based inspection, failure due to: fatigue, creep, wear, brittleness, heat treatment, residual stress, corrosion and environment, case study.
Prerequisite : -
Textbooks :
1. Wulpi, D. J., Understanding How Components Fail, ASM, 1998
2. Charlie, R. B and Ashok, C., Metallurgical Failure Analysis, McGraw-Hill Inc., 1993
3. French, D. N., Metallurgical Failure in Fossil Fired Boilers, John Wiley & Sons, 1983
4. R. J. Shipley and W. T. Becker (ed)., Failure Analysis and Prevention, ASM Handbook Vol. 11., ASM International
5. Principles of Failure Analysis (15-Lesson Series), ASM International
6. Daniel P. Dennies, How to Organize and Run a Failure Investigation
7. Myer, Ezrin, Plastics Failure Guide: Cause and Prevention
8. Arthur J. McEvily, Metal Failures: Mechanisms, Analysis, Prevention

ENMT600033
ENMT610033
INTERNSHIP
2 SKS
Objective : Students are able to acquire the industrial experience and to do their duty in engineering of management and technical
Syllabus : A minimum of 1 month of in the job training. The result of the Job Training is submitted as written report and is presented before the job training assembly
Prerequisite : -
Textbooks
1. Relevant reference in relation to the job training subject
2. Job Training Guidelines, Dept. of Metallurgical & Materials Engineering, FTUI

ENMT600034
ENMT610034
SEMINAR
1 SKS
Objective : Students are able to define problems for a final assignment research, to conduct literacy study, to construct research methodology and to present in the form of scientific paper.
Syllabus : Final assignment writing guide including initial research, abstract writing guide, research methodology, type of references, discussion, also conclusion. To make scientific paper from existing final report which then be presented according to certain journal term or final assignment proposal presentation.
Prerequisite : -
Textbooks :
1. Related Books to research topic
2. Felicia N. Utorodewo, Lucy R. Montolalu, L. Pamela Kawira, Bahasa Indonesia – Sebuah Pengantar Penulisan Ilmiah (Bahasa Indonesia 3. An Introduction to Scientific Writing), Program PDPT UI, 2004

ENMT600035
ENMT610035
FINAL PROJECT
4 SKS
Objective : Students are able to accomplish a final assignment research, to conduct literacy study, to construct research methodology and to produce final report according to the theme and scope approved by the counselor.
Syllabus : Implementation/application of various lectures taken by students on integration in a research to solve a problem in metallurgy and material engineering field. The research result is presented in a form of scientific report and presented in front of the judging lecturers.
Prerequisite : -
Textbooks :
1. Related Books to research topic
2. Panduan Skripsi (Final Project Guidelines), Engineering Faculty – Universitas Indonesia

ELECTIVE COURSES FROM MASTER PROGRAM

ENMT800001
SPECIAL STEELS & SUPER ALLOYS
3 SKS
Refer to Page 439

ENMT801002
ADDITIVE & DERIVATIVE OF POLYMERS
3 SKS
Refer to Page 439

ENMT800003
INDUSTRIAL MECHANIC EQUIPMENT
3 SKS
Refer to Page 439

ENMT801004
HIGH TEMPERATURE CORROSION
3 SKS
Refer to Page 439

ENMT800005
QUALITY MANAGEMENT SYSTEM
3 SKS
Refer to Page 440

ENMT800006
ADVANCED MATERIAL
3 SKS
Refer to Page 440

ENMT801007
MACHINING & POLYMER RECYCLING TECHNOLOGY
3 SKS
Refer to Page 440

ENMT801008
ADVANCED SURFACE ENGINEERING
3 SKS
Refer to Page 440

ENMT800009
ADVANCED EXTRACTIVE METALLURGY
3 SKS
Refer to Page 441

ENMT800010
ADVANCED POLYMER PRODUCT PROCESSING
3 SKS
Refer to Page 441

ENMT800011
PROJECT MANAGEMENT
3 SKS
Refer to Page 441

ENMT800011
NANOTECHNOLOGY
3 SKS
Refer to Page 442

4.8. UNDERGRADUATE PROGRAM IN ARCHITECTURE

Program Specification

1	**Awarding Institution**		Universitas Indonesia, for Double Degree Program : Universtas Indonesia and partner university
2	**Teaching Institution**		Universitas Indonesia Double Degree: Universitas Indonesia and Partner Universities
3	**Program**		Undergraduate Program in Architecture
4	**Class**		Regular, Parallel, International
5	**Degree Offered**		Sarjana Arsitektur (S.Ars) for Double Degree: Sarjana Arsitektur (S.Ars) and Bachelor of Architecture (B.Arch)
6	**Accreditation / Recognition**		A Accredited from BAN-PT AUN-QA
7	**Language of Instruction**		Bahasa Indonesia and English
8	**Study Scheme (Full time/Part time)**		Full time
9	**Entry requirement**		SMA Graduate/equal or D3/Polytechnic graduate
10	**Duration of Study**		4 years / program
	Semester	Total of semester	Weeks / Semester
	Regular	8	16-17
	Short (optional)	3	8
11	**Graduates Profile:** Sarjana Arsitektur is a graduate who has the ability to design architecture with respect to context and local needs and is based on the application of basic theories and architectural knowledge. Graduates are expected to have the ability as: • **An Initiator**- able to provide solutions to spatial problems critically and creatively with respect to local context and needs • **A Designer** - have the skill in assembling architectural elements and materials, have an understanding of built aspects, and have a sensibility in creating meaningful architectural design. • **A Communicator** – able to communicate ideas through words, writings, drawings, modeling and other media. • **A Collaborator** - able to work together with various stakeholders to propose creative solutions for real problems		
12	**Graduation Competence:** ***A. Basic and Personality*** 1. Understanding of religious aspects in personal life and society. ***B. Design*** 2. Ability to envision, think creatively, innovatively and promote design leadership 3. Ability to collect information, to formulate problems and to analyze 4. Ability to think three-dimensionally throughout the process of design exploration 5. Ability to synchronize a variety of design issues, integrate architectural knowledge and apply skills for design solutions.		

C. Knowledge

C1. Cultural and Artistic Studies

6. Ability to act with respect to historical and cultural precedents in local and world architecture. Ability to act with knowledge of the fine arts as an influence on the quality of architectural design.
7. Ability to design and apply basic visual arts and to understand their influence in the quality of architectural design.
8. Ability to identify architectural heritage issues in the built environment.
9. Ability to identify the linkage between architecture and other creative disciplines.

C2. Social Studies

10. Ability to act with respect to community knowledge, and to work with clients and users that represent the community's needs.
11. Ability to develop a project brief by defining the needs of users and clients, and to research and define contextual and functional requirements for different types of the built environment. An awareness of the relevant codes, regulations and standards for planning, design, construction, health, safety and use of built environments.
12. Ability to formulate social context where the built environment is located, to define ergonomic and space requirements and related issues of equity and access.
13. Ability to identify the relevant codes, regulations and technical standards for planning, design, construction, health, safety and occupancy of the built environment.

C3. Environmental Studies

14. Ability to act with knowledge of natural systems and the built environment.
15. Ability to formulate conservation and waste management issues.
16. Ability to formulate the lifecycle of materials, issues of ecological sustainability, environmental impact, and to design for reduced use of energy as well as passive cooling systems and their related energy management.
17. Ability to identify history and practice of landscape architecture, and urban design, as well as territorial and national planning and their various relationships to local and global demographic and resource management.
18. Ability to identify natural management systems to reduce natural disaster risks mitigation.

C4. Technical Studies

19. Ability to identify technical knowledge i.e structures, materials, and construction.
20. Ability to formulate technical design processes and structural integration, construction technologies and building utilities into an effectively functional system.
21. Ability to formulate building utility systems, vertical transportation systems, telecommunication, maintenance and building safety systems.
22. Awareness of the importance of technical documentation and specifications in design implementation, construction processes, budget planning and control.
23. Ability to act with innovative technical competence in the use of building techniques and the understanding of their evolution.

C5 Design Studies

24. Understanding of design theory and methods.
25. Ability to formulate design procedures and processes.
26. Ability to identify design precedents and to engage in architectural criticism.

C6 Professional Studies

27. Ability to act with respect to knowledge of the architectural profession, along with business, financial and legal aspects.
28. Ability to understand different forms of procurement of architectural services.
29. Awareness of the management and organization of the construction and development industry, financial dynamics, real estate investment and facilities management.
30. Awareness of the potential roles of architects in conventional and new areas of activity in a local and an international context.
31. Understanding of business principles and their application to the development of the built environment, project management and the function of professional consultancy.

D. Skill

32. Ability to act and to communicate ideas through collaboration, speaking, literacy, numeracy, writing, drawing, modeling and evaluation.

	33. Ability to utilize manual, electronic, graphic and model making to explore, develop, define and communicate a design proposal. 34. Ability to learn systems evaluation techniques that use manual and/or electronic means for the performance assessment of the built environment. 35. Ability to arrange scientific papers ***E. Design Behaviour*** 36. Ability to understand professional ethics and codes of conduct in architectural practices and to comprehend the architects' legal responsibilities where they are registered and practiced. 37. Ability to conduct academic ethics ***F. Social Life*** 38. Understanding citizenship and ability to communicate in national and international language(s).

13	**Course Composition**		
No	Type of Course	Credits	Percentage
i	University General Subjects	18	12,5
ii	Basic Engineering Subjects	12	8,33
iii	Architecture Core Subjects	81	56,25
iv	Electives	25	17,36
v	Undergraduate Thesis	8	5,56
	Total	144	100 %
14	**Total credits for graduation**		**144 Credit Semester Units**

Job Opprtunity

Graduates of Strata-1 Architecture Program UI hold a Sarjana Arsitektur with pre-professional qualifications. The graduate will be able/can may work as an intern in a professional practice or to continue on to a Professional Architectural Education Program (PPARS) (Architect). To obtain professional certification, a graduate has to perform an internship and pass the qualification assessment by the professional association (IAI/Indonesian Institute of Architects).

A graduate holding a Sarjana Arsitektur UI can work in various fields of the construction industry such as architecture, interior design or construction supervision. In addition to pursuing a career in the architectural field, graduates are able to develop a career as an assessor for project feasibility studies, building and environmental management, to work in the building materials industries as well as working in the public sector related to government buildings, construction and the built environment. In addition to these areas, graduates can also work in various fields of work that employ creative abilities and critical thinking skills.

COMPETENCY NETWORK

Sarjana Arsitektur are those graduates who are able to design architecture in line with context and local needs

Ability to design architecture imaginatively, creatively, and innovatively using analytical abilities; logical thinking as well as three-dimensional thinking, and to synchronize a variety of design issues

Ability to apply arts and cultural knowledge in architectural design

Ability to apply social knowledge in relation to architectural design

Ability to apply environmental knowledge in relation to architectural design

Ability to apply design knowledges in architectural design

Ability to apply technical knowledges in architectural design

Ability to employ a variety of communication techniques in architectural design and the ability to write scientific paper(s)

Deep understanding of professional ethics in the architectural profession

Ability to apply basic principles of mathematics and physics in solving the problems of architectural design

Ability to think critically, creatively, and innovatively as well as having the intellectual curiosity to solve problem(s) as an individual and in a group

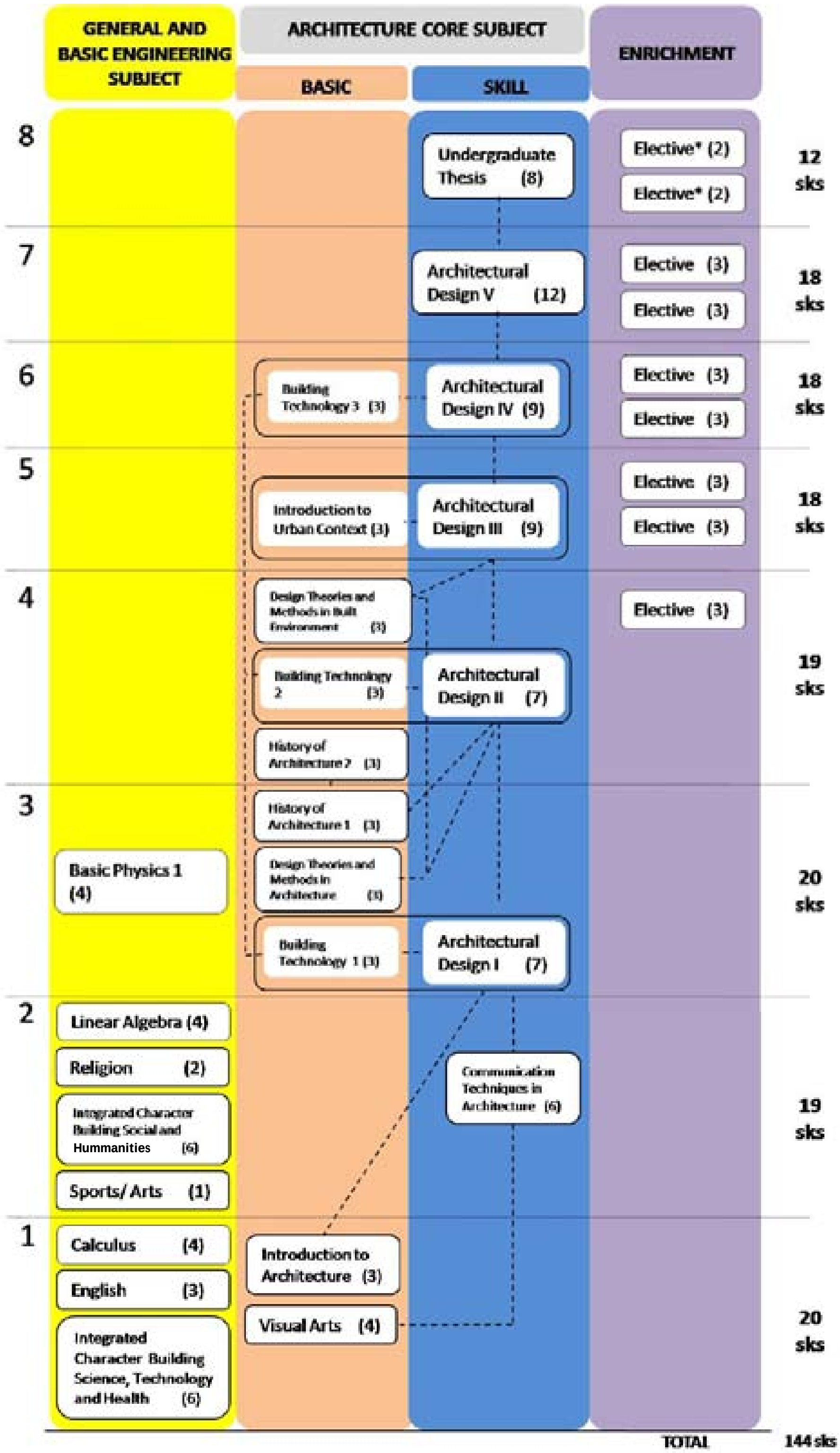
Ability to employ information technology and communication

Ability to identify the various entrepreneurial efforts, characterized by innovation and independence based on ethical principles

Ability to communicate ideas in spoken and written expression (Indonesian and English) both in an academic and non-academic context

Ability to provide alternative solutions to various problems for the society, nation and state

COURSES NETWORK



--------- Student has taken or is taking
*) Should be taken outside the Department of Architecture

Curriculum Structure of Regular/Parallel Bachelor Degree in Architecture

COURSE CODE	COURSE SUBJECT		CREDITS
	Semester 1	**1st Semester**	
UIGE600004	MPK Terintegrasi B	Integrated Character Building Subject B	6
UIGE600002	Bahasa Inggris	English	3
ENGE600001	Kalkulus	Calculus	4
ENAR600001	Pengantar Arsitektur	Introduction to Architecture	3
ENAR600010	Seni Rupa	Visual Arts	4
		Sub Total	**20**
	Semester 2	**2nd Semester**	
UIGE600001	MPK Terintegrasi A	Integrated Character Building Subject A Social Hummanities	6
UIGE600005 s.d. 9	Agama	Religious Studies	2
ENGE600002	Aljabar Linear	Linear Algebra	4
UIGE600003	Olahraga/ Seni	Sports/ Arts	1
ENAR600011	Teknik Komunikasi Arsitektur	Communication Techniques in Architecture	6
		Sub Total	**19**
	Semester 3	**3rd Semester**	
ENGE600003	Fisika Dasar 1	Basic Physics 1	4
ENAR600003	Perancangan Arsitektur 1	Architectural Design 1	7
ENAR600015	Teori & Metode Perancangan Arsitektur	Design Theories and Methods in Architecture	3
ENAR600008	Sejarah Arsitektur 1	History of Architecture 1	3
ENAR600012	Teknologi Bangunan 1	Building Technology 1	3
		Sub Total	**20**
	Semester 4	**4th Semester**	
ENAR600004	Perancangan Arsitektur 2	Architectural Design 2	7
ENAR600016	Teori & Metode Perancangan Lingkungan	Design Theories and Methods in Built Environment	3
ENAR600009	Sejarah Arsitektur 2	History of Architecture 2	
		Building Technology 2	3
ENAR600013	Teknologi Bangunan 2	Elective	3
	Pilihan	**Sub Total**	**16**

	Semester 5	5th Semester	19
ENAR600005	Perancangan Arsitektur 3	Architectural Design 3	9
ENAR600005	Pengantar Konteks Perko-taan	Introduction to Urban Context	3
ENAR600002	Pilihan	Elective	3
	Pilihan	Elective	3
		Sub Total	18
	Semester 6	**6th Semester**	
ENAR600006	Perancangan Arsitektur 4	Architectural Design 4	9
ENAR600014	Teknologi Bangunan 3	Building Technology 3	3
	Pilihan	Elective	3
	Pilihan	Elective	3
		Sub Total	**18**
	Semester 7	7th Semester	
ENAR600007	Perancangan Arsitektur 5	Architectural Design 5	12
	Pilihan	Elective	3
	Pilihan	Elective	3
		Sub Total	**18**
	Semester 8	8th Semester	
ENAR600017	Skripsi	Undergraduate Thesis	8
	Pilihan	Elective *)	2
	Pilihan	Elective *)	2
		Sub Total	**12**
		Total	**144**

ELECTIVES

COURSE CODE	COURSE SUBJECT		CREDITS
ENAR600018	Akustik	Acoustics	3
ENAR600019	Arsitektur di Kawasan Pesisir	Coastal Architecture	3
ENAR600020	Arsitektur Etnik	Ethnic Architecture	3
ENAR600021	Arsitektur Pusaka	Heritage in Architecture	3
ENAR600022	Arsitektur, Kota dan Kuasa	Architecture, City and Power	3
ENAR600023	Dasar Komputer untuk Arsitek-tur	Basic Computing in Architecture	3
ENAR600024	Ekologi Perkotaan	Urban Ecology	3
ENAR600025	Fasad Bangunan Tinggi	High-Rise Building Facades	3
ENAR600026	Fotografi	Photography	3
ENAR600027	Geometri dan Arsitektur	Geometry and Architecture	3

ENAR600028	Keseharian dan Arsitektur	Everyday and Architecture	3
ENAR600029	Perancangan Kota	Urban Design	3
ENAR600030	Perancangan Ruang Dalam	Interior Design	3
ENAR600031	Perancangan Ruang Luar	Site Planning	3
ENAR600032	Perencanaan Kota dan Wilayah	Urban and Regional Planning	3
ENAR600033	Psikologi Arsitektur	Architectural Psychology	3
ENAR600034	Real Estate	Real Estate	3
ENAR600035	Sejarah Arsitektur Lanjut	Advanced History of Architecture	3
ENAR600036	Struktur dan Konstruksi Lanjut	Advanced Building Technology	3
ENAR600037	Studi Kelayakan Proyek	Project Feasibility Study	3
ENAR600038	Tata Cahaya	Lighting Design	3
ENAR600039	Teori Perumahan Kota	Urban Housing Theories	3
ENAR600040	Utilitas Bangunan Lanjut	Advanced Building Utility	3
ENAR600041	2D – Komunikasi Desain Digital	2D - Digital Design Communication	3
ENAR600042	3D – Komunikasi Desain Digital	3D - Digital Design Communication	3
ENAR600043	Kapita Selekta	Capita Selecta	3
ENAR600044	Kajian Mandiri	Independent Study	3
ENAR600045	Kerja Praktek/KKN	Internship	3
	Lingkungan Daur Hidup	Life Cycle Environment	3

*) Students must take at least two courses outside the department of architecture as a elective courses

SIMULATION OF FAST TRACK S2 PROGRAM

S1/S2 Fast Track	S2 Courses	SKS
7th Semester	1st Semester	
Elective S1	Advanced Design Theories & Research Methods *(Metode Perancangan Lanjut dan Penelitian)*	4
Elective S1	Advanced Architectural Theory *(Teori Arsitektur Lanjut)*	3
Semester 8	2nd Semester	
Elective S1	Field Area Theory *(Teori Kekhususan)*	3
Elective S1	Field Area Studio/Workshop 2 *(Studio/Workshop Kekhususan)*	5
Elective S1	Elective S2 *(Pilihan S2)*	3
Semester 9	3rd Semester	
	Field Area Studio/Workshop 1 *(Studio/Workshop Kekhususan 1)*	5
	Pre-Thesis Seminar *(Seminar Thesis)*	3
	Elective *(Pilihan)*	3
Semester 10	4th Semester	
	Thesis	8
	Elective S2	3
	TOTAL	**40**

CURRICULUM STRUCTURE OF ARCHITECTURE PROGRAM (INTERNATIONAL CLASS)

COURSE CODE	COURSE SUBJECT	CREDITS
	1st SEMESTER	
ENGE610003	Basic Physics 1	4
UIGE610002	Academic Writing	3
ENAR610014	Introduction to Architecture	3
ENGE510001	Calculus	4
ENAR610016	Visual Arts	4
	Sub Total	**18**
	2nd SEMESTER	
ENGE610002	Linear Algebra	4
ENAR610009	Communication Techniques in Architecture	6
	Elective *	2
	Elective **	3
	Elective	3
	Sub Total	**18**
	3rd SEMESTER	
ENAR610001	Architectural Design 1	7
ENAR610010	Design Theories and Methods in Architecture	3
ENAR610012	History of Architecture 1	3
ENAR610006	Building Technology 1	3
	Elective	3
	Sub Total	**19**
	4rd SEMESTER	
ENAR610002	Architectural Design 2	7
ENAR610011	Design Theories and Methods in Built Environment	3
ENAR610013	History of Architecture 2	3
ENAR610007	Building Technology 2	3
	Elective	3
	Sub Total	**19**
	5th SEMESTER	
ENAR610003	Architectural Design 3	9
ENAR610015	Introduction to Urban Context	3
UIGE610001	Integrated Character Building Social and Humanities	6
	Sub Total	**18**
	6th SEMESTER	
ENAR610004	Architectural Design 4	9
ENAR610008	Building Technology 3	3
UIGE610004	Integrated Character Building Science, Technology and Health	6
UIGE610005 - 9	Religion	2
	Sub Total	**20**
	7th SEMESTER	
ENAR610005	Architectural Design 5	12
	Elective	3
	Elective	3
	Sub Total	**18**
	8th SEMESTER	
ENAR610017	Undergraduate Thesis	8
UIGE610003	Sports/ Arts	1
	Elective	2
	Elective	3
	Sub Total	**14**
	Total	**144**

LIST OF ELECTIVE COURSES

COURSE CODE	COURSE SUBJECT	CREDITS
ENAR610018	Acoustics	3
ENAR610019	Basic Computing in Architecture	3
ENAR610020	Ethnic Architecture	3
ENAR610021	Introducing Proffesional Learning	2
ENAR610022	Introducing Sustainability	3
ENAR610023	Life Cycle Environment	3
ENAR610024	Lighting Design	3
ENAR610025	Photography	3
ENAR610026	Real Estate	3
ENAR610027	Site Planning	3
ENAR610028	2D- Digital Design Communication	3
ENAR610029	3D- Digital Design Communication	3
ENAR610030	Capita Selecta	3
ENAR610031	Independent Study	3
ENAR610032	Internship	3

- Two subjects of the elective courses have to be taken outside the Department of Architecture
- Students who are planning to study abroad/to participate in an exchange program in Year 3, could take Integrated Character Building in their 4th year.
- Courses taken during study abroad / exchange program can be transferred to fulfill the 144 Credit Semester Units requirement (upon approval of Credit Transfer Committee).

COURSE STRUCTURE OF ARCHITECTURE AT CURTIN UNIVERSITY

Year 3	Semester 5 (Curtin) July	Credits
Course Code	Course Subject	
8385 V.3	Architecture Design 202	37.5
311059 V.1	Building Technology 204	25
7553 V.10	Building Science 202	12.5
6851 V.5	Architecture and Culture 302	12.5
6848 V.4	Architectural Techniques 202	12.5
		100

Year 3	Semester 6 (Curtin) Feb	Credits
Course Code	Course Subject	
9521 V.3	Architectural Design 301	37.5
3836 V.7	Building Technology 301	25
7554 V.11	Building Science 301/321	25
	Arch Histories of Illusion Power and Imagination 201	12.5
		100

Year 4	Semester 7 (Curtin) July	Credits
Course Code	Course Subject	
9522 V.3	Architectural Design 302	37.5
7579 V.6	Building Technology 302	12.5
3837 V.7	Building Science 302	12.5
	Australian Architectural Identity 202	12.5
	Elective	25
		100

Course Description

UIGE600001
UIGE610001
MPKT A / INTEGRATED CHARACTER BUILDING A
6 SKS
Refer to Page 74

UIGE600004
UIGE610004
MPKT B / INTEGRATED CHARACTER BUILDING B
6 SKS
Refer to Page 74

UIGE600002
ENGLISH
UIGE610002
ACADEMIC WRITING
3 SKS
Refer to Page 74

UIGE600003
UIGE610003
SPORTS / ARTS
1 SKS
Refer to Page 77

ENGE600001
ENGE610001
CALCULUS
4 SKS
Refer to Page 74

ENGE600010
ENGE610010
BASIC CHEMISTRY
Refer to Page 75

ENGE600003
ENGE610003
BASIC PHYSICS 1
4 SKS
Refer to Page 75

ENGE600002
ENGE610002
LINEAR ALGEBRA
4 SKS
Refer to Page 75

UIGE600005-9
UIGE610005-9
RELIGIOUS STUDIES
2 SKS
Refer to Page 76-77

ENAR600001
ENAR610014
INTRODUCTION TO ARCHITECTURE
3 CREDIT UNITS
Learning objectives: to introduce basic knowledge in architecture, to introduce basic architectural principles, to introduce the act of creating architecture works, to introduce the aspect of sustainability, to introduce the role of the architect, and architecture's position among other disciplines. Upon completion of this course, students are expected to be able to distinguish architecture from building construction, explain the relationship between architects and society (architect's role and architecture's domain), the essence of architecture, and demonstrate examples of architectural objects and principles.
Syllabus: People and environments: natural environment, built environment, social environment. The necessity to build shelter. Architecture, architect, practicing and experiencing architecture. Boundary, spatial boundary, building and builder. Background and foreground, solid and void, rugged and soft, single and multiple, far and close, high profile and low profile, complexities of function, science and design. Knowing, defining, and solving problems, explaining architectural works. Architects, architectural practices, code of ethics, milestone architects.
Prerequisites: -
References:
1. Conway, Hazel dan Rowan Roenisch. *Understanding Architecture: An Introduction to Architecture and Architecture History*. London & New York: Routledge, 1994.
2. Doxiadis, Constantinos A. *Ekistics: An Introduction to the Science of Human Settlement*. New York: Hutchinson, 1968.
3. Gideon, Sigfried. S*pace, Time, and Architecture*. Cambridge, Mass: Harvard University Press, 1964.
4. Gorman, James F. *ABC of Architecture*. Philadelphia: University of Pennsylvania Press, 1998.
5. Gropius, Walter. *Apollo in Democracy; The Cultural Obligation of the Architect*. New York: McGraw Hill, 1968.
6. Hall, Edwart T. *The Hidden Dimension*. New York: Double Day, 1966.
7. Hilier, Bill. *Space is the Machine*. Cambridge: Cambridge University Press, 1996.
8. Jackson, J.B. *Discovering the Vernacular Landscape*. New Haven: Yale University

Press, 1984.
9. Mangunwijaya, Y.B. *Wastucitra: Pengantar ke Ilmu Budaya Bentuk Arsitektur; Sendi-sendi Filsafatnya Beserta Contoh-contoh Praktis*. Jakarta, Gramedia, 1988.
10. Moore, Charles dan Gerald Allen. *Dimensions, Space, Shape, and Scale in Architecture*. New York: Architecture Books, 1975.
11. Pevsner, Nikolaus. *An Outline of European Architecture*.(7th edition) Middlesex, 1985.
12. Raskin, Eugene. *Architecture and People. Englewood Cliff*. New Jersey: Prentice Hall, 1974.
13. Sullivan, Louis. *Kindergarten Chat*. New York: Dover, 1960.
14. Tuan, I-Fu. *Space and Place: An Experiencial Perspectives*. Mineapolis: University of Minnesota Press, 1980.
15. Van de Ven, Cornelis. *Space in Architecture: The Evolution of a new idea in the Theory and History of Modern Movement*. Assen: Van Gorcum, 1980.
16. Venturi, Robert. *Complexity and Contradiction in Architecture*. New York: Museum of Modern Art Paper Series, 1966, 1977.
17. Vitruvius, M.P. *Ten Books of Architecture*. Terjemahan: M.Viadon and G. Caffee. Chicago: University of Chicago Press, 1960.

ENAR600010
ENAR610016
VISUAL ARTS
4 CREDIT UNITS

Learning objectives: To provide knowledge on basic visual elements, basic principles of aesthetics, composition, dimensionalities, and craftmanship.

Syllabus: Knowledge on basic visual elements. Knowledge of basic principles of aesthetics: beauty, ugliness; order, disorder. Composition: the formation of an object (point, line, plane, space, mass). Dimensions: two dimensionality, three dimensionality. Freedom of expression. Design meaning: 'from nothing to something'. Craftsmanship (materials, material treatment)

Prerequisites: -

References:
1. Frank D.K.Ching, *Architecture, Form, Space & Order*, John Wiley & Sons, 1997
2. Hideaku Chijiiwa, *Color Harmony*, Rockport Publisher, 1992
3. Bride M. Whelan, *Color Harmony-2,* Rockport Publisher, 1994
4. H. Harvard Anarson, *History of Modern Art: Painting, Sculpture, Architecture & Photography*, Prentice Hall. 1998
5. Kimberly Elam, *Geometry of Design*, Princeton, 1998

ENAR600011
ENAR610009
COMMUNICATION TECHNIQUES IN ARCHITECTURE
6 CREDIT UNITS

Learning objectives: to enable students to express architectural ideas through appropriate communication media

Syllabus: Introduction to a variety of communication techniques that can be used to present the idea of architecture, determining the appropriate communication techniques for particular ideas to be communicated to a particular audience, communicating visual shapes, communicating the conceived space. Communicating the space for human activities.

Prerequisites: Students have taken Visual Arts

References:
1. Frank D.K.Ching, *Drawing & Perceiving A Visual Dictionary of Architecture*. John Wiley & Sons, 1996
2. Frank D.K.Ching, *Architectural Graphics*, 2nd Ed. John Wiley & Sons, 2002
3. Francis DK Ching, *Drawing: A Creative Process*, Wiley, 1989
4. Paul Laseau and Norman Crewe, *Visual Notes for Architects and Designers*, Wiley 1986
5. Tom Porter and Sue Goodman, *Manual of Graphic Techniques*, Scribner, 1991

ENAR600008
ENAR610012
HISTORY OF ARCHITECTURE I
3 CREDIT UNITS

Learning objectives: Introducing modern architecture, with an emphasis on Western development.

Syllabus: Definition and description of modern architecture, Neo-Classics, urbanism and city planning, science and technological developments, Arts & Crafts, modernist architecture, late modernist architecture, post-modern architecture

Prerequisites: -

References:
1. Spiro Kostof, *A History of Architecture: Setting and Rituals*, 2nd edition, Oxford University Press, USA, 1985

2. Leonardo Benevolo, *History of Modern Architecture*, MIT Press, 1977

ENAR600015
ENAR610010
DESIGN THEORIES AND METHODS IN ARCHITECTURE
3 CREDIT UNITS
Learning objectives: To provide students with basic theories & basic methods of design, in order to enable students to explain their own ideas and works, as well as to apply one of the design methods through writing & drawing (sketches)
Syllabus: Theory and way of thinking; phenomenology, semiotics. Theory and identification of problems: architectural observation, design knowledge, the factual, the deontic, instrumental, black box, clear box. Theory and ways to comprehend problems, analysis & synthesis, theory and problem solving.
Prerequisites: -
References:
1. Gunawan Tjahjono, *Metode Perancangan: Suatu Pengantar untuk Arsitek dan Perancang*, 1998
2. Christopher Alexander, *Notes on The Synthesis of Form*, Harvard University Press,1994

ENAR600009
ENAR610013
HISTORY OF ARCHITECTURE 2
3 CREDIT UNITS
Learning objectives: Introduction to Indonesian modern architecture
Syllabus: Definition and description of modern architecture in Indonesia. The height of Dutch East Indies, 1870-1990, early modern architecture in Holland, works of first generation of Indonesian and Dutch architects during colonial era, Indonesian modernism, International Style and its local variants, architecture and the construction industry, eclecticism. Recent works in Indonesia.
Prerequisites: -
References:
1. Huib Akihary, *Architectuur en Stedebouw in Indonesie 1870-1970*, De Walburg Pers; Volledig herziene druk edition, 1990
2. Leonardo Benevolo, *History of Modern Architecture - Vol. 1*, MIT Press, 1977
3. Leonardo Benevolo, *History of Modern Architecture - Vol. 2*, MIT Press, 1977
4. *Indonesian Heritage Series: Vol 6 Early Modern History of the Indonesian Archipelago*, Editions Didier Millet, 1996

ENAR600016
ENAR610011
ENVIRONMENTAL DESIGN THEORIES AND METHODS
3 CREDIT UNITS
Learning objectives: To provide students with basic theories and methods of environmental design, so that they are able to explain their own ideas and works, and apply one of various methods of designing built environment through writing and drawing (sketches).
Syllabus: Theory and way of thinking: axiomatic and reductive; Theory and how to recognize built environment related problems, observing the environs and structures which shape them, theory and ways to comprehend built environment problems, theory and ways to solve built environment design problems.
Prerequisites: -
References:
1. Gunawan Tjahjono, *Metode Perancangan: Suatu pengantar untuk arsitek dan perancang*, 1998
2. Christopher Alexander, *Notes on the Synthesis of Form*, Harvard University Press, 1994
3. Christopher Alexander, *Timeless Way of Buildings*, Oxford University Press, 1979

ARCHITECTURAL DESIGN

Architectural Design courses are the studio courses at the Department of Architecture. The studios denote learning locations, as well as learning methods. Ability that is expected at the end of studio-based learning process is thinking critically and creatively, that can be measured from student ability to explain and present her/his design ideas.
Architectural Design learning process is implemented through Design Projects, which are direct manifestations of integration of knowledge, consisting of:
- Factual knowledge: understanding and formulating design problems which are abstract, qualitative, and related to socio-cultural aspects of human space/activities
- The context and environment of living space, ranging from micro/local/personal space, family, community, up to urban/rural environment
- Engineering aspects such as structure, tectonics (including building materials), building physics, building systems, and interior elements.

- Design methods
- Communication techniques

In its implementation, Design Projects accommodate learning materials from courses on Architecture Design, Building Technology, Introduction to Urban Context, within the following order:

- Design Project 1 is an integration of Architecture Design 1 and Building Technology 1
- Design Project 2 is an integration of Architecture Design 2 and Building Technology 2
- Design Project 3 is an integration of Architecture Design 3 and Introduction to Urban Context
- Design Project 4 is an integration of Architecture Design 4 and Building Technology 3

Gradually, knowledge and ability will be integrated into Architectural Design learning steps in each semester.

DESIGN PROJECT 1

Design Project 1 focuses on personal space design. Design Project 1 is an integration of knowledge on spatial design, ranging from understanding the relation of human and space, basic logic of structure application, to basic principles of ergonomics. Design Project 1 consists of learning activities carried out in two courses which complement each other, namely Architectural Design 1 and Building Technology 1

ENAR600003
ENAR610001
ARCHITECTURAL DESIGN 1
7 CREDIT UNITS

Learning objectives:
Able to design a space for one person, through understanding the relationship between a human being and space.

Syllabus:
Architectural Design 1 is an early and critical stage to introduce students to architecture through imaginative, creative, and innovative space design. Architectural knowledge encompasses basic comprehension about meaning and personal spatial experience, interaction between human body and space, understanding site and surrounding context as experienced by human body. This studio consists of a series of activities, ranging from information gathering, problem definition, analysis, and making critical decisions for formulating an active strategy toward human space, ability to think in three-dimentional manner through space design exploration, also communicating design idea

Prerequisites:
Students have taken Communication Techniques in Architecture
Students have taken or are taking Building Technology 1

Assignment:
Designing a space for an individual that is implemented through 1:1 scale model; Designing a space for an episode of human life.

References:
1. Bruno Zevi, *Architecture as Space: How to Look at Architecture,* 1993.
2. Donlyn Lyndon and Charles W. Moore, *Chambers For A Memory Palace,* MIT Press, 1994
3. Edward T. Hall, *The Hidden Dimension*, Peter Smith Publications, 1992
4. Francis DK Ching, *Architecture: Form, Space and Order*, Wiley, 1996.
5. Karen Franck & Bianca Lepori, *Architecture Inside Out*, Academy Press, 2000.
6. Michael Pollan, *A Place of My Own*. Penguin Press, 2008.
7. Steen Eiler Rasmussen, *Experiencing Architecture*, MIT Press, 1959.
8. Yi-Fu Tuan, *Space and Place: The Perspective of Experience*, University of Minnesota Press, 1981

ENAR600012
ENAR610006
BUILDING TECHNOLOGY 1
3 CREDIT UNITS

Learning objectives:
Able to explain the basic principles of building structural systems and manners of construction, the basic principles of air ventilation and lighting systems in buildings.

Syllabus:
Logics of structure and construction (firmness and stability), basics of mechanics (force, moment, action-reaction, gravity), basic principles of construction (tension and compression). Characteristics of materials and their use (wood, bamboo, stone, bricks, steel, concrete). Basics of assemblage. Building utilities and physics related to climate (passive cooling and natural lighting).

Prerequisites: -

Assignment:
Drawings and models of structure/construction, building utilities and building physics related to assignment of Design Project 1

References:

1. Daniel Schodek, *Structures*
2. Morgan, *The Elements of Structures*
3. Allan Konya, *Design in Tropical Climate*
4. Avil Fox & Robin Murrel, *Green Design Guide to Environmental Impact of Building Material, Architecture Design and Technology*, Press London, 1989
5. Hartono Poerbo, *Utilitas Bangunan*
6. Sugiharto, *Dasar-dasar Pengelolaan Air Limbah*
7. Sugihardjo BAE, *Konstruksi dan Sambungan Kayu*

DESIGN PROJECT 2

Design Project 2 is about designing space for a core social unit (family, a couple, etc.). Design Project 2 integrates space design, the concept of dwelling, analyzes on life cycle and daily activities, application of basic structural principles and low rise building constructions, building systems, and building physic principles. Design Project 2 integrates the activities carried out in two courses which support each other, namely Architectural Design 2 and Building Technology 2

ENAR600004
ENAR610002
ARCHITECTURAL DESIGN 2
7 CREDIT UNITS

Learning objectives: Ability to design a space for a core social unit based on the concept of dwelling, in consideration of life cycle and daily activities of the core social unit

Syllabus:
Architectural Design 2 proposes critical problem solving about living space in urban context, through the concept of dwelling and design. Design knowledge herewith includes the concept of dwelling, observation and analysis of core social unit, comprehension in physical and social contexts, development of spatial idea in creative manner, formulating spatial organization and program which act as the basis for integrated spatial idea, which would be communicated professionally

Prerequisites:
Students have taken Architectural Design 1
Students have taken or are taking Building Technology 2

Assignment:
Make a comprehensive study of precedent of dwellings, with an emphasis on the spatial design and technology. Designing a space for a core social unit.

References:

1. Martin Heidegger, *"Building, Dwelling, Thinking", in Poetry, Language, Thought*. New York: Harper and Row, 1971
2. Norberg Schulz; *The Concept of Dwelling, New York, 1984: Introduction & Chapter I*. Dwell-ing and Existence, pp. 9 – 30.
3. Norberg Schulz, *Genius Loci: Toward a Phenomenology of Architecture*, Rizzoli International Publication, 1980.
4. Amos Rapoport, *House Form and Culture*, Prentice Hall, Inc., 1969 especially Chapter 2. "Alternative Theories of House Form and Chapter Socio-cultural Factors and House Form," pp: 18 – 82.
5. Gaston Bachelard, *Poetics of Space* in Neil Leach, 1997.,Rethinking Architecture, Routledge: London
6. E.H Ericson, *The Life Cycle Completed*, W.W. Norton & Company, 1997
7. Paul Oliver, *Dwellings: The House Across the World*, Phaidon Press Limited, 1990 especially Chapter 8 "Values, Symbols and Meanings," pp. 153-170.
8. Witold Rybczynski, *Home: A Short History of an Idea*, Viking Penguin Inc., 1986.
9. Hannah Arendt, *The Human Condition*, University of Chicago Press, 1998

ENAR600013
ENAR610007
BUILDING TECHNOLOGY 2
3 CREDIT UNITS

Learning objectives: Students are able to analyze and design lowrise structural system and construction, complete with building utilities, building physics principles (passive cooling). Application of structural systems.

Syllabus: Application of low rise structural system in a built project, material specifications, budget estimation, application of building utilities. Application of passive cooling, lighting.

Prerequisites:

Students have taken Building Technology 1

Assignment:

Drawings and models of structure/construction, building utilities and building physics which are relevant for building scale related to assignment of Design Project 2

References:

1. Mario Salvadori, *Why Buildings Stand Up*, WW Norton Company, New York, 1990
2. Matthys Levy & Mario Salvadori, *Why Buildings Fall Down*, WW Norton Company, New York, 2002
3. Durham, *Theory and Practice of Reinforced Concrete*
4. Barrie DS, *Professional Construction Management*
5. Hartono Poerbo, *Utilitas Bangunan*, Penerbit Djambatan, 1992
6. Norbert Lechner, *Heating, Lighting, Cooling*, 2nd edition, PT Raja Grafindo Persada, 2007

DESIGN PROJECT 3

This studio requires students to design public space. It integrates typological design method, issue-based design, and basics knowledge on urbanism. The studio consists of activities related to Archietctural Design 3 studio and Introduction to Urban Context course.

ENAR600005
ENAR610003
ARCHITECTURAL DESIGN 3
9 CREDIT UNITS

Learning objectives:

This studio requires students to design public space through a typological approach. This design project is issue-based. It involves form exploration and spatial quality.

Syllabus:

Critically proposing human living space with socio-cultural complexities as found in urban/suburban context, through form exploration, and issue-based approach. Design knowledge herewith consists of concept of *the public*, type, spatial organization and programming, development of key statement (Design Trigger), institutional building concept and its application. Students are to comprehend context surrounding the designed work, through comprehension of physical condition of the site, urban context, and consideration of sustainability aspects.

Prerequisites:

Students have taken Architectural Design 2
Students have taken or are taking Introduction to Urban Context

Assignment:

Designing in a certain social context; designing in a rather complex urban context.

References:

1. Adrian Forty, *Words and Buildings: A Vocabulary of Modern Architecture*, Thames & Hudson, 2000, Chapter ‘Space’, pp. 256-275
2. Yi-Fu Tuan, Space and Place: *The Perspective of Experience*, University of Minnesota Press, 1981
3. Henri Lefebvre, *The Production of Space*, Blackwell, 1991
4. Jeremy Till, *Architecture Depends*, MIT Press, 2009
5. Karen Franck & Bianca Lepori, *Architecture Inside Out*, Academy Press, 2000
6. Giulio Carlo Argan, *On the Typology of Architecture*, in Nesbitt, *Theorizing a New Agenda for Architecture*, Princeton Architectural Press, 1996, pp. 240-246
7. Jonathan D. Sime, Creating Places or Designing Spaces, *Journal of Environmental Psychology*, Vol 6, 1986, pp. 49-63
8. Andrew Ballantyne, *What is Architecture?* Routledge, 2002
9. Aaron Betsky & Erik Adigard, *Architecture Must Burn: Manifestos for the Future of Architecture*, Gingko Press, 2001
10. Robert Venturi & Denise Brown, *Learning from Las Vegas*, MIT Press, 1977
11. Jane Jacobs, *The Death and Life of Great American Cities*, Random House, 1961
12. Bernard Tschumi, *Architecture and Limits I-III*, in Nesbitt, *Theorizing a New Agenda for Architecture*, Princeton Architectural Press, 1996, pp. 150-167
13. Bauman Lyons Architects, *How to be a Happy Architect*, Black Dog Publishing, 2008

ENAR600002
ENAR610015
INTRODUCTION TO URBAN CONTEXT
3 CREDIT UNITS

Learning objectives:
Basic knowledge about the physical form of the city. Ability to apply regulations/codes of design building in a city.
Syllabus:
Basic principles of urban morphology: urban areas and how the city developed: planned and unplanned urban development, how the city grows physically, urban planning (quantitative urban space), urban design (qualitative urban space), and site planning and design.
Prerequisites:
Students have taken Architectural Design 2.
References:

1. *Journal of the American Planning Association* (edition to be referred is based on the topics to be discussed in class)
2. Jacobs, Jane. *The Death and Life of Great American Cities*. New York: Random House. 1961
3. Kostof, Spiro. The City Assembled: *The Elements of Urban Form Through History*. London: Thames and Hudson. 1992
4. LeGates, Richard T and Frederic Stout (eds.). *The City Reader*. London: Routledge. 2003
5. Mumford, Lewis. *The Urban Prospect*. New York: Harvest Book. 1968

DESIGN PROJECT 4

Design Project 4 is a studio that places an emphasis on the assemblage of a building, and its structural complexities. The Design Project 4 is an integration of technology-based design, principles of structure and construction, structure and construction of portable buildings, wide span structure, high rise structure, and relevant building systems. The studio consists of activities related to Architectural Design 4 studio and Building Technology 3 course.

ENAR600006
ENAR610004
ARCHITECTURAL DESIGN 4
9 CREDIT UNITS
Learning objectives:
Able to design a building based on the aspect of technology
Syllabus:
Architectural Design 4 critically proposes living space by focusing on complexities of building structures and assemblage. Knowledge necessitated in this studio includes developing portable architecture in response to conditions of disaster or other special conditions, as well as the development of the idea of iconic design in the urban context. Knowledge of site and environmental context includes an explanation of the design through an understanding of the physical condition of the site and its urban context, and considerations on sustainability aspects.
Prerequisites:
Students have taken Architectural Design 3
Students have taken or are taking Building Technology 3
Assignment:
Designing a portable architecture in response to conditions of disaster or other special conditions; Designing iconic public building in urban context.
References:

1. Robert Kronenberg, *Portable Architecture*, Architectural Press, 2003.
2. Rem Koolhaas, *S, M, L, XL*, Monacelli Press, 1997.
3. Rem Koolhaas, *Delirious New York: A Retroactive Manifesto for Manhattan*, Monacelli Press, 1997.
4. Chris Abel, *Architecture, Technology and Process*, Architectural Press, 2004.
5. *Journal of Architectural Education*, Sustainability Issue, Volume 60, No 4, May 2007.

ENAR600014
ENAR610008
BUILDING TECHNOLOGY 3
3 CREDIT UNITS
Learning objectives: Students are able to design portable structure/construction, able to apply complex wide span or high rise structures, able to apply building utilities and building physics for such complex buildings.
Syllabus:
Application of structural systems for wide span or high rise buildings, principles of building utilities and building physics to achieve thermal comfort and lighting, basic knowledge on green building (site use, energy efficiency and conversion, water conservation, material sources and cycle, air quality & thermal comfort, managing built environment).
Prerequisites:
Students have taken Building Technology 2
Assignment:
Drawings and models of portable structure/

construction, wide span and/or high rise building according to assignment of the Design Project 4.

References:

1. Schuler Wolfgang, *Wide Span Building Structure*, John Wiley & Sons, 1991
2. Schuler Wolfgang, *High Rise Building Structure*, John Wiley & Sons, 1991
3. Pillar Echavarria M, *Portable Architecture and Unpredictable Surroundings*, Page One, Singapore, 2005
4. Joseph Lim, *Eccentric Structures in Architecture*, Page One, Singapore, 2010
5. Sophia Vyzoviti, *Folding Architecture*, Page One, Singapore, 2003
6. Asterios Angkathidis, *Modular Structures*, Page One Singapore, 2009
7. Jane Burry and Mark Burry, *The New Mathematics of Architecture*, Thames and Hudson, New York, 2010
8. Fashid Mousavi, *The Function of Form*, Harvard University Graduate School.
9. Ken Yeang, *The Skyscraper Bioclimatically Considered*, Academy Press, 1998
10. McGuiness, Stein, Reynolds, *Mechanical and Electrical Equipment For Building*
11. Norbert Lechner, *Heating, Lighting, Cooling*, 2nd edition, PT Raja Grafindo Persada, 2007

ENAR600007
ENAR610005
ARCHITECTURAL DESIGN 5
12 CREDIT UNITS

Learning objectives:
Able to design space by integrating design problems solutions, able to design using thematic approach in relation to urban sites and complex activities, able to provide design solutions which comply with the existing codes.

Syllabus:
Formulating function & formal type schemes upon analyzing some precedents, defining design concept to be developed in exterior and interior configurations. Defining complex activities on buildable site in accordance with existing building codes, while considering sustainability. Formulation of advance structure, construction, building systems, and tectonic principles, along with relevant mechanical and building systems. Presenting and defending all outcomes of the studio in front of internal & external reviewers.

Prerequisites:
Students have taken Architectural Design 4

References:

1. Ingels, Bjarke. *Yes is More, An Archicomic on Architectural Evolution*. Koln: Taschen, 2010
2. Guzowski, Mary. *Towards Zero-energy Architecture*. United Kingdom: Laurence King Publishing Ltd, 2010
3. Lim, Joseph. *Eccentric Structures in Architecture*. Singapore: Page One Publishing Pte Ltd, 2010
4. Vyzoviti, Sophia. *Super Surface*. Singapore: Page One Publishing Private Limited, 2010
5. Lim, Joseph. *Bio-Structural, Analogues in Architecture*. Amsterdam: BIS Publisher, 2009
6. Vyzoviti, Sophia. *Folding Architecture*. Singapore: Page One Publishing Pte Ltd, 2006
7. Yeang, Ken. *The Skyscraper, Bioclimatically Considered*. London: Academy Group Ltd, 1996
8. Antoniades, Anthony C. *Poetics of Architecture*. New York: Van Nostrand Reinhold, 1992

ENAR600017
ENAR610017
UNDERGRADUATE THESIS
8 CREDIT UNITS

Learning objectives: Ability to identify, study and communicate issues within specific area of study related to architecture. Ability to develop basic expertise to read, conduct research and write a written scientific work. Students an ability to develop an understanding of research as an activity that requires systematic, methodological thought and rationale, as well as ability to develop critical understanding of various architectural issues.

Syllabus: the thesis begins with an inquiry on what the student wishes to deal with indepth, and with proceeds the student's attempt to deal with the subject indepth. At this level, the student is neither required to solve a problem nor create or invent something new which would contribute to the field of architecture. Students are to carry out investigation through literature search and case studies. Originality is expected. Modes of writing: description, narrative, explanatory, or argumentation.

Prerequisites:students have passed Architectural Design IV

References:

1. John Zeisel, *Inquiry by Design*
2. *How To Write A Better Thesis Dissertation*
3. F. Crews. *The Random House Handbook*, Random House: New York, 1974, 1977, 1980, 3rd. ed, pgs 10-114.
4. I. Border and K. Ruedi, *The Dissertation: an Architecture Student's Handbook*, Oxford University Press, 2000.
5. TY. Hardjoko, *Panduan Meneliti dan Menulis Ilmiah*, Depok, Departemen Arsitektur Universitas Indonesia, 2005

ELECTIVE COURSES

ENAR600018
ENAR610018
ACOUSTICS
3 CREDIT UNITS

Learning objectives: providing students with basic acoustics principles in relation to space and its environs. Students obtain the ability to conduct analysis to produce good acoustics design.

Syllabus: Acoustics basics, characteristics of sounds, criterion of acoustics in a room, sound isolation, intensifying sound, sound pollution.

Prerequisites:

References:

1. Leslie L. Doelle & Lea Prasetio, *Akustik Lingkungan*, Erlangga,1993.
2. PH Parkin & HR Humpreys, *Acoustics Noise and Buildings*: Faber and Faber Ltd., London, 1984.
3. Finarya Legoh & Siti Hajarinto, *Buku Ajar AKUSTIK*, 2002.

ENAR600019
COASTAL ARCHITECTURE
3 CREDIT UNITS

Learning objectives: Understanding the relationship between spatial, temporal, cultural, and eco-athropomorphic systems changes in coastal areas. Such understanding would be contributive to spatial development in coastal areas. Students are expected to be able to systematically express their own understanding and concern on issues related to coastal context.

Syllabus: Water and architecture, basic knowledge and explanation on coastal area, continental area, sea, archipelago, spatial-temporal-cultural aspects, eco-anthroposystem, the effect of island – sea interactions, spatial planning, architecture for coastal areas, the dynamics of dwelling in Indonesia's coastal areas, climate change and risk of disaster in Indonesia's coastal areas, spatial-temporal-cultural changes and eco-anthroposystem in certain Indonesian coastal area, architect's role in coastal context.

Prerequisites: Students have taken Design Theories & Methods in Architecture

References:

1. Abimanyu Alamsyah, *Regionisme dalam Penataan Permukiman di Gugus Pulau Mikro*, unpublished doctoral dissertation, PSIL Universitas Indonesia, 2006
2. Subandono Diposaptono and Budiman, *Tsunami*, Penerbit Buku Ilmiah Populer, 2006
3. Charles Moore and Jane Lidz, *Water + Architecture*, Thames and Hudson, Ltd, 1994
4. Malcolm Newson, *Land, Water and Development. River Basin Systems and their Sustainable Development*. Routledge, London, 1992
5. Djoko Pramono, *Budaya Bahari*, Gramedia Pustaka Utama, Jakarta, 2005
6. Heather Vies and Tom Spencer, *Coastal Problems: Geomorphology, Ecology and Society at the Coast*. Edward Arnold, London, 1995
7. Ary Wahyono, AR Patji, SS Laksono, R. Indrawasih, Sudiyono dan Surmiati Ali, *Hak Ulayat Laut di Kawasan Indonesia Timur*, Media Presindo Yogjakarta, 2000.

ENAR600020
ENAR610020
ETHNIC ARCHITECTURE
3 CREDIT UNITS

Learning objectives: provide students with subjects pertaining to architecture which arise from ethnic groups' traditions, in order to explain and classify elements and principles of each ethnic group's architecture. Students obtain the ability to comprehend phenomena of ethnic architectures in general as well as analyze architecture tradition of each ethnic group.

Syllabus: comprehension of principles and elements of ethnic architecture, formation factors, symbolic classification, cosmological view and worldview, space, place, time, meaning, anthropomorphic, construction process

Prerequisites:

References:

1. Amos Rapoport, *House Form and Culture*, New Jersey: Englewood Cliffs, 1960.

2. N. Egenter, *Architectural Anthropology,* Lousanne: Structura Mundi, 1996.
3. Roxanna Waterson, *The Living House: An Anthropology of Architecture in Southeast Asia*, Oxford University Press, Singapore / Oxford/ New York, 1990.
4. E. Guidoni, *Primitive Architecture,* New York: Harry N. Abrams, 1978.
5. Paul Oliver (ed.), *Sign, Symbol, and Shelter,* New York: The Overlook Press, 1977.
6. J. Fox (ed.), *Inside Austronesian House*, Canberra: The Australian National University, 1993.
7. Djauhari Sumintardja, *Kompendium Arsitektur*. Bandung: Yayasan Lembaga Masalah Bangunan, 1978.
8. Bourdier & N.AlSayyad (eds), *Tradition, Dwellings and Settlements: Cross-cultural Perspectives*. Lanham, MD: University Press of America, 1989.

ENAR600021
HERITAGE IN ARCHITECTURE
3 CREDIT UNITS

Learning objectives: This course introduces students to architecture of the past as heritage; knowing the process of data collection and documentation of past architecture pieces (buildings and areas) and learn conservation efforts, including re-use of heritage buildings.

Syllabus: Introduction to heritage; conservation and preservation; technical aspects (measurement/documentation); and the reuse of historic building /area; project exercise

Prerequisites: -

References:

1. Bernard M Feilden, *Conservation of Historic Building*, Butterworth-Heinemann Ltd, Oxford, 1994,
2. Adolf SJ Heuken, *Tempat-tempat Bersejarah di Jakarta*, Cipta Loka Caraka. Jakarta, 1997,
3. INDONESIAN Heritage Society, 3rd ed The Jakarta Explore, *Equinox Publishing (Asia)*, Jakarta, 2001.
4. Bryan Lawson, *The Language of Space*, Architectural Press, Amsterdam, 2003,
5. Laurence LOH, *Suffolk House*, HSBC Bank Malaysia Berhad, Malaysia, 2007,
6. Pemerintah Propinsi DKI Jakarta, Dinas Kebudayaan dan Permuseuman, *Ensiklopedi Jakarta, Culture Heritage. Buku 1. Buku II, Buku III,* Yayasan Untuk Indonesia, Jakarta, 2005.
7. Pemerintah Provinsi DKI Jakarta. Dinas Kebudayaan dan Permuseuman, *Pedoman Teknis Pemugaran Bangunan Gedung dan Lingkungan Kawasan Kebayoran Baru Jakarta Selatan*, Jakarta, 2005
8. Peraturan Daerah Daerah Khusus Ibukota Jakarta Nomor 9 Tahun 1999 Tentang Pelestarian dan Pemanfaatan Lingkungan dan Bangunan Cagar Budaya

ENAR600022
ARCHITECTURE, CITY AND POWER
3 CREDIT UNITS

Learning objectives: Understanding of the role of architecture, planning and design within and between urban contexts. Improved understanding on the relationship between environmental design and power. Increased awareness to the intertwining relationship between architecture, social aspects, political aspects, economy, and culture. Understanding that built environment is conceived out of, and would yield particular power relation amongst the users in a specific context.

Syllabus: The role of architecture and planning in the broader context. The relationship between design and power. Syllabus is prepared according to the themes related to the aforementioned relationship, which includes the following themes: Architecture and consumption, poverty and inequality; illegality, informality, disasters, theme parks/leisure, enclaves/zone/segregation, housing, and infrastructure

Prerequisites: Students have taken Design Theories & Methods in Architecture, like reading and watching movies.

References:

1. Various movie titles related to learning objectives
2. David Harvey, *Spaces of Hope*, University of California Press, 2000
3. James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*, Yale University Press, 1998
4. Robert Neuwirth, *Shadow Cities, A Billion Squatters, A New Urban World*, Routledge, 2005
5. James Holston, *The Modernist City: an Anthropological Critique of Brasilia*, The University of Chicago Press, 1989
6. Mike Davis, *Evil Paradise: Dreamworlds of Neoliberalism*, The New Press, New York, 2007
7. Sharon Zukin, *Landscape of Power: from Detroit to Disney World*, University of California Press, 1991

8. Janice Perlman, *The Myth of Marginality*
9. Rafi Segal and Eval Weizman, *Civilian Occupation: the Politics of Israeli Architecture*, Babel and Verso, 2003
10. Teresa Caldeira, *City of Wall*, University of California Press, 2000
11. Nan Ellin (ed) *Architecture of Fear*, Princeton University Press,1997
12. Don Mitchell, *The Right to the City: Social Justice and the Fight for Public Space*, The Guildford Press, 2003
13. Neil Smith, *The New Urban Frontier: Gentrification and the Revanchist City*, Routledge, 1996
14. Edward S. Popko, *Transition: A Photographic Documentation of a Squatter Settlement*, McGraw-Hill, 1978
15. Stephen Graham and Simon Marvin, *Splintering Urbanism: Networked Infrastructures, Technological Mobilities and the Urban Condition*, Routledge, 2001
16. Brenda S.A Yeoh, *Contesting Space in Colonial Singapore: Power Relations and the Urban Built Environment*, Singapore University Press, 2003

ENAR600023
ENAR610019
BASIC COMPUTING IN ARCHITECTURE
3 CREDIT UNITS

Learning objectives: Students gain an ability to operate computers with knowledge of software packages and hardware, and capabilities to apply appropriate software for presentation.

Syllabus: software and hardware, multimedia, power point, Photoshop, Corel Draw, Pagemaker, CAD and computer simulation and modelling in 2d and 3d.

Prerequisites: Students have taken Visual Arts

References:

1. *Manual AutoCad versi terbaru*, Auto Desk
2. *Manual Archicad versi terakhir*, Graphisoft
3. *Manual Piranti Multi Media versi terakhir untuk Adobe Photoshop, Page Maker, Corel Draw*.

ENAR600024
URBAN ECOLOGY
3 CREDIT UNITS

Learning objectives: Providing students with principles on architecture with ecological awareness, introducing architectural works which consider socio-cultural values, ecological support, and holistic mode of thought in designing the buildings/areas.

Syllabus: ecological functions that are able to 'provides' for the primary needs of the city inhabitants, such as clean water, waste disposal arrangements, air pollution, transportation, and green spaces

Prerequisites: None

References:

1. Amos Rapoport, *Human Aspects of Urban Form: Towards a Man Environment Approach to Urban Form and Design*. Pergamon Press, Oxford,1997
2. Amos Rapoport, *The Meaning of The Built Environment: A Non Verbal Communication Approach*. Sage Publication, 1982
3. Graham Haughton et al, *Sustainable Cities*. Cromwell Press, 1994
4. Iftikar Ahmed, ed, *Beyond Rio: The Environmental Crisis and Sustainable Livelihoods in the third world*, MacMilan Press, London, 1995.
5. Moh. Soeryani, ed. *Lingkungan: Sumberdaya Alam dan Kependudukan dalam Pembangunan*. UI Press, 1987

ENAR600025
HIGH RISE BUILDING FAÇADES
3 CREDIT UNITS

Learning objectives: Mastering the principles of high rise building façades including of aesthetics, technical, and environmental aspects.

Syllabus:

- The essence of building façades of high-rise building (resistance to earthquakes, lateral force / wind and water resistance)
- The design of the façade
- Material and technology for façade detailing
- Green façade

Prerequisites: None

References:

1. Wolfgang Schueller, *Struktur Bangunan Bertingkat Tinggi*, Bandung: PT Eresco. 1989
2. Mario Camp, *Skycrapers: An Architectural Type of Modern Urbanism*, Birkhauser – Basel ; Boston ; Berlin. 2000
3. Hart, Henn, and Sontag, Multi-*Storey Buildings in Steel*, Granada Publishing. 1978
4. *Details in Architecture 5: Creative*

Detailing by Some of The World's Leading Architects, Mulgrave: The Images Publishing Group Pty Ltd. 2004

ENAR600026
ENAR610025
PHOTOGRAPHY
3 CREDIT UNITS
Learning objectives: Students are able to produce photographs with artistic elements, and communicate architectural photographs through photographic process and presentation
Syllabus: art and communication in photography, indoor and outdoor photography, print, methods of taking pictures, lighting, color, B & W, figure & portrait, presentation and photography.
Prerequisites: None
References: *Hand-Outs*

ENAR600027
GEOMETRY AND ARCHITECTURE
3 CREDIT UNITS
Learning objectives: This course introduces the role of geometry as a basis in architecture; Ability to explore various possible uses of geometry as the critical tools of analysis of the existing architecture and in architectural design.
Syllabus: Development of geometry and its implications for the development of architectural ideas and creativity; geometry and aesthetics of classical architecture; Euclidean and non-Euclidean geometries in architecture; geometry and the concept of an ideal city; geometry, music and architecture; geometry and perception; topology in architecture; geometry in nature; exploration of the mechanism of geometry shaping an architectural work and its potentiality for further development.
Prerequisites: None
References:
1. Vitruvius, *Ten Books on Architecture*, New York, Dover Publications, 1960
2. Colin Rowe, *Mathematics of an Ideal Villa*, MIT Press, 1976
3. Peter Davidson & Donald L. Bates, *Architecture after Geometry, Architectural Design*, 1999
4. Irenee Scalbert, Archis, *Towards a Formless Architecture: The House of the Future by A+P Smithson*, Archis, 1999
5. D'Arcy Thompson, *On Growth and Form*, 1961
6. Jane Jacobs, *The Death and Life of Great American Cities*, 1967
7. Elizabeth Martin, *Architecture as a Translation of Music*, Pamphlet Architecture 16, Princeton Architectural Press, 1994

ENAR600028
EVERYDAY AND ARCHITECTURE
3 CREDIT UNITS
Learning objectives: This course introduces the existence of everyday life as an approach to architecture; and position the discipline of architecture in response to various phenomena of everyday living space
Syllabus: Definition and historical background of the concept of the 'everyday' in architecture; domestic space; aesthetics in architecture and the 'everyday', the concept of an ideal city and its relation to the 'everyday'; cyber space and virtual space; the phenomenon of the 'everyday' in urban space: a participatory approach in architecture
Prerequisites: None
References:
1. Steven Harris & Deborah Berke (eds.), *Architecture of the Everyday*, Princeton Architectural Press, 1997
2. Sarah Wigglesworth & Jeremy Till (eds.), *The Everyday and Architecture*, Architectural Design, 1998
3. Michel de Certeau, *The Practice of Everyday Life*, University of California Press, 1998
4. Malcolm Miles, *The Uses of Decoration: Essays in the Architectural Everyday*, Wiley, 2000
5. Jonathan Hill (ed), *Occupying Architecture*, Routledge, 1998
6. Margaret Crawford, et.al, *Everyday Urbanism*, Monacelli, 1999
7. Arnstein, *Ladder of Citizen Participation*, 1969

ENAR600029
URBAN DESIGN
3 CREDIT UNITS
Learning objectives: To introduce urban spatial design theories and the applications to physical urban design, understanding methods of urban design, inquiry and design research, having knowledge on urban design process, understanding basic principles of urban spatial design and having an ability to interpret cases based on urban principles.
Syllabus: The principles of order in two and three dimensions (image, type, scale, precedent). Conditions of urban space and the spaces

between buildings, spatial theory and typology of urban space, urban design elements, exploring basic concepts and methods of urban design research through design inquiry and design research, spatial planning and environmental studies. Components of urban design as a controlling process to establishe physical environment of an urban area (land use, building intensity, codes, building envelope, green open spaces, circulation, parking, infrastructure, conservation and visual corridors/townscape)

Prerequisites: Students have taken Architectural Design 2, Design Theories & Methods in Architecture

References:

1. Hamid Shirvani, *Urban Design Process*, New York, Van Nostrand Reinhold Co, 1987
2. Ali Madanipour, *Design of Urban Space: an Inquiry into a Socio-Spatial Process*, John Wiley and Sons, 1996
3. Gideon S. Golany, *Ethics and Urban Design: Culture, Form and Environment*, Wiley, 1995
4. Matthew Carmona, et al, *Public Places - Urban Spaces*, Architectural Press, 2003
5. Ray Gindroz, *The Urban Design Handbook: Techniques and Working Methods*, W.W. Norton and Company, 2003
6. Geoffrey Broadbent, *Emerging Concepts in Urban Space Design*, Taylor and Francis, 1995
7. Congress for the New Urbanism, *Charter of the New Urbanism*, McGraw-Hill Professional, 1999
8. Allan B. Jacobs, *The Great Streets*, The MIT Press, 1995
9. Roger Trancik, *Finding Lost Space Theories of Urban Design*, Van Nostrand Reinhold Company, New York, 1986
10. Christopher Alexander, *The Oregon Experiment*, New York: Oxford University Press, 1975
11. Yoshinobu Ashinara, *The Aesthetics Townscape*, The MIT Press, 1984
12. Edmund Bacon, *Design of Cities*. Thames and Hudson, 1967.
13. Kevin Lynch, *The Image of The City*, Cambridge, MIT Press 1960
14. Kevin Lynch, *What is Time and Place?* Cambridge, MIT Press 1972

ENAR600030
INTERIOR DESIGN
3 CREDIT UNITS

Learning objectives: Ability to design interior spaces by considering building elements, furniture, color, light, noise and circulation

Syllabus: Principles and design problems in interior design, the elements of design, function and circulation, furniture layout, atmosphere, finishing materials, lighting, air and the sound, display and public spaces and residential facilities, design elements and furniture in interior space

Prerequisites:

References:

John Pile, *Interior Design Concept*

ENAR600031
ENAR610027
EXTERIOR SPACE DESIGN
3 CREDIT UNITS

Learning objectives: Ability to apply principles of site and area design in an integral manner.

Syllabus: basic principles of site planning, mass orientation, site characteristics, the role of exterior elements, topography, site and environment, typology and exterior space design analysis, methods of site and area design.

Prerequisites: None

References:

1. Joseph DeChiara & Lee L. Koppelman, *Standard Perancangan Tapak*, Penerbit Erlangga, 1994
2. Albert J. Rutledge, *Anatomy of a Park: The Essentials of Recreation Area Planning and Design*, ASLA, 1971
3. William A. Mann, *Landscape Architecture, An Illustrated History in Timeless, Site Plans and Biography*, 1993
4. Geoffrey & Susan Jellicoe,*The Landscape of Man, Shaping the Environment From Prehistory to the Present Day*, (1987) 1991
5. Charles W. Moore et al, *The Poetics of Gardens*, Cambridge, Mass, 1988 (1995)
6. Francis DK Ching, *Architecture: Form, Space and Order*, Erlangga, 1996
7. *Course hand-out.*

ENAR600032
URBAN AND REGIONAL PLANNING
3 CREDIT UNITS

Learning objectives: This course introduces students to the discourse of growth and development of urban areas. As the course is offered for architecture students, discussions will focus on how economic and social forces form physical urban environment. At the end of this course, students are expected to discuss complex urban issues from different actors' points of view (planners, developers, land owners, those who have political power, non-profit institutions, and so on). Students are expected to not only understand the relationship between socio-economic factors and physical environment, but also to have critical positions toward the idea that physical interventions will affect the quality of environment, socially and economically.

Syllabus: This course is divided into four major topics. During the first section, students start to observe urban transformations. In this section, students are encouraged to view such changes as not only as a phenomena, but also as well-planned steps to realize an alternative future for the city. In the second section students are introduced to the techniques of urban physical planning which include: (a) allocation of resources (land, transportation, and public infrastructure), (b) expansion of the city, the growth of suburban areas, growth areas, (c) planning old town area. In the third section students are to observe the relationship between social and physical environments, which includes introduction to the concept of community-based development and poverty reduction plans. The fourth section encourages students to have critical positions toward urban planning theories developed in the West, and propose possible ways to adapt those theories in an Asian and Indonesian context.

Prerequisites: Students have taken Architectural Design 3.

References:

1. LeGates, Richard T and Frederic Stout (eds.). *The City Reader*. London: Routledge. 2003
2. Fulton, William and Paul Shigley. *Guide to California Planning*, second edition. Point Arena, CA: Solano Press Books. 1999
3. Hanson, Susan and Genevieve Giuliano (eds.). *The Geography of Urban Transportation*, 3rd ed. New York, NY: The Guilford Press. 2004
4. Kostof, Spiro. The City Assembled: The Elements of Urban Form Through History. London: Thames and Hudson. 1992
5. *Journal of the American Planning Association*
6. Jacobs, Jane. *The Death and Life of Great American Cities*. New York: RandomHouse. 1961
7. Scott, James C. *Seeing Like A State*. New Haven: Yale University Press. 1998
8. Campbell, Scott and Susan Fainstein. *Readings in Planning Theory*. Malden: Blackwell Publishers. 1996
9. Peterman, William. *Neighborhood Planning and Community-Based Development: The Potential and Limits of Grassroots Action*. Sage: Thousand Oaks. 2000
10. Gottlieb, Robert. *Reinventing Los Angeles: Nature and Community in the Global City*. Cambridge: MIT press. 2007
11. Tipple, Graham. "Urban Poverty Alleviation and Housing Creation" in Sue Jones and Nici Nelson (eds.) *Urban Poverty in Africa*. London: ITP. Pp. 71-82. 1999
12. T. G. McGee. Managing the rural–urban transformation in East Asia in the 21st century. Sustainable Science 3:155–167. DOI 10.1007/s11625-007-0040-y. 2008

ENAR600033
ARCHITECTURAL PSYCHOLOGY
3 CREDIT UNITS

Learning objectives: Knowledge and understanding on the aspect of psychology in architecural design, in relation to designer, user, and social environment in post-occupancy cases.

Syllabus: Architectural Psychology, Human Behavior, attitudes and cultural values, perception, space, crowding, privacy, methods of research on territory, and emotional impact of color

Prerequisites: -

References:

1. Bell, Fischer, Greene, *Environmental Psychology*, Harcourt Publisher, 1996
2. Bryan Lawson, *The Language of Space*, Architectural Press, 2001
3. Byron Mikellides, *Architecture for People: Exploration in a New Humane Environmental*, 1980
4. Wolfgang F.E. Preisser, Harvey Z. Rabinowitz, Edward T. White, *Post-Occupany Evaluation*, Van Nostrad Reinhold, 1988

ENAR600034
ENAR610026
REAL ESTATE
3 CREDIT UNITS

Learning objectives: This course provides students knowledge and awareness on real estate and its connection to architecture, in relation to the built-environment.

Syllabus: Definition of real estate, planning and development process of real estate (the eight phases of Real Estate Development Process), fundamentals of property rental and sales project's cash-flow (short & long term), simple feasibility study.

Prerequisites: -

References:

1. Mike A. Miles, et.al, *Real Estate Development: Principles and Process*, Urban Land Institute, 2000
2. Carl Gunther, *Real Estate Fundamentals (Study Guide)*, 1995
3. Hartono Poerbo, *Tekno Ekonomi Bangunan Bertingkat Banyak*, Jakarta, Djambatan, 1993
4. Ralph Basile, et.al, *Downtown Development Handbook*, Washinton DS, Urban Land Institute, 2000
5. Adrienne Schmitz, *Residential Development Handbook*, 3rd ed. Urban Land Institute, 2004
6. Dean Schwanke, *Mixed Used Development Handbook*, 2nd ed, Urban Land Institute, 2003

ENAR600035
ADVANCED HISTORY OF ARCHITECTURE
3 CREDIT UNITS

Learning objectives: This course introduces students to pre-modern works of architecture

Syllabus: Pre-Hellenic architecture in the Mediterranean, Minoan, Mycenean, and early Greek architectures, Classical Greek architecture

Prerequisites: None

References:

Encyclopedia of Architecture, Academy Editions

ENAR600036
ADVANCED STRUCTURES AND CONSTRUCTIONS
3 CREDIT UNITS

Learning objectives: Students are able to follow the development of structural innovation and the latest construction techniques which can be applied in architectural design

Syllabus:

- innovative structural systems
- Innovative technologies and building constructions
- cutting-edge building materials
- Innovative architectural designs

Prerequisites: None

References:

1. Mario Savadori and Matthys Levy, *Structural Design in Architecture, Second Edition*, Prentice-Hall Inc, Englewood Cliffs, 1981
2. Heather Martienssen, *The Shapes of Structure*, Oxford University Press, 1976
3. Angus J. Macdonald, *Struktur& Arsitektur, Edisi Kedua*, Penerbit Erlangga, 2001
4. Sutherland Lyall, *Master of Structure: Bangunan dengan Struktur Inovatif Terkini*. Jakarta: PT Raja Grafindo Persada, 2006
5. Farshid Moussa, *The Function of Form*, Actar and The Harvard University Graduate School of Design, 2009
6. James B. Harris, Kevin Pui – K Li, *Masted Structures In Architecture*, Butterworth Architecture, 1996
7. Fuller Moore, *Understanding Structures*, WCB/McGraw-Hill
8. H. Werner Rosenthal, *Structure*, London and Basing Stoke: The MacMillan Press Ltd, 1974

ENAR600037
PROJECT FEASIBILITY STUDY
3CREDIT UNITS

Learning objectives: At the end of this course, students are able to propose a project plan, and explain the feasibility of a project, or program development in a clear, comprehensive, and systematic manner.

Syllabus: Basic knowledge which covers the requirements; analysis, technical and environmental feasibility, time feasibility; sociocultural aspects, legal feasibility, market and economic feasibility; exercises on issue formulation, SWOT analysis, scope, activities types and products, strategy, standard operational procedures, analyzing organizational issues and management, organizational plans, human resources and management, calculating market and economic feasibility, as well as legal feasibility and related institutional consequences.

Prerequisites: None

References:

ENAR600038
ENAR610024
LIGHTING DESIGN
3 CREDIT UNITS

Learning objectives: Students are able to design lighting fixtures and ambience for interior and exterior uses, using artificial as well as natural lights through a critical, active, col-

laborative learning process based on functional and aesthetical problems.
Prerequisites: None
Syllabus: lighting basics, color, natural light, artificial light, light distribution, interior lighting, exterior lighting (façades of a house and high rise), urban lighting.
References:
1. William M.C. Lam, *Perception and Lighting as form givers for Architecture*, McGraw-Hill
2. Norbert Lechner, *Heating Lighting Cooling*, 2nd edition, translated by PT RajaGrafindo Persada, 2007
3. John E Flyinn, *Architecturan Interior System, Van Nostrand Reinhold Environmental Engineering Series*.

ENAR600039
URBAN HOUSING THEORY
3 CREDIT UNITS
Learning objectives: Able to analyze the impact of housing, planning and development in an urban setting
Syllabus: Housing problems in an urban setting, studies on typology and housing area, methods and building typology, studies on economics and management of housing, studies on planning and design of urban housing
Prerequisites: None
References: *Hand-Outs*

ENAR600040
ADVANCED BUILDING UTILITIES
3 CREDIT UNITS
Learning objectives: Able to explain building utilities in multiple-storeyed buildings, which enable the buildings to the function, well particularly for the security and users' convenience.
Syllabus: System of water supply and sewerage /waste, man-made air ventilation, artificial lighting systems, sound systems, CCTV, telephone, lightning rods,vertical transportation systems, building cleaning systems.
Prerequisites: None
References:
1. Reynolds, John S and Stein, Benjamin; *Mechanical and Electrical Equipement for Buildings*, John Willey and Sons, 1999
2. Yeang, Ken; *The Skyscraper Bioclimatically Considered*, Academy Press, 1998
3. Reid, Esmond; *Understanding Building*. The MIT Press, 1984
4. Poerbo, Hartono; *Utilitas Bangunan: Buku Pintar untuk Mahasiswa Arsitektur-Sipil*, Djambatan, 1992

ENAR600041
ENAR610028
2D DIGITAL DESIGN COMMUNICATION
3 CREDIT UNITS
Learning objectives: Students are able to use software such as AutoCAD, ArchiCAD, or other modelling softwares, in order to express creative ideas through 2D models. Students are able to draw using the softwares.
Syllabus: Complete schematic drawings, 2D modeling, working drawings.
Prerequisites: None
References :
AutoCAD-ArchiCAD Manual, latest version, 2004

ENAR600042
ENAR610029
3D DIGITAL DESIGN COMMUNICATION
3 CREDIT UNITS
Learning objectives: Students are able to use software such as 3DS max, 3D Viz, Revit, Rhino or other modeling software, in order to express creative ideas through 3D models. Students are able to draw using the software.
Syllabus: Complete schematic drawings, 3D modeling, working drawings.
Prerequisites: None
References : Handout

ENAR600043
ENAR610030
CAPITA SELECTA
3 CREDIT UNITS
Learning objectives: Depends on the topics being offered during the semester.
Syllabus: Depends on the topics offered during the semester.
Prerequisites: Depends on the topics being offered during the semester.
References: Depends on the topics being offered during the semester.

ENAR600045
ENAR610032
INTERNSHIP
3 CREDIT UNITS
Learning objectives: Understanding design process, professional practices (project scheduling, construction and evaluation); to carry out collaborative work with people from different disciplines related to practice. Student can understand the process of planning, designing

and realizing a built environment, through involvement as Assistant Planner/Designer, Field Executive Assistant/Assistant Field Supervisor, or Community Architect.
Syllabus: Project management processes in the office. And proposal preparation, simple method of reporting field work results. Method of presentation: Methods of processing materials, data, tools, human resources and coordination among stake holders in engineering planning and its implementation.
Prerequisites: None
References: None

ENAR610023
LIFE CYCLE ENVIRONMENT
3 CREDIT UNITS
Learning objectives: Students are able to evaluate environmental feasibility for the users, based on their life cycles: birth, infancy, early childhood, childhood, adolescence, adulthood, old age, pemise – places & rites.
Syllabus: Introduction to life-cycle environment; psychology of pregnant mother, birth environment, house, hospices, & maternity hospital, infant and his/her parent environment; sensory development of infant, psychological development of a child; playing environment and unwritten rules of playing, home environment, vicinity, and pre-school; parent and childcare
Prerequisites: None
References:

1. Koentjaraningrat. *Ritus-Ritus Peralihan di-Indonesia*. Jakarta: Balai Pustaka, 1979.
2. A.Van Gennep, *The Rites of Passage*. Terjemahan M. Viadon dan G. Caffee. Chicago:University of Chicago Press, 1960.
3. Erik H Erickson, *Life Cycle Completed*, WW Norton & Company, 1997

4.9. UNDERGRADUATE PROGRAM IN INTERIOR ARCHITECTURE

Program Specification

1	**Awarding Institution**		Universitas Indonesia
2	**Teaching Institution**		Universitas Indonesia
3	**Program**		Undergraduate Program in Interior Architecture
4	**Class**		Regular
5	**Degree Offered**		Sarjana Arsitektur (S.Ars)
6	**Accreditation / Recognition**		A Accredited from BAN-PT AUN-QA
7	**Language of Instruction**		Bahasa Indonesia and English
8	**Study Scheme (Full time/Part time)**		Full time
9	Entry Requirements		SMA Graduate/equal or D3/Polytechnique graduate
10	**Duration of Study**		4-year Program
	Semester	Total semester	Weeks / Semester
	Regular	8	16-17
	Short (optional)	3	8

11 Graduates Profile:

Sarjana Arsitektur in Interior Architecture is a graduate who:

- has ability to design space innovatively based on interiority;
- has a multi-disciplinary view;
- is able to communicate information, ideas, problems and design solutions

12 Graduation Competence:

A. Basic and Personality

1. Understanding of religious values in personal life and society.

B. Design

2. Ability to engage envision, think creatively, innovatively and promote design leadership.
3. Ability to collect information, to formulate problems and to analyze.
4. Ability to think three-dimensionally throughout the process of design exploration
5. Ability to synchronize a variety of design issues, integrate interior architectural knowledge and apply skills for design solutions.

C. Knowledge

C1. Cultural and Artistic Studies

6. Ability to act with respect to historical and cultural precedents in local and world interior architecture.
7. Ability to design and apply basic fine arts and to understand their influence in the quality of interior architecture design.
8. Ability to respond to the most recent social and cultural issues which are reflected in the design solutions.
9. Ability to identify architectural heritage issues in the built environment.
10. Ability to understand the linkage between interior architecture and other creative disciplines.

C2. Social Studies (Human and Environment Needs)

11. Ability to act with respect to community knowledge, and to work with clients and users that represent the community's needs.
12. Ability to identify the essential needs of human beings in interior space and the problems that are attached to these needs.
13. Ability to observe human behavior and its interaction with the built environment.
14. Ability to apply the ergonomic and anthropometric principles as a reference for creating a comfortable space.
15. Ability to identify and awareness to the relevant codes, regulations and technical standards for planning, design, construction, health, safety and occupancy of the built environment.

C3. Technical Studies

16. Ability to explain the construction of interior elements and building methods
17. Ability to identify the variety of interior and architectural materials; method of selection, specification, application, costs and maintenance requirements.
18. Ability to explain the structure, construction elements and methods of an existing building.
19. Ability to identify sustainable material and 'green' requirements in accordance with codes, safety requirements and applicable standards.
20. Ability to explain building utility systems, comfort, vertical transportation systems, telecommunication, maintenance and building safety systems.
21. Ability to explain building codes, regulations and standards applicable to the site
22. Awareness of the importance of technical documentation and specifications in design implementation, construction processes, budget planning and control.
23. Ability to act with innovative technical competence in the use of building techniques and the understanding of their evolution.

C5 Design Studies

24. Ability to analyze design precedents and interior architectural criticism.
25. Understanding of design theory and methods.
26. Ability to formulate design procedures and processes.
27. Ability to apply the theory of colors as well as theory, system and principles of lighting and illumination in interior architecture design
28. Ability to identify the interior architecture design components and details
29. Ability to identify sustainable design principles and methods and ecological aspects of design.

C6 Professional Studies

30. Ability to act in respond to the problems that take place in the process of design and construction.
31. Ability to identify the regulations and policies related to building and interior design.
32. Ability to understand of professional business practices of an interior architect (contract administration, project management, marketing, strategic planning, accounting and real estate issues).

D. Skill

33. Ability to communicate ideas through collaboration, oral communication, numeracy, literacy, writing, drawing, modeling and evaluation.
34. Ability to utilize manual, electronic, graphic and model making to explore, develop, define and communicate a design proposal
35. Ability to learn systems evaluation techniques that use manual and/or electronic means for the performance assessment of the built environment.
36. Ability to write scientific papers.

	E. Design Behavior 37. Ability to understand professional ethics and codes of conduct in interior architecture practices and to comprehend the interior architects' legal responsibilities where they are registered and practiced. 38. Ability to conduct academic ethics. **F. Social Life** 39. Understanding citizenship and ability to communicate in national and international language(s).
13	**Course Composition**

No	Type of Course	Credits	Percentage
i	University General Subjects	18	12,5
ii	Basic Engineering Subjects	12	8,33
iii	Interior Architecture Core Courses	82	56,94
iv	Electives (incl. Independent Study)	24	16,67
v	Undergraduate Thesis or Final Project	8	5,56
	Total	144	100 %
14	**Total Credits for Graduation**		**144 SKS**

Job Opportunity

A graduate is able to work as an interior architect in the design of interior spaces of residential buildings; commercial buildings; hospitals and other public buildings. S/he can also work as a design principal in an interior design consultancy, act as a corporate designer or a designer of movie, TV, theater sets as well as working as an academic and as a critic.

COMPETENCY NETWORK

Sarjana Arsitektur in Interior Architecture Major are those graduates who are able to design interior architecture based on interiority with multi-disciplinary skills and have ability to communicate information, ideas, problem and design solutions

Ability to design interior architecture imaginatively, creatively, and innovatively using analytical abilities; logical thinking as well as three-dimensional thinking, and to synchronize a variety of design issues

Ability to apply arts and cultural knowledge in interior architectural design

Ability to apply social knowledge in relation to interior architectural design

Ability to apply design knowledge in interior architecture design

Ability to apply technical knowledge in interior architecture design

Ability to employ a variety of communication techniques in interior architectural design and the ability to write scientific paper(s)

Deep understanding of professional ethics in the interior architecture profession

Ability to apply basic principles of mathematics and physics in solving the problems of interior architecture design

Ability to think critically, creatively, and innovatively as well as having the intellectual curiosity to solve problem(s) as an individual and in a group

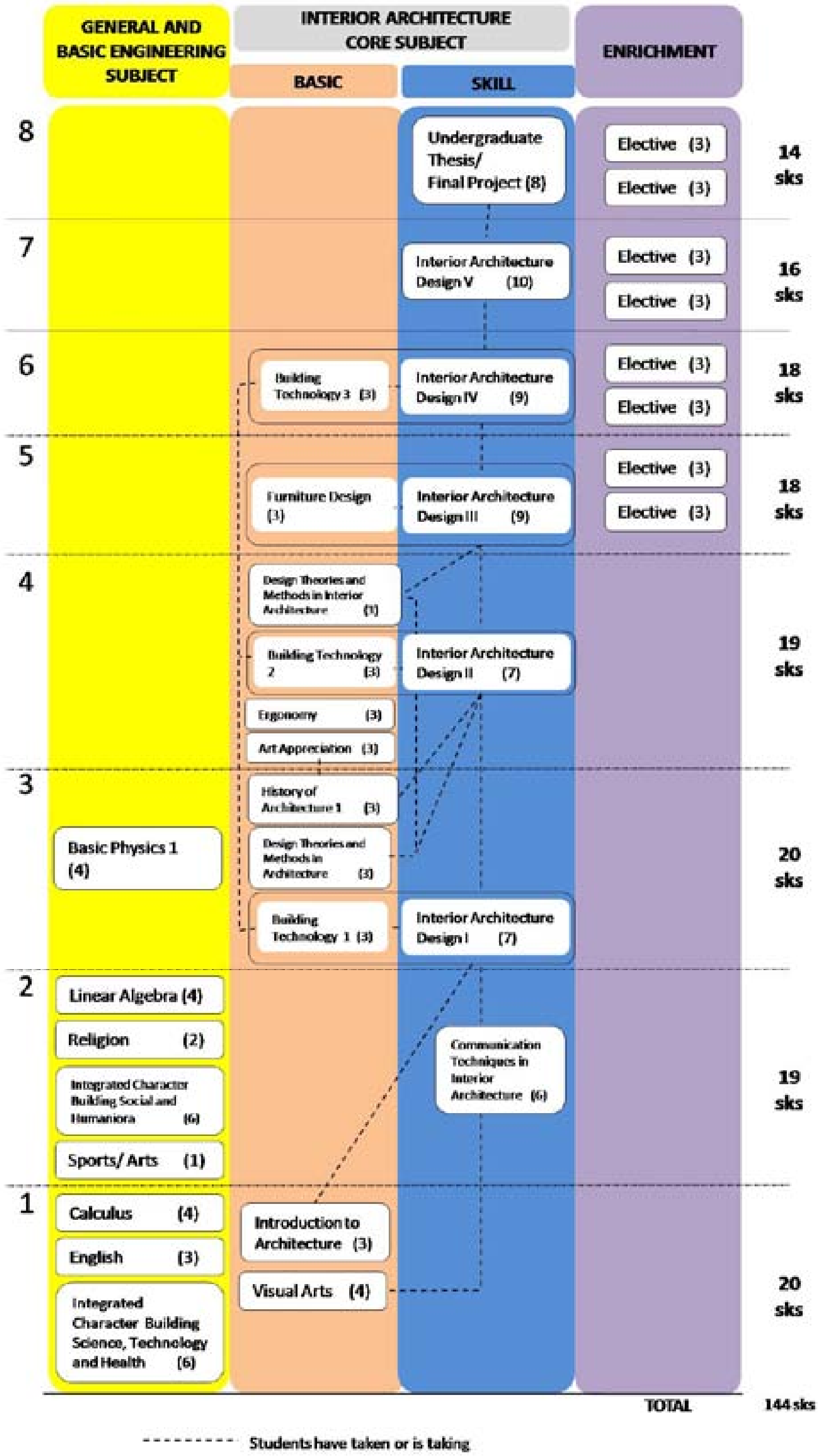
Ability to employ information technology and communication

Ability to identify the various entrepreneurial efforts, characterized by innovation and independence based on ethical principles

Ability to communicate ideas in spoken and written expression (Indonesian and English) both in an academic and non-academic context

Ability to provide alternative solutions to various problems for the society, nation and state

NETWORK COURSES



Curriculum Structure of Undergraduate of Interior Architecture Study Program

COURSE CODE	COURSE SUBJECT		CREDITS
	Semester 1	**1st Semester**	
UIGE600004	MPKT B	Integrated Character Building Subject B	6
UIGE600002	Bahasa Inggris	English	3
ENAR600001	Pengantar Arsitektur	Introduction to Architecture	3
ENGE600001	Kalkulus	Calculus	4
ENAR600010	Seni Rupa	Visual Arts	4
		Sub Total	**20**
	Semester 2	**2nd Semester**	
UIGE600001	MPK Terintegrasi A	Integrated Character Building Subject A	6
UIGE600005 s.d. 9	Agama	Religious Studies	2
ENGE600002	Aljabar Linear	Linear Algebra	4
UIGE600003	Olah Raga/ Seni	Sports/ Arts	1
ENAI600009	Teknik Komunikasi Arsitektur Interior	Communication Techniques in Interior Arch.	6
		Sub Total	**19**
	Semester 3	**3rd Semester**	
ENGE600003	Fisika Dasar 1	Basic Physics 1	4
ENAI600004	Perancangan Arsitektur Interior 1	Interior Architecture Design 1	7
ENAR600015	Teori & Metode Perancangan Arsitektur	Design Theories & Methods in Architecture	3
ENAR600008	Sejarah Arsitektur 1	History of Architecture 1	3
ENAI600010	Teknologi Bangunan 1	Building Technology 1	3
		Sub Total	**20**
	Semester 4	**4th Semester**	
ENAI600005	Perancangan Arsitektur Interior 2	Interior Architecture Design 2	7
ENAI600013	Teori & Metode Perancangan Arsitektur Interior	Design Theory & Methods in Interior Architecture	3
ENAI600003	Ergonomi	Ergonomy	3
ENAI600001	Apresiasi Seni	Art Appreciation	3
ENAI600011	Teknologi Bangunan 2	Building Technology 2	3
		Sub Total	**19**
	Semester 5	**5th Semester**	
ENAI600006	Perancangan Arsitektur Interior 3	Interior Architecture Design 3	9
ENAI600002	Desain Furnitur	Furniture Design	3
	Pilihan	Elective	3
	Pilihan	Elective	3
		Sub Total	**18**

	Semester 6	6th Semester	
ENAI600007	Perancangan Arsitektur Interior 4	Interior Architecture Design 4	9
ENAI600012	Teknologi Bangunan 3	Building Technology 3	3
	Pilihan	Elective	3
	Pilihan	Elective	3
		Sub Total	**18**
	Semester 7	**7th Semester**	
ENAI600008	Perancangan Arsitektur Interior 5	Interior Architecture Design 5	10
	Pilihan	Elective	3
	Pilihan	Elective	3
		Sub Total	**16**
	Semester 8	**8th Semester**	
ENAI600014	Skripsi / Tugas Akhir*	Undergraduate Thesis / Final Project *	8
	Pilihan	Elective	3
	Pilihan	Elective	3
		Sub Total	**14**
		Total	**144**

*) Students who choose the Final Project must take Independent Study course (3 credits semester units, as Design Report)

MATA AJAR PILIHAN			
KODE	**MATA AJARAN**	**SUBJECT**	**SKS**
ENAI600015	Akustik	Accoustics	3
ENAI600016	Arsitektur Pusaka	Heritage In Architecture	3
ENAI600017	Dasar Komputer untuk Arsitektur	Basic Computing in Architecture	3
ENAI600018	Desain Furnitur Lanjut	Advanced Furniture Design	3
ENAI600019	Desain Produk	Product Design	3
ENAI600020	Desain Ruang Pameran	Exhibition Space Design	3
ENAI600021	Desain Seni Instalasi	Installation Arts Design	3
ENAI600022	Fotografi	Photography	3
ENAI600023	Gaya Hidup dan Desain Arsitektur Interior	Life Style & Interior Architecture Design	3
ENAI600024	Psikologi Arsitektur	Architectural Psychology	3
ENAI600025	Tata Cahaya untuk Arsitektur Interior	Lighting Design in Interior Architecture	3
ENAI600026	2D - Komunikasi Desain Digital	2D - Digital Design Communication	3
ENAR600042	3D - Komunikasi Desain Digital	3D - Digital Design Communication	3
ENAI600027	Kapita Selekta	Capita Selecta	3
ENAI600028	Kerja Praktek/KKN	Internship	3
ENAI600029	Kajian Mandiri *)	Independent Study	3

*) Compulsory for students who choose to take Final Project

COURSE DESCRIPTION

ENAR600001
INTRODUCTION TO ARCHITECTURE
3 CREDIT UNITS

Learning objectives: To introduce basic knowledge about architecture, to introduce basic architectural principles, to introduce the act of creating architectural works, to introduce the aspect of sustainability, to introduce the role of the architect, and architecture's position among other disciplines. Upon completion of this course, students are expected to be able to distinguish architecture from building construction, explain the relationship between architects and society (architect's role and architecture's domain), the essence of architecture, and demonstrate examples of architectural objects and principles.

Syllabus: People and environments: natural environment, built environment, social environment. The necessity to build shelter. Architecture, architect, practicing and experiencing architecture. Boundary, spatial boundary, building and builder. Background and foreground, solid and void, rugged and soft, single and multiple, far and close, high profile and low profile, complexities of function, science and design. Knowing, defining, and solving problems, explaining architectural works. Architects, architectural practices, code of ethics, milestone architects.

Prerequisites: None

References:

1. Conway, Hazel and Rowan Roenisch. *Understanding Architecture: An Introduction to Architecture and Architecture History*. London & New York: Routledge, 1994.
2. Doxiadis, Constantinos A. *Ekistics: An Introduction to the Science of Human Settlement*. New York: Hutchinson, 1968.
3. Gideon, Sigfried. S*pace, Time, and Architecture*. Cambridge, Mass: Harvard University Press, 1964.
4. Gorman, James F. *ABC of Architecture*. Philadelphia: University of Pennsilvania Press, 1998.
5. Gropius, Walter. *Apollo in Democracy; The Cultural Obligation of the Architect*. New York: McGraw Hill, 1968.
6. Hall, Edwart T. *The Hidden Dimension*. New York: Double Day, 1966.
7. Hilier, Bill. *Space is the Machine*. Cambridge: Cambridge University Press, 1996.
8. Jackson, J.B. *Discovering the Vernacular Lanscape*. New Haven: Yale unviersity Press, 1984.
9. Mangunwijaya, Y.B. *Wastucitra: Pengantar ke Ilmu Budaya Bentuk Arsitektur; Sendi-sendi Filsafatnya Beserta Contoh-contoh Praktis*. Jakarta, Gramedia, 1988.
10. Moore, Charles dan Gerald Allen. *Dimensions, Space, Shape, and Scale in Architecture*. New York: Architecture Books, 1975.
11. Pevsner, Nikolaus. *An Outline of European Architecture*.(7th edition) Middlesex, 1985.
12. Raskin, Eugine. *Architecture and People. Englewood Cliff*. New Jersey: Prentice Hall, 1974.
13. Sullivan, Louis. *Kindergarten Chats*. New York: Dover, 1960.
14. Tuan, I-Fu. *Space and Place: An Experiencial Perspectives*. Minneapolis: University of Minnesota Press, 1980.
15. Van de Ven, Cornelis. *Space in Architecture: The Evolution of a new idea in the Theory and History of Modern Movement*. Assen: Van Gorcum, 1980.
16. Venturi, Robert. *Complexity and Contradiction in Architecture*. New York: Museum of Modern Art Paper Series, 1966, 1977.
17. Vitruvius, M.P. *Ten Books of Architecture*. Terjemahan: M.Viadon dan G. Caffee. Chicago: University of Chicago Press, 1960.

ENAR600010
VISUAL ARTS
4 CREDIT UNITS

Learning objectives: To provide knowledge on basic visual elements, basic principles of aesthetics, composition, dimensionalities, and craftmanship.

Syllabus: Knowledge of basic visual elements. Knowledge of basic principles of aesthetics: beauty, ugliness; order, disorder. Composition: the formation of an object (point, line, plane, space, mass). Dimensions: two dimensionality, three dimensionality. Freedom of expression. Design meaning: 'From Nothing to Something'. Craftsmanship (materials, material treatment)

Prerequisites: None

References:

1. Louis Fisher Rathus, *Understanding Art*,Prentice hall 1994
2. Claire Holt, Art in Indonesia, *Continuity and Changes*, Cornel University-Ithaca and London1967
3. Frank D.K.Ching, *Architecture form, Space & Order*, John Wiley & Son, 1997
4. Hideaku Chijiwa, *Color Harmony*, Rockport Publisher, 1992
5. Bride M.Whelan, *Color Harmony-2*, Rockport Publisher, 1994
6. Harvard Anarson, *History of modern Art: Painting, Sculpture, Architecture & Photography*, Prentice Hall, 1998
7. Kimberly Elam, *Geometry of Design*, Princenton, 1998
8. John F Pile, *Interior Design*, Harry Abrams, Inc Publisher, New York,1995
9. John F Pile, *Color in Interior Design*, McGraw Hill, 1997

ENAI600009

COMMUNICATION TECHNIQUES IN INTERIOR ARCHITECTURE

6 CREDIT UNITS

Learning objectives: To enable students to express architectural ideas through appropriate communication media

Syllabus: Introduction to a variety of communication techniques to present ideas related to the field of Interior Architecture, determining the appropriate communication techniques for particular ideas to be communicated and particular audience, communicating visual shapes, communicating the conceived space. Communicating the space for human activities.

Prerequisites: Students have taken Visual Arts

References:

1. Frank D.K.Ching, *Drawing & Perceiving A Visual Dictionary of Architecture*. John Wiley & Sons, 1996
2. Frank D.K.Ching, *Architectural Graphics*, 2nd Ed. John Wiley & Sons, 2002
3. Francis DK Ching, *Drawing: A Creative Process*, Wiley, 1989
4. Paul Laseau and Norman Crewe, *Visual Notes for Architects and Designers*, Wiley 1986
5. Tom Porter and Sue Goodman, *Manual of Graphic Techniques*, Scribner, 1991

ENAR600015

DESIGN THEORIES & METHODS IN ARCHITECTURE

3 CREDIT UNITS

Learning objectives: To provide students with basic theories & basic methods of design, in order to enable students to explain their own ideas and works, as well as to apply one of the design methods through writing & drawing (sketches)

Syllabus: Theory and way of thinking; phenomenology, semiotics. Theory and identification of problems: architectural observation, design knowledge, the factual, the deontic, instrumental, black box, clear box. Theory and ways to comprehend problems, analysis & synthesis, theory and problem solving.

Prerequisites: None

References:

1. Gunawan Tjahjono, *Metode Perancangan: Suatu Pengantar untuk Arsitek dan Perancang*, 1998
2. Christoper Alexander, *Notes on The Synthesis of Form*, Harvard University Press,1994

ENAR600008
HISTORY OF ARCHITECTURE I
3 CREDIT UNITS

Learning objectives: Introducing modern architecture, with emphasis on Western development.

Syllabus: Definition and description of Modern Architecture, Neo-Classic, Urbanism and City Planning, Science and Technological developments, Arts & Crafts, Modernist Architecture, Late Modernist Architecture, Post-modern Architecture

Prerequisites: None

References:

1. Spiro Kostof, *A History of Architecture: Setting and Rituals*, 2nd edition, Oxford University Press, USA, 1985
2. Leonardo Benevolo, *History of Modern Architecture,* MIT Press, 1977

ENAI600013
DESIGN THEORIES & METHODS IN INTERIOR ARCHITECTURE
3 CREDIT UNITS

Learning objectives: To provide students with basic theories and methods in Interior Architecture, to enable students to explain how certain theory or method is applied on a work through writing and drawing (sketches).

Syllabus: Interiority; Body and Space; Programming; Type, Sign and Society; Design in Society, Semiotics in Design; Critical Regionalism; Design and the Issue of Locality; Folding.

Prerequisites: Students have taken Design Theories & Methods in Architecture

References:

1. Shashi Caan, *Being,* in a book, *Rethinking Design and Interiors: Human Beings in the Built Environment*, Laurence King Publishing, London, 2011.
2. Mark Kingwell, Mark Taylor and Julieanna Preston,*Tables, Chairs, and Other Machines for Thinking*, in *Intimus*, by (eds.), Wiley-Academy, Chichester, 2006, pp. 173-179.
3. Gaston Bachelard, *The Dialectics of Outside and Inside*, in *Intimus*, by Mark Taylor and Julieanna Preston (eds.), Wiley-Academy, Chichester, 2006, pp. 22-25.
4. Rem Koolhaas, *Delirious New York: A Retroactive Manifesto of Manhattan*, 1978
5. Adrian Forty, *Words and Buildings: a Vocabulary of Modern Architecture*, pp. 304 – 311.
6. Michel Foucault, *Discipline and Punish,* (only the chapter on disciplining the docile bodies).
7. Neil Leach (ed), *Rethinking Architecture*. Read articles by Umberto Eco and Roland Barthes.
8. Robert Venturi, Denise Scott Brown, Steven Izenour,*Learning from Las Vegas*,
9. Fredric Jameson, *Postmodernism, or the Cultural Logic of Late Capitalism*. Read the parts of *The Rise of Aesthetic Populism*, and *Postmodernism as Cultural Dominant* (pp. 54-58). Then, read *The Bonaventura Hotel* (pp. 80-84). *http://classweb.gmu.edu/sandrew3/misc/nlr142jameson_postmodernism.pdf*
10. Kenneth Frampton, *Towards a Critical Regionalism: Six Points for an Architecture of Resistance*. *http://www.colorado.edu/envd/courses/envd4114-001/Spring%2006/Theory/Frampton.pdf*
11. Greg Lynn, *Architectural Curvilinearity: the Folded, the Pliant and the Supple*, in *Theories and Manifestoes of Contemporary Architecture* (Jencks and Kropf, eds., 1999), pp. 125-127.

Optional:

12. Guy Debord, *Society of Spectacle*, by 1967. *http://www.marxists.org/reference/archive/debord/society.htm*, **OR** *http://library.nothingness.org/articles/SI/en/pub_contents/4*
13. Maurice Merleau-Ponty, Part II, *The World as Perceived*, in *Phenomenology of Perception*, by (English trans. by Colin Smith), Routledge, London, 2002).

https://wiki.brown.edu/confluence/download/attachments/73535007/Phenomenology+of+Perception.pdf?version=1&modificationDate=1286305678000

ENAI600003
ERGONOMICS
3 CREDIT UNITS

Learning objectives: Students understand the principles of ergonomics in the planning and design of built environment (anthropometry, aspects of quality space: sound, vibration, illumination). Proposing ergonomic designs with a variety of considerations aimed at improving the quality of human life which is based on the limitations and human excellence in implementing the various activities.

Syllabus: The basic theory of ergonomics as a science. Applications in planning and designing the built environment: sizes and shapes, vision, sound, design, human error

Prerequisites: None

References:

1. Alphonse Chapanis, Human Factors in Systems Engineering. John Wiley & Sons. New York. 1996
2. Mark S Sanders and Ernest J. MC Cormick. *Human Factors in Engineering and Design*, McGraw Hill, Singapore, 1992
3. Galen Cranz, *The Chair: Rethinking Culture, Body and Design*, W & W Norton Company, 2000.
4. RS Bridger, *Introduction to Ergonomics*, Mc.Graw Hill, Singapore, 1992
5. Amit Bhattacharya, James D Mc. Glothin, *Occupational Ergonomics Theory and Applications*, Marcel Dekker Inc, New York, 1996.

ENAI600001
ART APPRECIATION
3 CREDIT UNITS

Learning objective: Aesthetic sensibilities of art works on practical and theoretical levels in related disciplines, as well as in everyday life; understanding the sense of art appreciation, aesthetic theories and theories of art, especially in contemporary times; application of knowledge on art appreciation and practice discussion works of art and association it with the field of science.

Syllabus: Art and art appreciation through the adoption of submission of a described experience (sense, aesthetic) and understanding (concepts and theories) to works of art, based on technical criteria - formal as well as an understanding of theories through an interpretative view of the artworks. Artworks herein cover various genres of art: visual arts, audio, performance, literature and other arts which are relevant to the field of Interior Architecture studies.

Prerequisites: None

References:

1. Alex Neil & Aaron Ridley, *Arguing About Art: Contemporary Philosopical Debates,* Routledge (3rd ed), 2007.
2. Arthur Danto, *The Transfiguration of the Commonplace*: *A Philosophy of Art*, Harvard University Press, 2001.
3. Arthur Danto, *The Abuse of Beauty: Aesthetics and the Concept of Art (the Paul Carus Lecture Series*), Open Court, 2003.
4. Cynthia Freeland, *But Is It Art*? An Introduction to Art Theory, Oxford University Press, 2001.
5. Claire Holt, *Art in Indonesia: Continuity and Changes*, Cornell University-Ithaca and London, 1967.
6. Edmund Burke Feldman, *Art as Image and Idea*, Prentice Hall, 1967.
7. Noel Carrol, *Theories of Art Today*, University of Wisconsin Press, 2000.
8. Peter Lamarque, *The Philosophy of Literature (Foundation of the Philosophy of the Arts*), Wiley-Blackwell, 2008.
9. Rathus Louis Fisher, *Understanding Art*,

Prentice Hall 1994.
10. Robin Maconie, *The Concept of Music*, Oxford University Press USA, 1993.
11. *Selected books on Aesthetics and Design.*

INTERIOR ARCHITECTURE DESIGN

Interior Architecture Design courses are the studio courses of the Interior Architecture Programme. The studios denote learning locations, as well as learning methods. Ability that is expected at the end of studio-based learning process is thinking critically and creatively that can be measured from student is ability to explain and present her/his design idea.

The Interior Architecture Design learning process is implemented through Design Projects, which are direct manifestations of the integration of knowledge, consisting of:

- Factual knowledge: Understanding and formulating design problem which are abstract, qualitative, and related to socio-cultural aspects of human space/activities.
- The context and environment of living space, ranging from micro/local/personal space, family, community, up to urban/rural environment.
- Engineering aspects such as structure, tectonics (including building materials), building physics, building systems, and interior elements.
- Design methods.
- Communication techniques.

In its implementation, the Design Studio Projects accommodate learning material from Architecture Design, Building Technology and Furniture Design courses in the following order:

- Design Project 1 is an integration of Interior Architecture Design 1 and Building Technology 1
- Design Project 2 is an integration of Interior Architecture Design 2 and Building Technology 2
- Design Project 3 is an integration of Interior Architecture Design 3 and Furniture Design
- Design Project 4 is an integration of Interior Architecture Design 4 and Building Technology 3

Interior Architecture Design 5 and Final Project are separate courses which are not paired with other courses in design project scope.
Gradually, knowledge and ability will be described in the Interior Architecture Design learning step in each semester.

DESIGN PROJECT 1

Design Project 1 focuses on personal space design. Design Project 1 is an integration of knowledge on spatial design, ranging from understanding the relation of humans and space, the basic logic of structure application, to basic principles of ergonomics. Design Project 1 consists of learning activities carried out in two courses which complement each other, namely Interior Architecture Design 1 and Building Technology 1

ENAI600004
INTERIOR ARCHITECTURE DESIGN 1
7 CREDIT UNITS
Learning Objectives:
Able to design a space for one person, a through understanding of the relationship between human being and space.
Syllabus:
Interior Architecture Design 1 is an early and critical stage to introduce students to Interior Architecture through imaginative, creative, and innovative space design. Interior architectural knowledge encompasses basic comprehension about meaning and personal spatial experience, interaction between human body and space, understanding the site and surrounding context as experienced by human body. This studio consists of a series of activities, ranging from information gathering, problem defini-

tion, analysis, and making critical decisions to formulating action strategy toward human space, an ability to think in a three-dimensional manner through space design exploration, also communicating design ideas.

Prerequisite:

Students have taken Communication Techniques in Architecture course

Students have taken or are taking Building Technology 1 course

Assignment:

Designing a space for an individual that is implemented through 1:1 scale model; Designing a space for an episode of human life.

References:

1. Bruno Zevi, *Architecture as Space*. Da Capo Press, 1993.
2. Karen Franck & Bianca Lepori, *Architecture Inside Out*. Academy Press, 2000.
3. Yi Fu Tuan, *Space and Place: The Perspective of Experience*. University of Minnesota Press, 1981.
4. Steen Eiler Rasmussen, *Experiencing Architecture*. MIT Press, 1959.
5. Donlyn Lyndon & Charles Moore, *The Chambers of Memory Palace*. MIT Press, 1994.
6. Francis DK Ching, *Interior Design Illustrated*. Wiley, 2005
7. John F Pile,*Interior Design.* Prentice Hall (4th ed), 2007
8. Edward T. Hall, *The Hidden Dimension*. Peter Smith Publications, 1992.
9. D'Arcy Thompson, *On Growth and Form*, 1961.
10. Russell C. Hibbeler, *Structural Analysis*. Prentice Hall, 1997.
11. J.E. Gordon, *Structures of Why Things Don't Fall Down*. Da Capo Press, 2003.
12. Edward Allen, *Fundamentals of Building Construction: Materials and Methods*. John Wiley and Sons, 1999.
13. Gaston Bachelard, *Poetics of Space* in Neil Leach (ed), *Rethinking Architecture*: A Reader in Cultural Theory, 1997
14. Fran Kellogg Smith, *Bringing Interior to Light*. Fredj.Bertolone-Whitney, 1986
15. John F Pile, *Color in Interior Design.* McGraw-Hill Professional, 1997.
16. Ernest Scott,*The Mitchell Beazley Illustrated Encyclopaedia of Working in Wood: Tools - Methods - Materials – Classic*, Mitchell Beazley, 1992.
17. Julius Panero and Martin Zelnik. *Human Dimension & Interior Space: A Source Book of Design Reference Standards,* Watson-Guptill, 1979.
18. Alvin R. Tilley and Henry Dreyfuss,*The Measure of Man and Woman: Human Factors in Design,* Wiley, 2001.

ENAI600010

BUILDING TECHNOLOGY 1

3 CREDIT UNITS

Learning Objectives:

An introduction to structural principles and building construction methods that assist students in understanding of how a building works from a structural and material aspect. Structure and interior constructions are examined, and students begin to draw interior construction elements. Structural and architectural materials are presented to further the understanding of building as something that is "given" in any architecture interior architectural project.

Syllabus:

Structural system logic and construction (sturdy, rigid, firm, and stable); basic mechanics; force (action-reaction, moment); load characteristics (inanimate, animate, and dynamic load); construction connections (compression, tension); characteristics and common uses of building materials (wood, bamboo, stone, brick, iron, mortar) and interior materials (gypsum, glass, fabric, etc.); construction system for building development; interior element construction. Basic knowledge on utility and building physic principles related to climatic factors (passive cooling, natural lighting).

Prerequisite: None

Assignment:

Drawings and models of structure/construction, building utilities and building physics related to assignment of Design Project 1

References:

1. Daniel Lewis Schodek, Martin Bechthold, *Structures*, Prentice Hall, 2007
2. William Morgan, Ian G. Buckle, *The Elements of StructuresAn Introduction to the Principles of Building and Structural Engineering*, Pitman Publishing, 2nd ed, March 1978.
3. Allan Konya, *Design Primer in Hot Climates,* Archimedia Press Limited, 2011.
4. Avil Fox & Robin Murrel, *Green Design Guide to Environmental Impact of Building Materials, Architecture Design and Technology*, Press London, 1989.
5. Hartono Poerbo, *Utilitas Bangunan,* Penerbit Djambatan, 1992.
6. Sugiharto, *Dasar-dasar Pengelolaan Air Limbah*
7. Sugihardjo BAE, *Konstruksi dan Sambungan Kayu*
8. David Kent Ballast, AIA, *Interior Construction and Detailing for Designers and Architects*, Belmont, CA : Professional Publications, 2002.
9. Jim Postell, Nancy Gesimondo, *Materiality and Interior Construction*, John Wiley & Sons, 2011.

DESIGN PROJECT 2

Design Project 2 is about designing space for a core social unit (family, a couple, etc.). Design Project 2 integrates space design, the concept of dwelling, analyses on life cycle and daily activities, application of basic structural principles and low rise building constructions, building systems, and building physics principles. Design Project 2 integrates the activities carried out in two courses which support each other, namely Interior Architecture Design 2 and Building Technology 2

ENAI600005
INTERIOR ARCHITECTURE DESIGN 2
7 CREDIT UNITS

Learning objectives:

Able to design a space for a core social unit based on the concept of dwelling, in consideration of life cycle and daily activities of the core social unit.

Syllabus:

Interior Architecture Design 2 proposes critical problem about living space in urban context, through the concept of dwelling and design. Design knowledge herewith includes the concept of dwelling, observation and analysis of core social unit, comprehension in physical and social contexts, development of spatial idea in creative manner, formulating spatial organization and program which act as the base for integrated spatial idea, which would be communicated professionally.

Prerequisite:

Students have taken Interior Architecture Design 1

Students have taken or are taking Building Technology 2 course

Assignment:

Make a comprehensive study of dwelling precedents, with an emphasis on best practices for spatial design and technology. Designing a space for a core social unit.

References:

1. Karen A. Franck, R. Bianca Lepori, *Architecture from the Inside Out: From the Body, the Senses, the Site and the Community,* Academy Press, 2007.
2. Martin Heidegger, *"Building, Dwelling, Thinking", in Poetry, Language, Thought*, New York: Harper and Row, 1971.
3. Erik Erikson, *The Life Cycle Completed*, WWNorton & Company, 1997.
4. Electa, Rizzoll.*The Concept of Dwelling*, New York,1984.
5. Toby Israel, *Some Place Like Home: Using Sesign Psychology to Create Ideal Places*, Wiley-Academy, 2003.
6. Christian Norberg-Schulz,*Genius Loci: Towards a Phenomenology of Architecture*, Rizzoli, 1984

7. Bryan Lawson, *The Language of Space*, Routledge, 2001
8. Juhani Pallasmaa, *The Eyes of the Skin: Architecture and the Senses*, John Wiley & Sons, 2012
9. Hannah Arendt, *The Human Condition*, The University of Chicago Press,1958
10. John F Pile, *Interior Design*.Harry N, Abrams, Inc Publishers, New York, 2004
11. John E Flynn, Arthur W. Segil,*Architectural Interior System: Lighting, Accoustics, Air Conditioning*, Van Nostrand Reinhold; 1992.
12. S.C. Reznikoff, *Interior Graphic and Design Standars*, Whitney Library of Design, New York 198S.

ENAI600011
BUILDING TECHNOLOGY 2
3 CREDIT UNITS
Learning objectives:
Students understand interior construction and built-in furniture details, types and characters of materials, construction techniques, and finishing processes. Understanding of building utility and its connection with interiors, building physics principles (passive cooling) for comfort, acoustics, and lighting.
Syllabus:
Application of the concept into physical form; comprehensive knowledge about materials and specifications; utility applications; and building physics (passive cooling) for thermal comfort, acoustics, and lighting.
Prerequisite:
Students have taken Building Technology 1 course
Assignment:
Sketch and build structure/construction model, utility and building physics of the design being carried out in Design Project 2 assignment.
References:
1. Mario Salvadori, *Why Buildings Stand Up*, WW Norton Company, New York, 1990.
2. Matthys Levy & Mario Salvadori, *Why Buildings Fall Down*, WW Norton Company, New York, 2002.
3. Hartono Poerbo, *Utilitas Bangunan*, Penerbit Djambatan, 1992.
4. Norbert Lechner, *Heating, Lighting, Cooling*, edisi ke 2, PT Raja Grafindo Persada, 2007.
5. Binggeli, Corky. *Building Systems for Interior Designers*. Wiley, 2009.
6. David Kent Ballast, AIA, *Interior Construction and Detailing for Designers and Architects*, Belmont, CA : Professional Publiactions, 2002.
7. Jim Postell, Nancy Gesimondo, *Materiality and Interior Construction*, John Wiley & Sons, 2011.
8. Maryrose McGowan, Kelsey Kruse, *Interior graphic standards*, John Wiley & Sons, 2003.

DESIGN PROJECT 3
This studio requires students to design public space. It is an issue-based design project, with basic knowledge on urbanism. The studio consists of activities related to Interior Architecture Design 3 and Furniture Design courses.

ENAI600006
INTERIOR ARCHITECTURE DESIGN 3
9 CREDIT UNITS
Learning objectives:
Design commercial public space based on ensuing issues, and exploration of ideas on form and space quality creatively.
Syllabus:
Interior Architecture Design 3 proposes critical problem of human living space with socio-cultural complexity, through an issue-based approach and exploration of forms. Design knowledge introduced in this studio includes knowledge on public space, breaking down functional types, spatial programming and organization, developing keywords, commercial public building concept and its explanation in space design, formulation of initial statement based on existing issues, program development and its explanation in space design.

Prerequisite:
Students have taken Interior Architecture Design 2
Students have taken or are taking Introduction to Furniture Design course

Assignment:
Designing space in a social environment in a society with strong kinship. Designing space in complex urban environment.

References:

1. Adrian Forty, *Words and Buildings: A Vaocabulary of Modern Architecture*, Thames & Hudson, 2000, Chapter 'Space', pp. 256-275.
2. Yi-Fu Tuan, *Space and Place: The Perspective of Experience*, University of Minnesota Press, 1981.
3. Henri Lefebvre, *The Production of Space*, Blackwell, 1991.
4. Karen Franck & Bianca Lepori, *Architecture Inside Out*, Academy Press, 2000.
5. Giulio Carlo Argan, *On the Typology of Architecture*, in Nesbitt, *Theorizing a New Agenda for Architecture*, Princeton Architectural Press, 1996, pp. 240-246.
6. Jonathan D. Sime, "Creating Places or Designing Spaces," in*Journal of Environmental Psychology*, Vol 6, 1986, pp. 49-63.
7. Andrew Ballantyne, *What is Architecture?* Routledge, 2002.
8. Robert Venturi & Denise Brown, *Learning from Las Vegas,* MIT Press, 1977.
9. Bauman Lyons Architects, *How to be a Happy Architect,* Black Dog Publishing, 2008.
10. Kenneth Frampton, John Cava, *Studies in Tectonic Culture : The Poetics of Construction in Nineteenth and Twentieth Century Architecture,* MIT Press, 1995.
11. C. Reznikoff,*Specification for Commercial Interiors*, Whitney Library of Design, New York 1995.
12. Kim Dovey,*Framing Places: Mediating Power in Built*, Form, London. New York, Routledge, 1999.

ENAI600002
FURNITURE DESIGN
3 CREDIT UNITS

Learning objectives:
Introduce student to concepts, functions, and furniture construction. To understand theories and methods to conceive a concept and furniture design.

Syllabus:
This course encourages student to learn about furniture and its existence in a space. Furniture is observed as a tool to connect space that is located between human bodies, as in a building or on a broader scope. Furniture is observed as functional object that fills the space. Students are expected to learn and criticize a priori knowledge on furniture, so that they can consider a new perspective in designing furniture.

Prerequisite:
Students have taken Architecture Interior Design 2

References:

1. Galen Cranz. *The Chair, Rethinking Culture, Body and Design*, W. W. Norton & Company, 2000.
2. Christopher Natale.*Furniture Design and Construction for the Interior Designer*. Fairchild Publications, 2009.
3. Jim Postell. *Furniture Design*. Wiley, 2007.
4. M. F. Ashby, Kara Johnson, *Materials and Design: The Art and Science of Material Selection in Product Design*, Elsevier, 2002.

DESIGN PROJECT 4
Design Project 4 consists of a design project that focuses on human behavior, programme complexity, and technical aspects of interior material installation. Design Project 4 integrates professional interior design knowledge, application of form conception into interior construction in wide span and high rise building context and supporting building systems. Design Project 4 integrates two courses, Architecture Interior Design 4 and Building

Technology 3.

ENAI600007
INTERIOR ARCHITECTURE DESIGN 4
9 CREDIT UNITS
Learning objectives:
Students develop their ability in designing interiors of public space in broader scale. Students are able to solve design problems through applying ergonomy in furniture design, while considering technological efficiency in its construction.
Syllabus:
Interior Architecture Design 4 proposes the critical problem of human working space that is focused on programming and designing interior space in existing buildings with complex structures, and applying the latest technology in an urban context.
Prerequisite:
Students have taken Architecture Interior Design 3
Students have taken or are taking Building Technology 3 course
Assignment:
Designing working space in an iconic building
References:

1. Mark Kingwell. *Tables, "Chairs and Other Machines for Thinking," in INTIMUS,* Queen's Quarterly, 2005.
2. Peter Opsvik. *Rethinking Sitting*. W. W. Norton & Company, 2009.
3. CM Deasy, *Designing Places for People,* Watson-Guptill,1990.
4. Hannah Arendt, *The Human Condition*, The University of Chicago Press,1958.
5. Gary Gordon, *Interior Lighting*, Wiley, 2003.
6. Corky Binggeli. *Building Systems for Interior Designers*. Wiley, 2009.
7. Lisa Godsey, *Interior Design Materials and Specification*, Fairchild Books, 2012.
8. Sally Augustin, *Place Advantage: Applied Psychology for Interior Architecture, John Wiley & Sons, 2009.*
9. Mark Taylor, Julieanna Preston (eds). *INTIMUS: Interior Design Theory Reader,* Academy Press, 2006.
10. John E. Flynn, Arthur W. Segil,*Architectural Interior System: Lighting, Accoustics, Air Conditioning*, Van Nostrand Reinhold; 1992.

ENAI600012
BUILDING TECHNOLOGY 3
3 CREDIT UNITS
Learning objectives:
Student may review, research, and explore connection among design, detail, building and their construction. This course also dwells on interior construction details and furniture drawings, understanding application of various traditional, non-traditional, and the latest materials. It introduces principles of adaptive reuse (transformation, adaptation, expansion) and sustainability.
Syllabus:
Understanding and designing construction details required for design realization, material exploration and its application, application of principles of adaptive reuse and sustainability into interior architecture design.
Prerequisite:
Students have taken Building Technology 2 course
Assignment:
Sketch and structure/construction model of interior element related to Design Project 4 assignment.
References:

1. McGuiness, Stein, Reynolds, *Mechanical and Electrical Equipment For Building, 1997.*
2. Norbert Lechner, *Heating, Lighting, Cooling*, 2nd ed, PT Raja Grafindo Persada, 2007.
3. Hartono Poerbo, *Utilitas Bangunan,* Penerbit Djambatan, 1992.
4. Norbert Lechner, *Heating, Lighting, Cooling*, edisi ke 2, PT Raja Grafindo Persada, 2007.
5. David Kent Ballast, AIA, *Interior Con-*

struction and Detailing for Designers and Architects, Belmont, CA: Professional Publications, 2002.
6. Blaine Erickson Brownell, *Transmaterial: A Catalog of Materials That Redefine Our Physical Environment, Princeton Architectural Press, 2006.*
7. Jim Postell, Nancy Gesimondo, *Materiality and Interior Construction*, John Wiley & Sons, 2011.
8. Maryrose McGowan, Kelsey Kruse, *Interior Graphic Standards*, John Wiley & Sons, 2003.
9. Fred Scott, *On Altering Architecture*, Routledge, 2008.
10. Graeme Brooker, Sally Stone, *Rereadings*, RIBA Enterprises, 2004.
11. Kenneth Frampton, John Cava, *Studies in Tectonic Culture: The Poetics of Construction in Nineteenth and Twentieth Century Architecture,* Mit Press, 1995.
12. Sally Augustin, *Place Advantage: Applied Psychology for Interior Architecture, John Wiley & Sons, 2009.*

ENAI600008
INTERIOR ARCHITECTURE DESIGN 5
10 CREDIT UNITS
Learning objectives:
Student can integrate their knowledge to solve interior design problem that have a high degree of complexity and broader scale by applying principle of adaptable space as the context.
Syllabus:
Student will analyze requirements in a certain community and give a solution for existing problem through interior architecture design by applying principles of adaptable space. Space exploration considers various factors such as economic, social, urban culture, complexity of existing building to be re-used, materials and building utility. Students are expected to produce space programming that coordinates spatial requirements and all the relevant elements. Students are to revitalize existing buildings and their surrounding environment. Regulations and building codes are to be considered.
Prerequisite:
Students have taken Interior Architecture Design 4
References:
1. Yi-Fu Tuan, *Space and Place*, Chapter 10, 1977.
2. Adrian Forty, *Words and Buildings,* Chapter "Space" pp. 256-275.
3. Edward Relph, *On the Identity of Places*, 1976, pp. 103-107
4. Ed Hollis, *Thinking Inside the Box: a Reader in Interior Design for the 21st Century*, Middlesex University Press, 2007
5. S.Carr, M.Francis, L.G. Rivlin and A.M.Stone, *Need in Public Space*, 1992, pp.230-240.
6. Deasy, C.M. & Laswell, Thomas E, *Designing Places for People*, Whitney Library of Design, New York, 1998.
7. Christopher Day, *Spirit & Place*, Architectural Press, 2002.
8. Mark Dudek, *Schools and Kindergartens: a Design Manual*, Birkhauser, 2007.
9. Corky Binggeli A.S.I.D, *Building Systems for Interior Designers*, John Wiley & Sons.
10. Fred Scott, *On Altering Architecture*, Routledge, 2008.
11. Graeme Brooker, Sally Stone, *Rereadings*, RIBA Enterprises, 2004.
12. Mark Taylor, Julieanna Preston (eds). *INTIMUS: Interior Design Theory Reader,* Academy Press, 2006.
13. John E. Flynn, Arthur W. Segil, *Architectural Interior System: Lighting, Accoustics, Air Conditioning*, Van Nostrand Reinhold; 1992.
14. Other references in structure, construction, services, safety, and thermal comfort, will be decided in class.

ENAI600014
FINAL PROJECT
Learning Objectives:

This course is taken simultaneously with Independent Study course (3 credit UNITS). Student are expected to be able to respond to an issue in a local context, community, and urban context. The chosen issue will be solved through interior architecture design on an institutional public scale, with interiority as the main theme of the design. Students are demonstrate chosen design method to solve the aforementioned problem.

Syllabus:

The Final Project puts an emphasis on professionalism in designing as the final phase of the interior architecture learning process. The Final Project is conceived as a portfolio of a professional project by the student. As such, Final Project is a comprehensive combination of knowledge obtained by student of Interior Architecture programme throughout the whole years of her/his studies. Student are expected to demonstrate capabilities through design presentation techniques, construction assemblage, and portfolio. The expected output produced by the student consists of portfolio, design report, technology report, and mock-up.

ENAI600014
UNDERGRADUATE THESIS
8 CREDIT UNITS

Learning objectives: Ability to identify, study and communicate issues within specific area of study related to interior architecture. Ability to develop basic expertise to read, conduct research and write a written scientific work. Students obtain an ability to develop an understanding of research as an activity that requires systematic, methodical thought and rationale, as well as ability to develop a critical understanding of various interior architectural issues.

Syllabus: the thesis begins with an inquiry on what the student wishes to deal with in-depth, and is followed by the student's attempt to deal with the subject in-depth. At this level, the student is not required to solve a problem, or to create or invent something new which would contribute to the field of interior architecture. Students are to carry out investigations through literature searches and case studies. Originality is expected. Modes of writing: description, narrative, explanatory, or argumentative.

Prerequisites: students have passed Interior Architecture Design 4.

References:

1. John Zeisel, *Inquiry by Design: Environment/Behavior/Neuroscience in Architecture, Interiors, Landscape, and Planning,* WW Norton, 2006
2. 3. F. Crews. *The Random House Handbook*, Random House: New York, 1974, 1977, 1980.3rd. Ed, pp. 10-114.
3. I. Border and K. Ruedi, *The Dissertation: an Architecture Student's Handbook*, Oxford University Press, 2000.
4. TY. Hardjoko, *Panduan Meneliti dan Menulis Ilmiah*, Depok, Departemen Arsitektur Universitas Indonesia, 2005.

ELECTIVE COURSES

ENAI600015
ACOUSTICS
3 CREDIT UNITS

Learning objectives: providing students with basic acoustics principles in relation to space and environs. Improve ability to conduct analysis to produce good acoustics design.

Syllabus: Acoustics basics, characteristics of sounds, criterion of acoustics in a room, sound isolation, intensifying sound, sound pollution.

Prerequisites: None

References:

1. Leslie L. Doelle & Lea Prasetio, *Akustik Lingkungan*, Erlangga,1993.
2. PH Parkin & HR Humpreys, *Acoustics Noise and Buildings*: Faber and Faber Ltd., London, 1984.
3. Finarya Legoh & Siti Hajarinto, *References*

AKUSTIK, 2002.

ENAI600016
HERITAGE IN ARCHITECTURE
3 CREDIT UNITS

Learning objectives: This course introduces students to architecture of the past as heritage; knowing the process of data collection and documentation of past architectural pieces (buildings and areas) and learning conservation efforts, including re-use of heritage buildings.

Syllabus: Introduction to heritage; conservation and preservation; technical aspects (measurement/documentation); and the reuse of historic building /area; project exercise

Prerequisites: None

References:

1. Bernard M Feilden, *Conservation of Historic Building*, Butterworth-Heinemann Ltd, Oxford, 1994.
2. Adolf SJ Heuken, *Tempat-tempat besejarah di Jakarta*, Cipta Loka Caraka. Jakarta, 1997.
3. INDONESIAN Heritage Society, 3rd Ed The Jakarta Explore, *Equinox Publishing (Asia)*, Jakarta, 2001.
4. Bryan Lawson, *The Language of Space*, Architectural Press, Amsterdam, 2003,
5. Laurence LOH, *Suffolk House*, HSBC Bank Malaysia Berhad, Malaysia, 2007.
6. Pemerintah Propinsi DKI Jakarta, Dinas Kebudayaan dan Permuseuman, *Ensiklopedi Jakarta, Culture Heritage. Buku 1. Buku II, Buku III,* Yayasan Untuk Indonesia, Jakarta, 2005.
7. Pemerintah Provinsi DKI Jakarta. Dinas Kebudayaan dan Permuseuman, *Pedoman Teknis Pemugaran Bangunan Gedung dan Lingkungan Kawasan Kebayoran Baru Jakarta Selatan*, Jakarta, 2005.
8. Peraturan Daerah Daerah Khusus Ibukota Jakarta Nomor 9 Tahun 1999 Tentang Pelestarian dan Pemanfaatan Lingkungan dan Bangunan Cagar Budaya, 1999.

ENAI600017
BASIC COMPUTING IN ARCHITECTURE
3 CREDIT UNITS

Learning objectives: Students gain an ability to operate computers, knowledge about softwares and hardwares, and capabilities to apply appropriate softwares for presentation.

Syllabus: software and hardware, multimedia, power pint, Photoshop, Coreldraw, Pagemaker, CAD and computer simulation and modeling in 2D and 3D.

Prerequisites: Students have taken Visual Arts

References:

1. *AutoCad Manual, latest version*, Auto Desk
2. *Archicad Manual, latest version*, Graphisoft
3. *Multi Media Manual, latest version for Adobe Photoshop, Page Maker, Corel Draw*.

ENAI600018
ADVANCED FURNITURE DESIGN
3 CREDIT UNITS

Learning objectives: Introducing students to basic principles of designing furnitures as disposable items which serve as forming element of spatial quality, in relation to architectural design, space and interiority.

Syllabus: Furniture as disposable objects with certain prerequisites based on the intention behind the design. Interiority and spatial quality as inseparable aspects of furniture design. Once such understanding is established, then the learning process includes: basic furniture construction and furniture construction which form the quality of space.

Prerequisites: None

References:

1. Joyce Ernest, *The Technique of Furniture Making*, B.T. Batsford Liminted, London, 1970
2. *Sunset Series for Furniture Making, Cabinet and Book Shelves Making, Bedroom Storage;*

Kitchen Storage.

3. Ernest Scott, *The Mitchell Beazley Illustrated Encyclopaedia of Working in Wood: Tools - Methods - Materials – Classic*, Mitchell Beazley, 1992.

ENAI600019
PRODUCT DESIGN
3 CREDIT UNITS

Learning objectives: Students are introduced to basic knowledge about aspects of products, such as function, shape, materials, color and aesthetics. This knowledge would assist students in exploring various design details with some aspects of technology and human needs for functionality of the product itself. During its development, understanding and application of product design can affect the nuance of a space.

Prerequisites: None

References:

1. Richard Morris, *The Fundamentals of Product Design*, Ava Publishing, 2009.
2. Michael F. Ashby, Kara Johnson, *Materials and Design: The Art and Science of Material Selection in Product Design*, Butterworth-Heinemann; 2nd Ed, 2009.

ENAI600020
EXHIBITION SPACE DESIGN
3 CREDIT UNITS

Learning objectives: Introduce students to basic principles of exhibition space which are conceived for certain aims and purposes.

Syllabus:
The background of exhibition rooms, types of exhibitions, people who contribute to exhibitions, basic principle for exhibitions, construction principles for exhibition, by visiting exhibition.

Prerequisites:

References:

1. Robert B Konikow, *Exhibit Design 6*, PBC International,1994
2. Robert B. Settle and Pamela L. Alreck, *Why They Buy: American Consumers Inside and Out*, Wiley, 1986.
3. Martin M. Pegler, *Visual Merchandising & Display*, 6th Ed, Fairchild Publications, 2011.

ENAI600021
INSTALLATION ARTS DESIGN
3 CREDIT UNITS

Learning objectives: Students understand the power of spatial art.

Syllabus: Art and Architecture, Art Nouveau and Art Deco; Bauhaus, International Style (Cubist, Surrealist, etc.), Installation in the Settings: Happy Art: Art and Architecture: Architectural Details the Elements: Architecture and Art Installation.

Prerequisites: None

References:

1. Cinthya Maris Dantzic, *Design Dimensions, An Introduction to the Visual Surface.*
2. Maly and Dietfried Gerhardus, *Cubism and Futurism: The evolution of the self-Sufficient Picture,* Phaidon Oxford.
3. Arsen Pohribny, *Abstract Painting*, Phaidon Oxford.
4. “The Ideal Place,” in Art and Design Magazine No.42.
5. Chris Drury, *Silent Spaces*, Thames and Hudson Ltd, London (1989).
6. Fiedler Jeannine, Peter Feierabend, *Bauhaus*, Konemann, 1999.
7. Booqs,*1000 Details in Architecture*, Belgium, 2010.
8. William Hardy, *A Guide to Art Nouveau Style*, Chartwell Book, Inc.
9. Patrick Lowry, *The Essential Guide to Art and Design*, Hodder & Stoughton, 1997.

ENAI600022
PHOTOGRAPHY
3 CREDIT UNITS

Learning objectives: Students are able to produce photographs with artistic elements, and communicate architectural photographs through photographic processes and presen-

tation
Syllabus: art and communication in photography, indoor and outdoor photography, print, methods of taking pictures, lighting, color, B & W, figure & portrait, presentation and photography.
Prerequisites: None
References: *Hand-Outs*

ENAI600023
LIFESTYLE & INTERIOR ARCHITECTURE DESIGN
3 CREDIT UNITS
Learning objectives: Knowing the aspects of lifestyle in the world of interior design during the Early Modern period to present, and the application of such knowledge.
Syllabus: Knowing the basic of lifestyle in the community, especially in the field of interior architecture design, the notion of style in the Development Era, various styles applied in society today, various styles applied in the Community.
Prerequisites: None
References:

1. Idi Subandy Ibrahim. *Lifestyle, Kebudayaan Pop dalam Masyarakat Komoditas Indonesia*,
2. Jean Baudrillard, *The Consumer Society: Myths and Structures*, Sage Publications Ltd; 1st Ed. 1998
3. Dominic Strinati, *An Introduction to Theories of Popular Culture, Routledge 2nd Ed, 2004*
4. Agus Sachari & Yan Yan Sunarya. *Modernism: Sebuah Tinjauan Histori Desain Modern*.
5. David Chaney. *Life Style (Key Ideas)*, Routledge, 1996.
6. Francois Baudot, *Styles: Compendium of Interiors*, Assouline, 2005

ENAI600024
ARCHITECTURAL PSYCHOLOGY
3 CREDIT UNITS
Learning objectives: Knowledge and understanding about the aspect of psychology in architecural and interior architectural design, in relation to designer, user, and social environment in post-occupancy cases.
Syllabus: Architectural Psychology, Human Behavior, attitudes and cultural values, perception, space, crowding, privacy, methods of research on territory, and emotional impact of color.
Prerequisites: None
References:

1. Bell, Fischer, Greene, *Environmental Psychology*, Harcourt Publisher, 1996
2. Bryan Lawson, *The Language of Space*, Architectural Press, 2001
3. Byron Mikellides, *Architecture for People: Exploration in a New Humane Environmental*, 1980
4. Wolfgang F.E. Preisser, Harvey Z. Rabinowitz, Edward T. White, *Post-Occupany Evaluation*, Van Nostrad Reinhold, 1988

ENAI600025
LIGHTING DESIGN IN INTERIOR ARCHITECTURE
3 CREDIT UNITS
Learning objectives: Students are able to design interior and exterior lighting fixtures and ambience using artificial as well as natural lights through critical, collaborative, active learning process based on functional and aesthetic problems.
Prerequisites:
Syllabus: Lighting basics, color, natural light, artificial light, light distribution, interior lighting, exterior lighting (façades of a house and a high rise), urban lighting.
References:

1. William M.C. Lam, *Perception and Lighting as Form Givers for Architecture*, McGraw-Hill
2. Norbert Lechner, *Heating Lighting Cooling*, (2nd Ed), translated, PT RajaGrafindo Persada, 2007
3. John E. Flynn, Arthur W. Segil, *Architectural Interior System: Lighting, Acoustics, Air Conditioning*, Van Nostrand Reinhold, 1992.

ENAI600026
2D –DIGITAL DESIGN COMMUNICATION
3 CREDIT UNITS

Learning objectives: Students are able to use software such as AutoCAD, ArchiCAD, or other modeling software, in order to express creative ideas through 2D models. Students are able to draw using the software packages.

Syllabus: Complete pre-plan drawings, 2D modeling, working drawings.

Prerequisites: None

References :

AutoCAD-ArchiCAD Manual, latest version, 2004

ENAR600042
3D –DIGITAL DESIGN COMMUNICATION
3 CREDIT UNITS

Learning objectives: Students are able to use software such as 3DS max, 3D Viz, Revit, or other modeling softwares, in order to express creative ideas through 3D models. Students are able to draw using the softwares.

Syllabus: Complete pre-plan drawings, 3D modeling, working drawings.

Prerequisites: None

References : Handout

ENAI600027
CAPITA SELECTA
3 CREDIT UNITS

Learning objectives: Depends on the topics being offered during the semester.

Syllabus: Depends on the topics being offered during the semester.

Prerequisites: Depends on the topics being offered during the semester.

References: Depends on the topics being offered during the semester.

ENAI600028
INTERNSHIP
3 CREDIT UNITS

Learning objectives: understanding design process, professional practices (project scheduling, construction and evaluation); to carry out collaborative work with people from different disciplines related to the practice. Student can understand the process of planning, designing and realizing a built-environment, through involvement as Assistant Planner/Designer, Field Executive Assistant/Assistant Field Supervisor, or Community Architect.

Syllabus: Project management processes in the office. Simple method of proposal preparation, simple method of reporting field work results. Method of presentation. Methods of processing materials, data, tools, human resources and coordination among stake holders in engineering planning and its implementation.

Prerequisites: None

References:

4.10. UNDERGRADUATE PROGRAM IN CHEMICAL ENGINEERING

Program Specification

1	**Awarding Institution**		Universitas Indonesia and partner universities
2	**Teaching Institution**		Universitas Indonesia Universitas Indonesia and partner universities
3	**Programme Title**		Undergraduate Program in Chemical Engineering
4	**Type of Class**		Regular, Paralel, Internasional
5	**Degree Given**		Sarjana Teknik (S.T) Double degree: Sarjana Teknik (S.T) and Bachelor of Engineering (B.Eng)
6	**Accreditation status**		BAN-PT: A Accreditation AUN-QA
7	**Medium Language**		Indonesian and English
8	**Study Scheme(Full time/Part time)**		Full time
9	**Entry requirement**		SMA Graduate/equal or D3/Polytechnic graduate
10	**Duration of Study**		Scheduled for 4 years
	Type of Semester	Number of semester	Number of weeks /semester
	Regular	8	17
	Short (optional)	3	8
12	**Graduate Profiles:** *Graduates of the undergraduate program of PSTK-FTUI should be able to contribute to the field of chemical engineering by applying chemical engineering principles with careful consideration of the engineering, economic, social, health and safety, energy, environment, sustainability, and ethics aspects; able to think critically, communicate effectively, and work together in multidisciplinary teams.*		
12	**Expected Learning Outcomes:** 1. Able to communicate effectively and work in multidisciplinary team. 2. Capable of critical, creative, and innovative thinking, and also have the intellectual ability to solve problems independently and and interdependently 3. Good at both spoken and written Bahasa Indonesia and English for academic and non-academic activity 4. Capable of utilizing communication information technology 5. Able to apply knowledge of mathematics and science in solving engineering problems 6. Able to apply concept of mass and energy balances in solving chemical engineering problems 7. Able to apply thermodynamic concepts in solving chemical engineering problems 8. Able to apply concepts of transport phenomena in solving chemical engineering problems 9. Able to apply the concepts of chemical reaction engineering 10. Able to use modern chemical engineering tools 11. Able to conducts experiments and analyze the data obtained		

12	12. Able to design components, systems, processes, and products related to chemical engineering profession with careful consideration of the engineering, economic, social, health and safety, energy, environment, sustainability, and ethics aspects 13. Able to provide solutions to various problems occurred wherever they live and work 14. Able to identify the kind of entrepreneurial approach needed based on innovation, self-reliance and ethics 15. Continuously develop oneself to contribute in solving local and global problems.		
13	**Course Composition**		
No	Type of Course	Credits	Percentage
i	General Course of University	18	12,4
ii	General Course of Engineering Faculty	25	17,2
iii	Skill Course	80	55,2
iv	Optional Course	12	8,3
v	Internship , Seminar, Final Project, Project	10	6,9
	Type of Course	145	100 %
14	**Total Credit Hours to Graduate**		**144 SKS**

Employment Prospects

A graduate of the chemical engineering and bioprocess technology study programs can be described as a "Universal Engineer" as they learn the basics of engineering such as thermodynamics, reaction kinetics and reactor design, separation processes, as well as transport phenomena (momentum, energy and mass). Graduates of chemical engineering department at UI have contributed in the following areas: energy (oil and gas industry), engineering contractor companies (engineering, procurement, construction and trial operation), chemical industry (petrochemicals, bulk and specialty chemicals), research and development of process and/or chemical products, and processing and synthesis of food products and pharmaceuticals.

Competency network

The competency network of bachelor graduates of PSTK-FTUI is shown in Figure 1. The main competencies (blue color) are those generally possessed by chemical engineering graduates. Achievement of main competencies is supported by the achievement of the supporting competence (green color) whereas the other competencies (purple) are those set by the Faculty of Engineering and University of Indonesia.

Course Network

The course network of the undergraduate program of PSTK-FTUI is shown in Figure 2. The curriculum framework with a total of 145 credits hours consisting of the general basic courses managed by UI, engineering basic courses managed by FTUI, and chemical engineering courses managed by the department is shown in Figure 3. Chemical engineering courses consists of basic chemical engineering, supporting, elective, and capstone courses.

Figure 1. Competency network of PSTK-FTUI graduates.

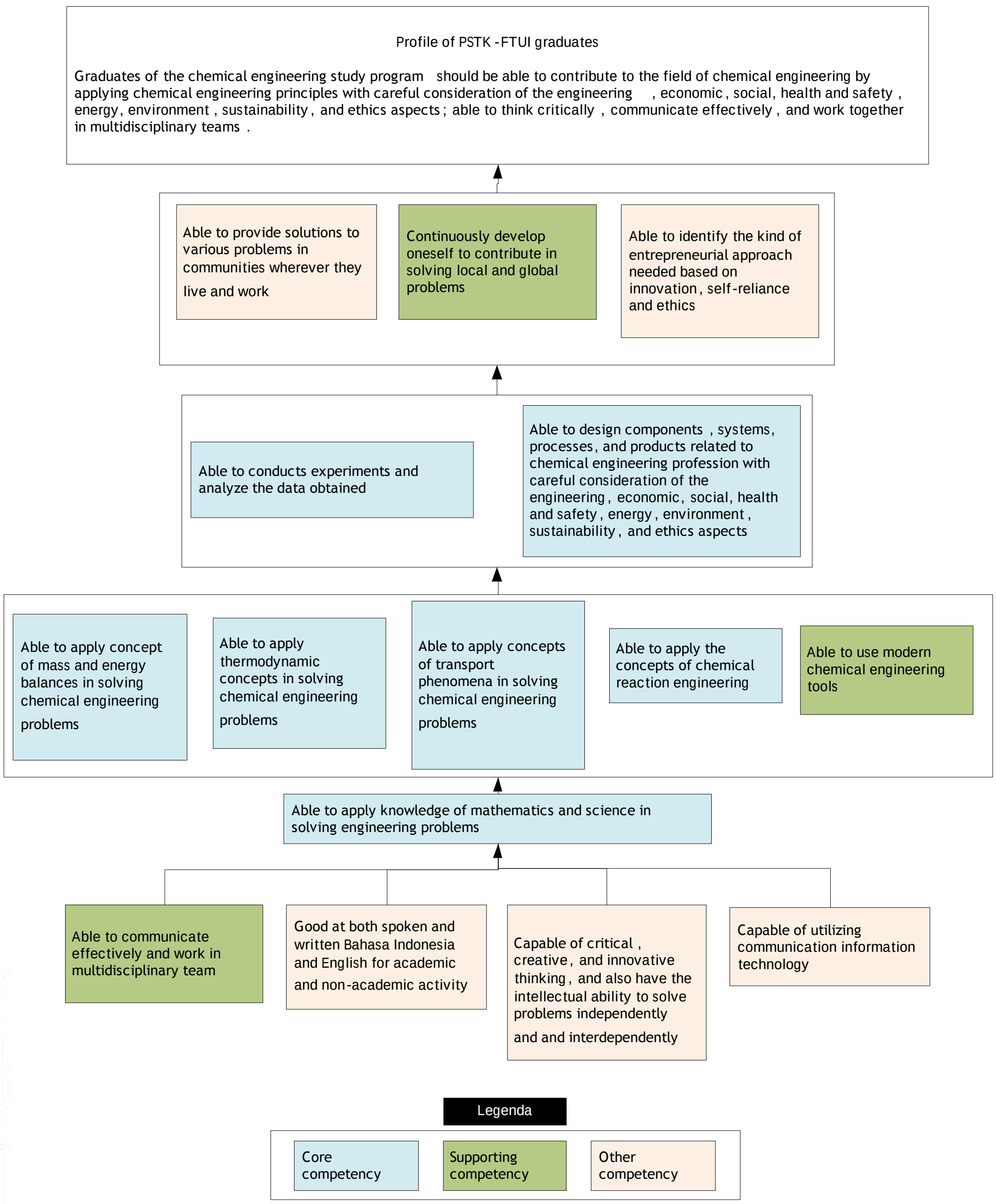
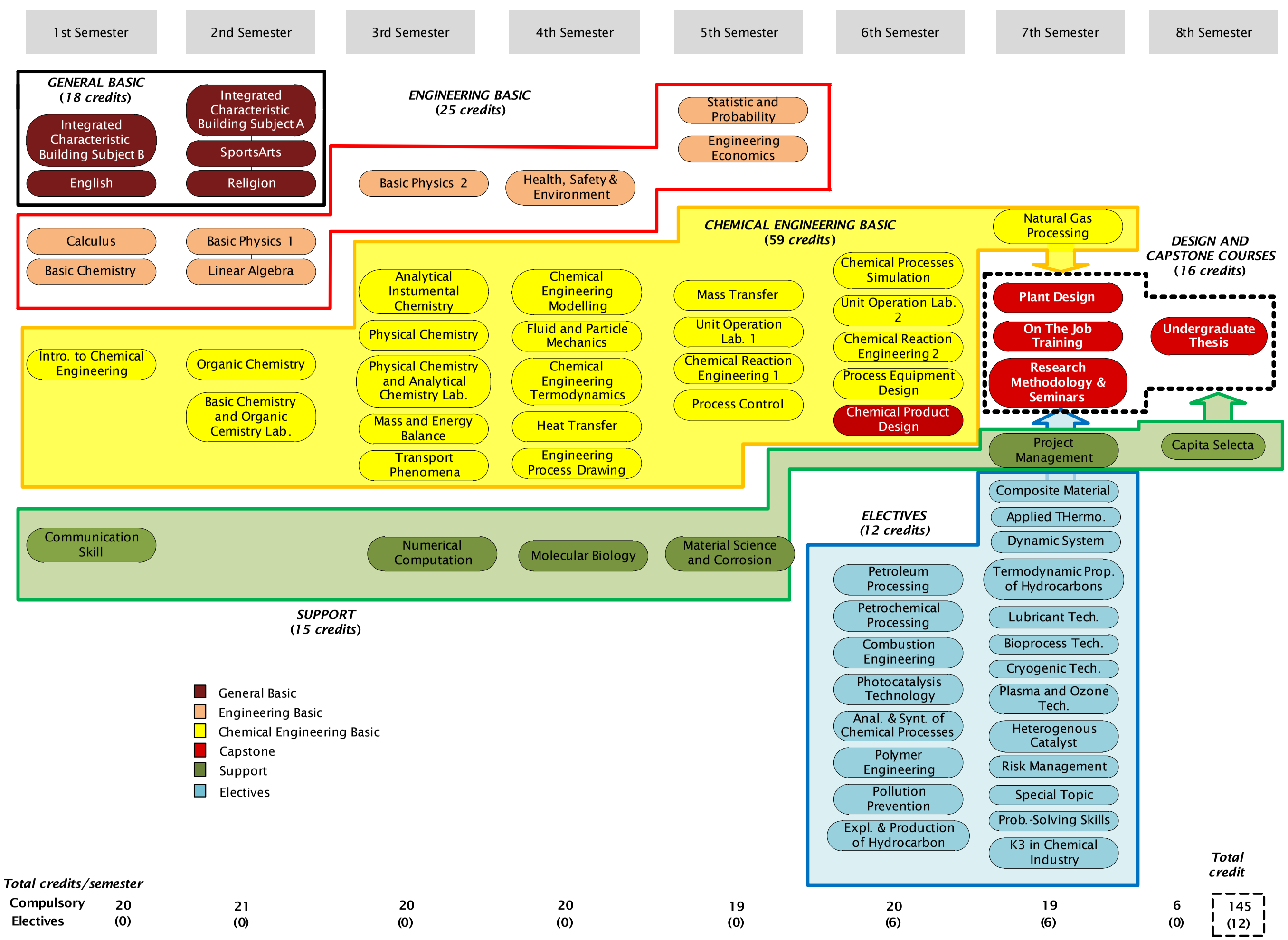


Figure 2. Course network of the undergraduate program PSTK-FTUI.



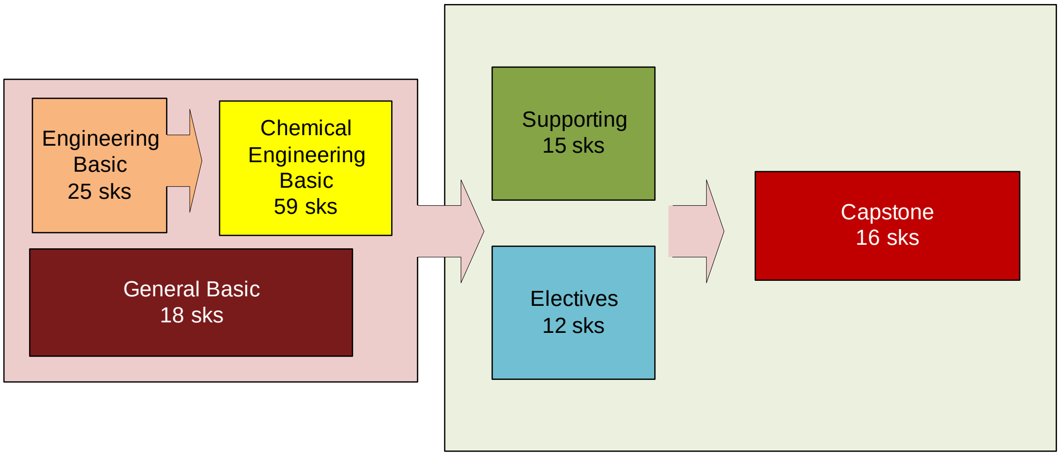


Figure 3. Curriculum framework undergraduate progam PSTK-FTUI.

Curriculum structure undergraduate (reguler/paralel) program

Undergraduate curriculum structure of PSTK-FTUI given in Table 1 and list of the elective courses is given in Table 2. Elective courses listed in Table 2 are available for students participating in the undergraduate (regular and parallel programs), fast-track, and master programs.

Table 1. Curriculum structure of the undergraduate (reguler/paralel) chemical engineering programs.

KODE	MATA AJARAN	SUBJECT	CREDIT
	Semester 1	**1st Semester**	
UIGE 6 0 0004	MPK Terintegrasi B	Integrated Character Building Subject B	6
UIGE 6 0 0002	Bahasa Inggris	English	3
ENGE 6 0 0001	Kalkulus	Calculus	4
ENGE 6 0 0010	Kimia Dasar	Basic Chemistry	2
ENCH 6 0 0001	Pengantar Teknik Kimia	Introduction to Chemical Engineering	3
ENCH 6 0 0002	Kecakapan Komunikasi	Communication Skill	2
		Sub Total	**20**
	Semester 2	**2nd Semester**	
UIGE 6 0 0001	MPK Terintegrasi A	Integrated Character Building Subject A	6
ENGE 6 0 0003	Fisika Dasar 1	Basic Physics 1	4
ENGE 6 0 0002	Aljabar Linear	Linear Algebra	4
ENCH 6 0 0003	Kimia Organik	Organic Chemistry	3
UIGE 6 0 0005-9	Agama	Religious Studies	2
ENCH 6 0 0004	Praktikum Kimia Dasar dan Kimia Organik	Basic Chemistry and Organic Chemistry Lab.	1
UIGE 6 0 0003	Olah Raga/ Seni	Sports/ Arts	1
		Sub Total	**21**
	Semester 3	**3rd Semester**	
ENGE 6 0 0004	Fisika Dasar 2	Basic Physics 2	4
ENEE 6 0 0031	Komputasi Numerik	Numerical Computation	2
ENCH 6 0 0005	Kimia Analitik Instrumental	Instrumental Analytical Chemistry	3
ENCH 6 0 0006	Kimia Fisika	Physical Chemistry	3
ENCH 6 0 0007	Praktikum Kimia Fisika dan Kimia Analitik	Physical Chemistry and Analytical Chemistry Lab.	1
ENCH 6 0 0008	Neraca Massa dan Energi	Mass and Energy Balance	3
ENCH 6 0 0009	Peristiwa Perpindahan	Transport Phenomena	3
		Sub Total	**19**

	Semester 4	4th Semester	
ENCH 6 0 0010	Permodelan Teknik Kimia	Modeling Chemical Engineering	3
ENCH 6 0 0011	Mekanika Fluida dan Partikel	Fluid and Particle Mechanics	3
ENGE 6 0 0008	Kesehatan, Keselamatan Kerja dan Lindung Lingkungan	Health, Safety & Environment	2
ENCH 6 0 0012	Termodinamika Teknik Kimia	Chemical Engineering Thermodynamics	4
ENCH 6 0 0013	Perpindahan Kalor	Heat Transfer	3
ENCH 6 0 0014	Menggambar Teknik Proses	Process Engineering Drawing	2
ENBP 6 0 0003	Biologi Molekuler	Molecular Biology	3
		Sub Total	**20**

KODE	Semester 5	5th Semester	CREDIT
ENGE 6 0 0030	Ilmu Bahan dan Korosi	Materials and Corrosion Science	3
ENGE 6 0 0005	Statistik dan Probabilitas	Statistics and Probability	2
ENG E 6 00007	Ekonomi Teknik	Engineering Economics	3
ENCH 6 0 0015	Perpindahan Massa	Mass Transfer	4
ENCH 6 0 0016	Praktikum UOP 1	Unit Operation Lab. 1	1
ENCH 6 0 0017	Teknik Reaksi Kimia 1	Chemical Reaction Engineering 1	3
ENCH 6 0 0018	Pengendalian Proses	Process Control	3
		Sub Total	**19**
	Semester 6	**6th Semester**	
ENCH 6 0 0019	Simulasi Proses Kimia	Simulation of Chemical Processes	3
ENCH 6 0 0020	Praktikum UOP 2	Unit Operation Lab. 2	1
ENCH 6 0 0021	Teknik Reaksi Kimia 2	Chemical Reaction Engineering 2	3
ENCH 6 0 0022	Perancangan Alat Proses	Process Equipment Design	3
ENCH 6 0 0023	Perancangan Produk Kimia	Cehmical Product Design	4
	Pilihan	Elective	3
	Pilihan	Elective	3
		Sub Total	**20**
	Semester 7	**7th Semester**	
ENCH 6 0 0024	Pengolahan Gas Bumi	Natural Gas Processing	3
ENIE 6 0 0020	Manajemen Proyek Industri	Industrial Project Management	2
ENCH 6 0 0025	Perancangan Pabrik	Plant Design	4
ENCH 6 0 0026	Kerja Praktek	Internship	2
ENCH 6 0 0027	Metodologi Penelitian & Seminar	Research Methodology & Seminars	2
	Pilihan	Elective	3
	Pilihan	Elective	3
		Sub Total	**19**
	Semester 8	**8th Semester**	
ENCH 6 0 0028	Skripsi / Tugas Akhir	Undergraduate Thesis / Final Project	4
ENCH 6 0 0029	Kapita Selekta	Capita Selecta	2
		Sub Total	**6**
Total			**145**

Tabel 2. List of elective courses available for undergraduate (reguler/paralel), fast track and master students PSTK-FTUI.

Odd Semester

KODE	MATA AJARAN	SUBJECT	CREDIT
ENCH801017	Material Komposit	Composite Material	3
ENCH801018	Termodinamika Terapan	Applied Termodynamics	3
ENCH801019	Sistem Dinamik	Dynamic System	3
ENCH801020	Sifat Termodinamika Hidrokarbon	Thermodynamic Properties of Hydrocarbons	3
ENCH801021	Teknologi Pelumas	Lubricant Engineering	3
ENCH801022	Teknologi Bioproses	Bioprocees Engineering	3
ENCH801023	Teknologi Kriogenik	Cryogenic Engineering	3
ENCH801024	Teknologi Plasma Ozon	Plasma and Ozone Engineering	3
ENCH801025	Katalis Heterogen	Heterogeneous Catalyst	3
ENCH801026	Manajemen Resiko	Risk Management	3
ENCH801027	Topik Khusus 1	Special Topic 1	3
ENCH801028	Kecakapan Pemecahan Masalah	Problem-Solving Skills	3
ENCH801029	K3 dalam Industri Kimia	Health and Safety in Chemical Industry	3
ENCH801014	Energi Berkelanjutan	Sustainable Energy	3
ENBP601021	Industri Oleokimia	Oleochemical Industry	3
ENBP601022	Teknologi Pangan	Food Technology	3
ENBP601024	Rekayasa Protein	Protein Engineering	3
ENBP601025	Teknologi Herbal	Herbal Technology	3

Even Semester

KODE	MATA AJARAN	SUBJECT	CREDIT
ENCH801030	Pengolahan Minyak Bumi	Petroleum Processing	3
ENCH801031	Proses Petrokimia	Petrochemical Processing	3
ENCH801032	Teknik Pembakaran	Combustion Engineering	3
ENCH801033	Teknologi Fotokatalis	Photocatalysis Technology	3
ENCH801034	Analisis dan Sintesis sistem Proses Kimia	Analysis and Synthesis of Chemical Processes	3
ENCH801035	Teknologi Polimer	Polymer Engineering	3
ENCH801036	Pencegahan Pencemaran	Pollution Prevention	3
ENCH801037	Eksplorasi dan Produksi Hidrokarbon	Exploration and Production of Hydrocarbons	3
ENCH801038	Utilitas dan Pemeliharaan Pabrik	Utilities and Plant Maintenance	3
ENCH801011	Transportasi dan Pemanfaatan Gas Bumi	Natural Gas Transportation and Utilization	3
ENBP601027	Teknologi Penyimpanan dan Pengemasan	Packaging and StorageTechnology	3
ENBP601028	Bioinformatika	Bioinformatics	3
ENBP611029	Teknologi Pelepasan Terkendali Obat	Drug Controlled Release Technology	3
ENBP601030	Teknologi Obat dan Kosmetik	Drugs and Cosmetics Technology	3
ENBP601031	Biomaterial	Biomaterial	3
ENCH801039	Topik Khusus 2	Special Topic 2	3

Curriculum structure of the fast track program PSTK-FTUI is given in Table 3. Elective courses for fast track students is given in Table 2.

Table 3. Curriculum structure of the Fast Track Program PSTK-FTUI.

KODE	MATA AJARAN	SUBJECT	CREDIT
	Semester 1	**1st Semester**	
UIGE 6 0 0004	MPK Terintegrasi B	Integrated Character Building Subject B	6
UIGE 6 0 0002	Bahasa Inggris	English	3
ENGE 6 0 0001	Kalkulus	Calculus	4
ENGE 6 0 0010	Kimia Dasar	Basic Chemistry	2
ENCH 6 0 0001	Pengantar Teknik Kimia	Introduction to Chemical Engineering	3
ENCH 6 0 0002	Kecakapan Komunikasi	Communication Skill	2
		Sub Total	**20**
	Semester 2	**2nd Semester**	
UIGE 6 0 0001	MPK Terintegrasi A	Integrated Character Building Subject A	6
ENGE 6 0 0003	Fisika Dasar 1	Basic Physics 1	4
ENGE 6 0 0002	Aljabar Linear	Linear Algebra	4
ENCH 6 0 0003	Kimia Organik	Organic Chemistry	3
UIGE 6 0 0005-9	Agama	Religious Studies	2
ENCH 6 0 0004	Praktikum Kimia Dasar dan Kimia Organik	Basic Chemistry and Organic Chemistry Lab.	1
UIGE 6 0 0003	Olah Raga/ Seni	Sports/ Arts	1
		Sub Total	**21**
	Semester 3	**3rd Semester**	
ENGE 6 0 0004	Fisika Dasar 2	Basic Physics 2	4
ENEE 6 0 0031	Komputasi Numerik	Numerical Computation	3
ENCH 6 0 0005	Kimia Analitik Instrumental	Instrumental Analytical Chemistry	3
ENCH 6 0 0006	Kimia Fisika	Physical Chemistry	3
ENCH 6 0 0007	Praktikum Kimia Fisika dan Kimia Analitik	Physical Chemistry and Analytical Chemis-try Lab.	1
ENCH 6 0 0008	Neraca Massa dan Energi	Mass and Energy Balance	3
ENCH 6 0 0009	Peristiwa Perpindahan	Transport Phenomena	3
		Sub Total	**20**
	Semester 4	**4th Semester**	
ENCH 6 0 0010	Permodelan Teknik Kimia	Modeling Chemical Engineering	3
ENCH 6 0 0011	Mekanika Fluida dan Partikel	Fluid Mechanics and Particles	3
ENGE 6 0 0008	Kesehatan, Keselamatan Kerja dan Lindung Lingkungan	Health, Safety & Environment	2
ENCH 6 0 0012	Termodinamika Teknik Kimia	Chemical Engineering Thermodynamics	4
ENCH 6 0 0013	Perpindahan Kalor	Heat Transfer	3
ENCH 6 0 0014	Menggambar Teknik Proses	Process Engineering Drawing	2
ENBP 6 0 0003	Biologi Molekuler	Molecular Biology	3
		Sub Total	**20**

KODE	Semester 5	5th Semester	CREDIT
ENCH 6 0 0030	Ilmu Bahan dan Korosi	Materials Science and Corrosion	3
ENGE 6 0 0005	Statistik dan Probabilitas	Statistics and Probability	2
ENGE 6 0 0007	Ekonomi Teknik	Engineering Economics	3
ENCH 6 0 0015	Perpindahan Massa	Mass Transfer	4
ENCH 6 0 0016	Praktikum UOP 1	Unit Operation Lab. 1	1
ENCH 6 0 0017	Teknik Reaksi Kimia 1	Chemical Reaction Engineering 1	3
ENCH 6 0 0018	Pengendalian Proses	Process Control	3
		Sub Total	**19**
	Semester 6	**6th Semester**	
ENCH 6 0 0019	Simulasi Proses Kimia	Simulation of Chemical Processes	3
ENCH 6 0 0020	Praktikum UOP 2	Unit Operation Lab. 2	1
ENCH 6 0 0021	Teknik Reaksi Kimia 2	Chemical Reaction Engineering 2	3
ENCH 6 0 0022	Perancangan Alat Proses	Process Equipment Design	3
ENCH 6 0 0023	Perancangan Produk Kimia	Cehmical Product Design	4
	Pilihan	Elective	3
	Pilihan	Elective	3
		Sub Total	**20**
	Semester 7	**7th Semester**	
ENCH 6 0 0024	Pengolahan Gas Bumi	Natural Gas Processing	3
ENIE 6 0 0020	Manajemen Proyek Industri	Industrial Project Management	2
ENCH 6 0 0025	Perancangan Pabrik	Plant Design	4
ENCH 6 0 0026	Kerja Praktek	On the Job Training	2
ENCH 6 0 0027	Metodologi Penelitian & Seminar	Research Methodology & Seminars	2
ENCH 8 0 0001	Pemodelan Teknik Kimia Lanjut	Advanced Chemical Engineering Modeling	3
ENCH 8 0 0002	Termodinamika Teknik Kimia Lanjut	Advanced Chemical Eng. Thermodynamics	3
		Sub Total	**19**
	Semester 8	**8th Semester**	
ENCH 6 0 0028	Skripsi / Tugas Akhir	Undergraduate Thesis / Final Project	4
ENCH 6 0 0029	Kapita Selekta	Capita Selecta	2
ENCH 8 0 0003	Peristiwa Perpindahan Lanjut	Advance Transfer Phenomena	3
ENCH 8 0 0004	Teknik Reaksi Kimia Lanjut	Advance Chemical Reaction Engineering	3
	Pilihan	elective	3
		Sub Total	**15**
	Semester 9	**9th Semester**	
ENCH 8 0 0005	Metodologi Penelitian	Research Methods	3
ENCH 8 0 0006	Seminar	Seminar	3
	Pilihan 4	Elective 4	3
	Pilihan 5	Elective 5	3
		Sub Total	**12**

	Semester 10	10th Semester	
ENCH800007	Tesis	Thesis	7
		Sub Total	**7**
Total			**173**

Curriculum Structure of the International Program PSTK-FTUI

Curriculum structure of the international program PSTK-FTUI is given in Table 4. Students of the double degree program enroll in the first four semester courses at UI and continue their second four semesters at one of the partner universities. Single degree international students follow the whole 8 semesters at UI. The list of elective courses for international program students is given in Table 5.

Table 4. Curriculum structure of the international chemical engineering program PSTK-FTUI.

KODE	MATA AJAR	SUBJECT	CREDIT
	SEMESTER 1	**1st SEMESTER**	
UIGE610010	Penulisan Akademik	Academic Writing	3
ENGE610003	Fisika 1	Physics 1	4
ENGE610001	Kalkulus	Calculus	4
ENGE610010	Kimia Dasar	Basic Chemistry	2
ENGE610005	Statistik dan Probabilitas	Statistic and Probability	2
ENCH610001	Pengantar Teknik Kimia	Introduction to Chemical Engineering	3
		Sub Total	**18**
	SEMESTER 2	**2nd SEMESTER**	
ENGE610004	Fisika 2	Physics 2	4
ENCH610003	Kimia Organik	Organic Chemistry	3
ENCH610008	Neraca Massa dan Energi	Mass and Energy Balances	3
ENCH610004	Praktikum Kimia Dasar dan Kimia Orgnik	Basic Chem. and Org. Chem. Lab.	1
ENGE610002	Aljabar Linier	Linear Algebra	4
ENCH610006	Kimia Fisika	Physical Chemistry	3
		Sub Total	**18**
	SEMESTER 3	**3rd SEMESTER**	
ENCH610030	Ilmu Bahan dan Korosi	Material Science and Corrosion	3
ENEE610031	Komputasi Numerik	Numerical Computation	2
ENCH610005	Kimia Analitik	Instrumental Analytical Chemistry	3
ENCH610011	Mekanika Fluida dan Partikel	Fluid and Particle Mechanics	3
ENCH610007	Praktikum Kimia Fisika dan Kimia Analitik	Phys. Chem. and Anal. Chem. Lab.	1
ENCH610012	Termodinamika Teknik Kimia	Chemical Engineering Thermodynam-ics	4
ENCH610009	Peristiwa Perpindahan	Transport Phenomena	3
		Sub Total	**19**
	SEMESTER 4	**4th SEMESTER**	
ENCH610010	Pemodelan Teknik Kimia	Chemical Engineering Modeling	3
ENCH610015	Perpindahan Massa	Mass Transfer	4
ENCH610013	Perpindahan Panas	Heat Transfer	3

ENCH610014	Menggambar Teknik Proses	Process Engineering Drawing	2
ENCH610019	Simulasi Proses Kimia	Chemical Process Simulation	3
ENBP610003	Biologi Molekuler	Molecular Biology	3
ENGE610008	Kesehatan, Keselamatan, dan Lingkungan	Health, Safety, and Environment	2
		Sub Total	**20**
	SEMESTER 5	**5th SEMESTER**	
ENCH610017	Teknik Reaksi Kimia 1	Chemical Reaction Engineering 1	3
ENCH610018	Pengendalian Proses	Process Control	3
UIGE610004	MPK Terintegrasi	Integrated Character Building Subject	6
UIGE610002	Bahasa Inggris	English	3
ENCH610016	Praktikum Unit Operasi 1	Unit Operation Laboratory 1	1
ENIE610020	Manajemen Proyek Industri	Industrial Project Management	2
		Sub Total	**18**
	SEMESTER 6	**6th SEMESTER**	
UIGE610001	MPK Terintegrasi	Integrated Character Building Subject	6
UIGE610003	Olah raga/Seni	Sports / Arts	1
UIGE610005-9	Agama	Religion	2
ENCH610020	Praktikum Unit Operasi 2	Unit Operation Laboratory 2	1
ENCH610021	Teknik Reaksi Kimia 2	Chemical Reaction Engineering 2	3
ENCH610022	Perancangan Alat Proses	Process Equipment Design	3
ENCH610023	Perancangan Produk Kimia	Chemical Product Design	4
		Sub Total	**20**
	SEMESTER 7	**7th SEMESTER**	
ENCH610025	Perancangan Pabrik	Plant Design	4
ENCH610026	Praktik Kerja	Internship	2
ENCH610027	Metodologi Penelitian dan Seminar	Research Methodology and Seminar	2
ENCH600029	Kapita Selekta	Capita Selecta	2
ENGE610007	Ekonomi Teknik	Engineering Economics	3
	Pilihan 1	Elective 1	3
	Pilihan 2	Elective 2	3
		Sub Total	**19**
	SEMESTER 8	**8th SEMESTER**	
ENCH610024	Pengolahan Gas Bumi	Natural Gas Processing	3
ENCH600028	Skripsi	Final Project	4
	Pilihan 3	Elective 3	3
	Pilihan 4	Elective 4	3
		Sub Total	13

Table 5. List of elective courses available for international students PSTK-FTUI.

KODE	MATA AJARAN	SUBJECT	CREDIT
Odd Semester			
KODE	**MATA AJARAN**	**SUBJECT**	**CREDIT**
ENCH811018	Termodinamika Terapan	Applied Termodynamics	3
ENCH811020	Termodinamika Sifat Hidrokar-bon	Thermodynamic Prop. Hydrocarbons	3
ENCH811027	Topik Khusus 1	Special Topics 1	3
Even Semester			
KODE	**MATA AJARAN**	**SUBJECT**	**CREDIT**
ENCH811035	Teknik Polimer	Polymer Engineering	3
ENCH811039	Topik Khusus 2	Special Topics 2	3
ENBP611029	Pelepasan Terkendali Obat	Controlled Release of Drugs	3

Curriculum Structure of Bachelor Program Chemical Engineering in Partner Universities

Course structure of chemical engineering at Monash University.

Year 3	Semester 5		Year 3	Semester 6	
CODE	COURSE TITLE	CREDIT	KODE	SUBJECT	CREDIT
CHE3162	Process control	6	CHE3161	Chemistry and chemical thermodynamics	6
CHE3164	Reaction engineering	6	CHE3163	Sustainable processing 1	6
CHE3166	Process design	6	CHE3165	Separation processes	6
	Choose one stream	6	CHE3167	Transport phenomena and numerical methods	6
	Subtotal	24			24

Year 4	Semester 7		Year 4	Semester 8	
CODE	COURSE TITLE	CREDIT	KODE	SUBJECT	CREDIT
CHE4162	Particle technology	6	CHE4161	Engineers in society	6
CHE4170	Design project	12	CHE4180	Chemical engineering project	12
	Choose one stream	6		Choose one stream	6
	Subtotal	24			24

Elective course structure at Monash University.

Year 3			
CODE	COURSE TITLE	CREDIT	STREAM
CHE3171	Bioprocess technology	6	Biotechnology
CHE3172	Nanotechnology and materials 1	6	Nanotechnology and materials
CHE3175	Process engineering	6	Sustainable processing
Year 4			
CODE	COURSE TITLE	CREDIT	STREAM
BCH2011	Bioprocess technology	6	Biotechnology
CHE4171	Biochemical engineering	6	Biotechnology
CHE4172	Nanotechnology and materials 2	6	Nanotechnology and materials
MTE2541	Nanostructure of materials	6	Nanotechnology and materials
CHE4173	Sustainable processing 2	6	Sustainable processing
ENE3608	Environmental impact and management systems	6	Sustainable processing

Course structure of chemical engineering at Curtin University.

Year 3	Semester 5		Year 3	Semester 6	
CODE	COURSE TITLE	CREDIT	KODE	SUBJECT	CREDIT
CHE 223	Thermodynamics	25	CHE 322	Process Plant Engineering	25
CHE 324	Fluid & Particle Processes	25	CHE 312	Proc Syn & Design 1	12.5
CHE 325	Reaction Engineering	25	CHE 479	Advanced Special Topics	12.5
CHE 328	Process Instrumentation & Control	25	CHE	Mass Transfer Operations	25
			CHE 421	Risk Management	25
	Subtotal	100		Subtotal	100

Year 4	Semester 7		Year 4	Semester 8	
CODE	COURSE TITLE	CREDIT	KODE	SUBJECT	CREDIT
CHE 423	Process Economics & Management	25	CHE 481	Process Laboratory Projects	25
CHE 422	Advanced Separation Processes	25	CHE 414	Proc Syn & Design II	12.5
CHE 499	Design Project (Lectures/Feasibility Studies)	50	CHE 411	Advanced Process Control	12.5
			CHE 491 CHE 493	Research Project Research Project Optional Unit Optional Unit	12.5 12.5 12.5 12.5
	Subtotal	100		Subtotal	100

Optional units at Curtin University.

CODE	COURSE TITLE	CREDIT
CHE374	Mineral processing	12.5
CHE475	Petroleum processing	12.5
CHE39	Special topics (biochemical engineering	12.5
CHE493	Research project	12.5
CHE477	Computational fluid dynamics	12.5
CHE313	Fundamentals of ari pollution control	12.5

Course structure of chemical engineering at the University of Queensland.

Year 3	Semester 5		Year 3	Semester 6	
CODE	COURSE TITLE	CREDIT	KODE	SUBJECT	CREDIT
CHEE3004	Unit operations	2	CHEE4002	Environmental risk assessment	2
CHEE3005	Reaction engineering	2	CHEE4009	Transport phenomena	2
CHEE3006	Process and control system synthesis	2	CHEE1001	Principles of biological engineering	2
CHEE3007	Process modelling and dynamics	2		Part B2 Advanced Elective	2
	Subtotal	8			8

Year 4	Semester 7		Year 4	Semester 8	
CODE	COURSE TITLE	CREDIT	KODE	SUBJECT	CREDIT
CHEE4001	Process engineering design project	4		Part B2 Advanced Elective	2
	Part B2 Advanced Elective	2		Part B2 Advanced Elective	2
	Part B2 Advanced Elective	2		Part B3 Advanced Elective	2
	Subtotal	8			6

Table. List of elective course at UQ.

CODE	COURSE TITLE	CREDIT
Part B2 Advanced Electives		
CHEE4003	Special Topics A	2
CHEE4005	Polymer rheology & processing	2
CHEE4006	Individual inquiry A	2
CHEE4007	Individual inquiry B	2
CHEE4012	Industrial wastewater & solid waste management	2
CHEE4015	Special Topics VII	2
CHEE4020	Biomolecular engineering	2
CHEE4021	Particle design & processing	2
CHEE4022	Principles of adsorption	2
CHEE4024	Energy systems in sustainable development	2
CHEE4028	Metabolic engineering	2
CHEE4301	Cell & tissue engineering	2
CHEE4302	Nanomaterials and their characterization	2
CHEE4101	Electrochemistry and corrosion	2
CHEE4102	Systems engineering & design management	2

CHEE4103	Advanced product design method	2
Part B3 Process Engineering Electives		
CHEE2005	Chemical product design	2
CHEE3008	Special Topics C	12.5
CHEE3301	Polymer engineering	12.5
CHEE3305	Biomaterials: Materials in Medicine	12.5
CHEM2002	Biophysical chemistry	
CIVL3150	Modelling of environmental systems	
MINE2201\	Physical & chemical processing of minerals	

Course description

UIGE600001
UIGE610001
MPKT A / INTEGRATED CHARACTER BUILDING A
6 SKS
Refer to Page 74

UIGE600004
UIGE610004
MPKT B / INTEGRATED CHARACTER BUILDING B
6 SKS
Refer to Page 74

UIGE600002
ENGLISH
UIGE610002
ACADEMIC WRITING
3 SKS
Refer to Page 74

UIGE600003
UIGE610003
SPORTS / ARTS
1 SKS
Refer to Page 77

ENGE600001
ENGE610001
CALCULUS
4 SKS
Refer to Page 74

ENGE600010
ENGE610010
BASIC CHEMISTRY
Refer to Page 75

ENGE600003
ENGE610003
BASIC PHYSICS 1
4 SKS
Refer to Page 75

ENGE600004
BASIC PHYSICS 2
4 SKS
Refer to Page 77

ENGE600002
ENGE610002
LINEAR ALGEBRA
4 SKS
Refer to Page 75

UIGE600005-9
UIGE610005-9
RELIGIOUS STUDIES
2 SKS
Refer to Page 76-77

ENGE600005
ENGE610005
STATISTICS AND PROBABILITY
2 SKS
Refer to Page 78

ENGE60007
ENGE61007
ENGINEERING ECONOMICS
2 SKS
Refer to Page 78

ENGE600008
ENGE610008
HEALTH, WORK SAFETY, AND ENVIROMENT
2 SKS
Refer to Page 78

ENCH600001
ENCH610001
INTRODUCTION TO CHEMICAL ENGINEERING
3 SKS
Learning Objectives: Students are able to:
1. Distinguish chemical engineering from the other techniques
2. Explain the development of chemical engineering

3. Understand the fundamentals of chemical engineering of existing processes and systems as well
4. Do simple calculation from mass and energy balance, and know the criteria for process equipment.

Syllabus: Overview of the chemical engineering profession, employment, and the contribution of chemical engineering, chemical engineering code of ethics, processes and equipment of chemical industry, chemical engineering graduate of the criteria according to ABET, Bologna Declaration, and the industry.

Prerequisites:

Textbook:

1. R.N. Shreve and G.T. Austin, Shreve's Chemical Process Industries, McGraw Hill, 1984
2. R.M. Felder and R.W. Rousseau, Elementary Principles of Chemical Processes, 3rd Edition, Wiley 2005
3. R. Schizininger and M. W. Martin. Introduction to Engineering Ethics. Mc. Graw-Hill, 2000.

ENCH600002
ENCH610002
COMMUNICATION SKILLS
2 SKS

Learning Objectives: Students are able to design the communication products through audience analysis, then compile them into a series of coherent and logical message, and present it effectively using an appropriate media technology.

Syllabus: Communicating effectively, audience analysis, writing process, making a memo, making an abstract, technical papers structure, oral presentation.

Prerequisite: -

Textbook:

1. Donald R. Woods, Communication effectively, McMaster University Bookstore, 1996.
2. Donald R. Woods, Problem Based Learning: How to gain the most PBL, 1994, Mc-Master University, Hamilton, ON L8S 4L8.
3. Gloria J. Galenes, et.al., Communication in Groups, 4th ed.,McGraw-Hill, 2000.
4. Patricia E. Seraydarian, Writing for Business Results, The Business Skills Express Series, Mirror Press, 1994
5. Dennis Becker and Paula Borkum Becker, Powerful Presentation Skills, The Business Skills Express Series, Mirror Press, 1994.

ENCH600003
ENCH610003
ORGANIC CHEMISTRY
3 SKS

Learning Objectives: Students are able to:

1. Explain the link structure and stereochemistry, IUPAC name, physical properties, chemical reactivity, and reaction mechanisms
2. Determine the mechanisms of some organic chemical reactions and be able to estimate how to synthesize a simple organic chemical compounds.

Syllabus: Naming of organic compounds, the role of structure and stereochemistry of the physical / chemical an organic compound, the cracking reactions or free radicals alkane, polymerization of alkenes, aromatic electrophilic substitution on benzene, substitution and elimination reactions of alkyl halidas, acylation and esterification reactions, dehydration-polymerization on carboxylic compound

Prerequisites: -

Textbook:

1. Fessenden, alih bahasa : A. Hadiyana Pujatmaka, Kimia Organik, edisi Kedua Erlangga 1986
2. Morrison, RT and Boyd, RN, Organic Chemistry, 6th ed., Prentice Hall 1998.
3. Organic Chemistry lecture notes

ENCH600004
ENCH610004
BASIC CHEMISTRY AND ORGANIC CHEMISTRY LAB.
1 SKS

Learning Objectives: Students are able to prepare a preliminary report on the theory behind the lab module, conducting experiments in the laboratory, process and analyze data from experiments, and create a final report containing the explanation of phenomena that occur during experiments.

Syllabus: General techniques and chemical lab safety aspect, physical and chemical properties, separation and purification of substances, the reaction of metals with acids, water crystals, suspension formed reaction, identification of hydrocarbons, alcohols and phenols identification, identification of carbonyl compounds, carbohydrates, lipid analysis, extraction and identification of fatty acids from corn oil.

Prerequisites: -

Textbook:

1. Fessenden, translation: A. Hadiyana Pujatmaka, Organic Chemistry, Second edition 1986 grants
2. Morrison, RT and Boyd, RN, Organic Chemistry, 6th ed., Prentice Hall 1998.
3. Vogel, Practical Organic Chemistry
4. TGP majors, Organic Chemistry Lab Instructions diktat (Basic Chemistry and

Organic Chemistry Guide, Department of Chemical Engineering , FTUI)
5. Fieser, Organic Chemistry
6. Moran, L. dan Masciangioli, T.Safety and Security of Chemical Lab, the National Academies Press, 2010
7. Brown, T.L., H. E. LeMay and B.E. Bursten, Chemistry, ed. 8, Prentice Hall, 2000.
8. Vogel, Anorganic Qualitative Analyze, PT. Kalman Media Pustaka, 1985.

ENCH600005
ENCH610005
INSTRUMENTAL ANALYTICAL CHEMISTRY
3 SKS
Learning Objectives: Students are able to explain and compare the various basic principles methods of analytical chemistry and its application as well as solve problems by applying the stages of problem solving.
Syllabus: Skill workshop, Electrochemistry process, Potentiometry, Atomic Spectroscopy (AAS), Molecular spectroscopy (IR), Chromatography gas.
Prerequisite: -
Textbook:
1. Day R.A. dan A. L. Underwood, Analisis Kimia kuantitatif (terjemahan), Erlangga, 1986, atau buku aslinya dalam bahasa Inggris.
2. D. A. Skoog, et.al., Fundamentals of Analytical Chemistry, 5th. Ed., Saunders College Publishing, 1988. Atau edisi terbaru
3. G. D. Christian and J. E O'Reilly, Instrumental Analysis, 2nd. Ed., Allyn Bacon Inc., 1986.
4. Donald R. Woods, Problem based learning: How to gain the most from PBL, 2994, McMaster University, Hamilton, ON L8S 4L8.

ENCH600006
ENCH610006
PHYSICAL CHEMISTRY
3 SKS
Learning Objectives: Students are able to understand the basic concepts of physical chemistry including the topics of thermodynamics, equilibrium reactions, and molecular spectroscopy, and apply these concepts to solve simple problems of chemical physics
Syllabus: pvT properties: gas properties: ideal gas laws, kinetic theory of gases, the viscosity of gas; the properties of liquids and solutions: fluid viscosity, colligative properties of solution, electrolyte solution, Arrhenius and Debye-huckel theory; chemical bond and spectroscopy: atomic orbital, molecular orbital, hybrid orbital, visible light / infrared / ultraviolet spectroscopy; phase and chemical equilibrium: liquid-vapor phase equilibrium and Raoult's law, the application of Le Chatelier's principle to equilibrium reactions.
Prerequisites: -
Textbook:
1. Levine, IN, Physical Chemistry, 6th ed., McGraw-Hill, 2008.
2. Atkins & de Paula, Atkin's Physical Chemistry, 9th ed., Oxford University Press, 2009

ENCH600007
ENCH610007
PHYSICAL CHEMISTRY AND ANALYTICAL CHEMISTRY LAB.
1 SKS
Learning Objectives: Students are able to apply the principles of physical chemistry and analytical chemistry which is obtained from the study and the experiments in laboratory, able to explain physical chemistry phenomena, and able to use quantitative and qualitative analysis tools.
Syllabus: Isothermal adsorption, effect of concentration and temperature on reaction rate, three-component liquid systems, colligative properties of solution, chemical equilibrium and Le Chatelier's principle, determination of molecular properties based on gas density, gravimetric analysis, potentiometric methods, spectrophotometry visible light, conductometric methods, gas chromatography.
Prerequisite: Physical Chemistry and Analytical Chemistry Instrumental
Textbook:
1. Kwe Tjien Fe (translation), Practical Guide Physical Chemistry, London, Scholastic 1987
2. Physical Chemistry Lab Instructions FTUI TGP-1989.
3. TGP majors, Organic Chemistry Lab Instructions diktat
4. R. Day A. And A. L. Underwood, Quantitative Chemical Analysis (translation), grants, 1986, or the original book in English.
5. D. A. Skoog, et al, Fundamentals of Analytical Chemistry 5th., Saunders College Publishing, 1998 or latest edition
6. Daniel et al., Experimental Physical Chemistry, 7th ed., McGraw-Hill 1970.

ENCH600008
ENCH610008
MASS AND ENERGY BALANCE
3 SKS
Learning Objectives: Students are able to

solve the problem of mass balances, energy balances, and the combination of it.

Syllabus: Basic concept **of** mass and energy balance in the chemical process, chemical equations and stoichiometry, the principles of mass balance, mass balance with and without chemical reactions, recycle, bypass and purge, the mass balance in the system with lots of tools, general equation of energy balance, enthalpy changes, energy balance application for the system without and with chemical reactions, the solution of system combined heat balance and energy balance.

Prerequisites: -

Textbook:

1. Himmelblau D.M. Basic Principles and Calculation in Chemical Engineering, 6th ed, Prentice Hall 1996
2. G. Reklaitis V. Introduction to Material and Energy Balances, John Wiley 1983
3. Felder, R.M. & R.W. Rousseau. Elemnetary Principle of Chemical Process. John Wiey & Sons inc. 2005.
4. Dictates of Mass and Energy Balance 2001

ENCH600009
ENCH610009
TRANSPORT PHENOMENA
3 SKS

Learning Objectives: Students can identify and describe as well as analyze momentum, mass, and heat transfer phenomenon, through the application of macroscopic and microscopic balance.

Syllabus: Viscosity and momentum transfer phenomenon, Velocity distribution of laminar flow, Thermal conductivity and energy transfer mechanism, Temperature and concentration distribution in solids and laminar flow, Diffusivity and mass transfer mechanism, Converter equation for isothermal system, Momentum transfer in turbulent flow, Mass and energy transfer in turbulent flow, Transfer between two phases, Macroscopic balance of isothermal and non-isothermal system, Macroscopic balance of multi-component system.

Prerequisites:

Textbook:

1. R. B. Bird, W. E. Stewart and E. N. Lightfoot, Transport Phenomena, 2nd Ed., John Wiley, 2002.
2. J.R. Welty et al., Fundamentals of Momentum, Heat and Mass Transfer, 3rd Ed., Wiley, 1984.
3. Brodkey, R. S and RC Herskey, Transport Phenomena, McGraw-Hill, 1998

ENCH600010
ENCH610010
MODELING OF CHEMICAL ENGINEERING
3 SKS

Learning Objectives: Students are able to create a mathematical model of a process system and solve it using numerical methods with the assistance of a programming language

Syllabus: Modeling chemical process systems, equation systems of linear algebra and non-linear algebra; ordinary differential equations: initial value problem and boundary value problem; partial differential equations.

Prerequisites: -

Textbook:

1. Rice, RG. And Duong D. D, Applied Mathematics and Modeling for Chemical Engineers, John Willey & Sons, New York, 1995
2. Davis, M. E., Numerical Methods and Modeling for Chemical Engineers, John Willey & Sons, New York, 1984
3. Constantinides, A. and Mostouvi, N, Numerical Methods for Chemical Engineers with MATLAB Applications, Prentice Hall, 1999.
4. Tosun, I., Modeling in Transport Phenomena: A Conceptual Approach, Elsevier, 2002.

ENCH600011
ENCH610011
FLUID AND PARTICLE MECHANICS
3 SKS

Learning Objectives: Students are able to apply the phenomenon of fluid flow and particle (continuity equation, Bernoulli, etc) to solve problem in process unit through calculation of energy and force, etc, especially in the fluid flow system of piping, rate measurer and fluid transportation tool, and in the system of fluid-solid flow (fluidization, filtration, sedimentation, particle motion in gas.

Syllabus: Fluid properties; static fluid and its application; basic equation of fluid flow (mass balance and continuity equation, energy balance and Bernoulli Equation); the application of Bernoulli equation to measuring flow rate; friction loss in fluid flow through piping, The equipment of fluid transport: pump, compressor, turbine; high velocity gas flow; particle motion in fluid; fluidization; filtration; sedimentation.

Prerequisite: Transport Phenomena

Textbook:

1. Noel de Nevers, Fluid Mechanics for Chemical Engineers, 2nd Ed., McGraw-Hill, 1991.
2. Bruce R. Munson, Donald F. Young, Theodore H. Okiishi, Fundamentals of

Fluid Mechanics, John Wiley & Sons, 2006.

ENCH600012
ENCH610012
CHEMICAL ENGINEERING THERMODYNAMICS
4 SKS

Learning Objectives: Students are able to explain the basic principles relating to the PVT and thermodynamic properties of pure and mixtures compounds, mass and energy balance, thermodynamic cycles, phase equilibrium and reaction, and be able to apply problem-solving strategies to resolve the thermodynamic problems in a group.

Syllabus: Skills assessment: The first law of thermodynamics: energy, enthalpy, steam tables, mass and energy balance of steady state and non-steady system; second law of thermodynamics and cyclic processes: entropy signification, Rankine cycle and refrigeration cycle; thermodynamic properties of pure and mixed compounds: the amount of residual and partial molar quantities; Equilibrium: Raoult's law and liquid-vapor phase equilibrium, activity coefficients and coefficients fugacity no ideal system, the chemical reaction equilibrium and Le Chatelier's principle; Simulation process: module of thermodynamics properties, phase equilibrium module, and reaction equilibrium module

Prerequisites: -

Textbook:

1. J. M. Smith, H. C. Van Ness, and M. M. Abbott, Introduction for Chemical Engineering Thermodynamic, 5th ed., McGraw-Hill, 1996.
2. Thermodynamics Notes, Kamarza Wulan dan Praswasti PDK Wulan.
3. Donald R. Woods, Problem Based Learning: How to gain the most PBL, 1994, Mc-Master University, Hamilton, ON L8S 4L8.
4. Mulia, K and Wulan, PPDK, Textbook of Chemical Thermodynamics

ENCH600013
ENCH610013
HEAT TRANSFER
3 SKS

Learning Objectives: Students are able to analyze the heat transfer phenomena and apply them to solve problems in heat transfer process unit.

Syllabus: Introduction, skills workshop process, steady-state conduction, unsteady-state conduction, natural and forced convection, radiation.

Prerequisite: Transport Phenomena

Textbook:

1. Holman, J. P., "Heat Transfer (translation: E. Jasjfi), the sixth edition, the publisher, Jakarta 1993.
2. Mc. Adam, W. H., "Heat Transmission", 3rd Ed., Mgraw-Hill International Book Company, 1981.
3. Kern, D. Q., "Process Heat Transfer", Mc.Graw-Hill International Book Company, 1984.

ENCH600014
ENCH610014
PROCESS ENGINEERING DRAWING
2 SKS

Learning Objectives: Students are able to draw it manually process flow diagrams, P & IDs and plant layout, familiar with the use of software for drawing, understand and able to read the meaning of the picture

Syllabus: The importance of engineering drawings, standard rules of the drawing, block diagrams, and symbols of industrial equipment, process flow diagrams, piping and instrumentation symbols, piping and Instrumentation diagram, plot plan, plant layout, isometric piping and equipment.

Prerequisites: -

Textbook:

1. W. Boundy, Engineering Drawing, McGraw-Hill Book Company
2. Colin Simmons and Dennis Maguire, Manual of Engineering Drawing, Edward Arnold
3. ISO 1101, Mechanical Engineering Drawings, International Organization for Standardization
4. Japanese Industrial Standard, Technical Drawing for Mechanical Engineering, Japanese Standard Association.
5. Warren J. Luzadder, Fundamentals of Engineering Drawing, Prentice-Hall, Inc.

ENBP600003
ENBP610003
MOLECULAR BIOLOGY
3 SKS
Refer to Page 337

ENCH600015
ENCH610015
MASS TRANSFER
4 SKS

Learning Objectives: Students are able to analyze the phenomenon of mass transfer and apply it to solve the problem of unit mass transfer process.

Syllabus: Batch and continuous distillation; a mixture of binary or multiple components, humidification and drying, gas absorption,

solvent extraction.
Prerequisites: Chemical engineering thermodynamics, transport phenomena
Textbook:
1. Ketta, John J., Unit Operations Handbook, Vol 2: Mass Transfer, Marcel Dekker 1993
2. Treyball, R. E, Mass Transfer Operations, McGraw-Hill, 1984
3. Coulson, J. M. And J. Richardson R. Chemical Engineering Vol. 2, Pergamon Press. In 1989.

ENCH600016
ENCH610016
UOP LAB. 1
1 SKS
Learning Objectives: Students be able to:
1. Verify the technique of chemical engineering concept in fluid mechanic (CHS 220804), heat transfer (CHS 220807) that applied on tools or process unit.
2. Operate the equipment and measuring the flow rate (orifice meter, venturimeter, rotameter), temperature (thermocouple), process and analyze the data, discussed and took the conclusion, convey the result in the writing report in standard format.

Syllabus: The modules operating unit including: fluid circuit, centrifugal pump, incompressible flow, filtration, fluidization, conduction, convection, double pipe heat exchange, mixing and compounding.
Prerequisites: Fluid Mechanics and Heat Transfer
Textbook: Practical Manual Processes and Operations Teknik1, UI Department of Chemical Engineering

ENCH600017
ENCH610017
CHEMICAL REACTION ENGINEERING 1
3 SKS
Learning Objectives: Students are able to comprehend the concept of chemical kinetics and catalysis, design the experiment of kinetics data interpretation, formulate the kinetics models as well as analyze the performance of reaction
Syllabus: Basic concepts of chemical reaction kinetics, chemical reaction thermodynamics, experiments and kinetics data, formulation of kinetic models, the estimation method of constant values of the kinetic model, the sensitivity analysis of the kinetics model, catalyst and the influence of external and internal diffusion of the chemical reaction rate, the effectiveness factor, the effect of heat displacement at the catalytic reaction.
Prerequisites: Physical Chemistry
Textbook:
1. Davis, Mark E. and Davis, Robert J. (2003) Fundamentals of chemical reaction engineering. McGraw-Hill Higher Education, New York, NY.
2. Fogler, H. S., Elements of Chemical Reaction Engineering, Prentice-Hall, 3rd Ed., 1999
3. Fogler, H. S., and LeBlanc, Strategies for Creative Problem Solving, Prentice-Hall, 1995.
4. Levenspiel, O., Chemical Reaction Engineering, 2nd Ed., John Wiley & Sons. Of 1972.
5. K. J. Leidler, Chemical Kinetics, 3rd ed., Harper Publish, 1987
6. Widodo, W. P., Slamet, Lecture diktat of Chemical Kinetics and Reactor Design, TGP-UI, 2002.

ENCH600018
ENCH610018
PROCESS CONTROL
3 SKS
Learning Objectives: Students are able to design a single loop control system and connected the dynamic process with the performance
Syllabus: Introduction to process control, objectives and benefits of control, the principle of mathematical modeling, process modeling and control analysis, the system dynamic behavior of a typical process, the identification of empirical models, loop-back baited, PID controllers, PID controller tuning, stability analysis,
Prerequisites: Mathematic (calculus and linear algebra), Energy and Mass Balance, Numerical Method
Textbook:
1. T. Marlin, Process Control: Designing Processes and Control Systems for Dynamic Performance, 2nd Edition, McGraw-Hill, New York, 2000
2. D. E Seborg, T. F. Edgar, D. A. Mellichamp, Process Dynamics and Control, John Wiley & Sons, 1989, ISBN 0-471-86389-0
3. Ogata, Katsuhiko, Teknik Kontrol Automatik (Sistem Pengaturan), Jilid 1, Penerbit Erlangga, 1985, Bandung
4. Bequette, R. W., Process Dynamics: Modeling, Analysis, and Simulation, Prentice Hall,1998
5. Luyben, William L., Process Modeling, Simulation and Control for Chemical Engineers, Second Edition, McGraw-Hill International Edition, 1990
6. Stephanopoulos, George, Chemical Process Control: An Introduction to Theory and Practice, Prentice-Hall

International, 1984

ENCH600019
ENCH610019
CHEMICAL PROCESS SIMULATION
3 SKS
Learning Objectives: Students are able to use the latest chemical engineering software to make the steady state and dynamic simulations, and able to manipulate the process variable and the topology of the unit processes in the chemical industry.
Syllabus: steady state and dynamic models, stream, heat exchanger equipment, piping and rotating equipment, separation equipment, columns and towers, reactors, refrigeration system, the selection of PID controllers for temperature, pressure, level and flow, cascade control, model testing and tuning PID controllers.
Prerequisites: -
Textbook:
1. Fogler, HS, Elements of Chemical Reaction Engineering, Prentice-Hall
2. Douglas, J. M., 1998, Conceptual Design of Chemical Processes, McGraw-Hill, 1988
3. Peter, M.S, and K.D. Timmerhaus, 1991, Plant Design and Economic for Chemical Engineering 4th Edition, McGraw-Hill.
4. HYSYS Steady State Model and Tutorial
5. SuperPro Designer User Guide and Tutorial, intelligent, Inc.

ENCH600020
ENCH610020
UOP LAB. 2
1 SKS
Learning Objectives: Students be able to:
1. Verify the technique of chemical engineering concept in transport phenomena theory (CHS 210802), Heat Transfer (CHS 220807), Process Control (CHS 310806) that applied on tools or process unit.
2. Operate the equipment and measuring the flow rate (orifice meter, venturimeter, rotameter), air humidity (humidity meter), temperature (thermocouple), process and analyze the data, discussed and took the conclusion, convey the result in the writing report in standard format.

Syllabus: The modules operating unit of mass transfer and the process controlling including: measuring the diffusivity coefficient of liquid gas, drainage, wetted wall column, gas absorption, climb film evaporation, flow rate control, pipe reactor.
Prerequisites: Mass Transfer and Process Controlling
Textbook:
1. Practical Manual Processes and Technique Operations 2, UI Department of TGP
2. Literature for the course prerequisites

ENCH600021
ENCH610021
CHEMICAL REACTION ENGINEERING 2
3 SKS
Learning Objectives: Students are able to design and analyze various types of chemical reactors
Syllabus: The basic concept of chemical reactor design, isothermal ideal reactor designs: batch, CSTR, and PFR / PBR, ideal-isothermal reactor designs: spherical reactor, membrane reactor, micro-reactor, reactor design for multiple reactions, non-isothermal reactor designs: CSTR, multiple steady state, non-isothermal reactor design: PFR / PBR, multi-bed reactor (interstage cooler / heater), multi-phase reactor design (multiple phase), non-ideal reactor design
Prerequisites: Chemical Reaction Engineering 1
Textbook:
1. Fogler, H. S., Elements of Chemical Reaction Engineering, Prentice-Hall, 3rd Ed., 1999
2. Fogler, H. S., and LeBlanc, Strategies for Creative Problem Solving, Prentice-Hall, 1995.
3. Levenspiel, O., Chemcial Reaction Engineering, 2nd Ed., John Wiley & Sons. Of 1972.
4. K. J. Leidler, Chemical Kinetics, 3rd ed., Harper Publish., 1987
5. Widodo, W. P., Slamet, Lecture diktat of Chemical Kinetics and Reactor Design, TGP-UI, 2002

ENCH600022
ENCH610022
PROCESS EQUIPMENT DESIGN
3 SKS
Learning Objectives: Students are able to design chemical process equipment in accordance with the applicable standards.
Syllabus: Pumps, compressors, piping, pressure vessels and tanks, distillation columns, heat exchangers.
Prerequisites: Fluid Mechanics, Heat Transfer, Mass Transfer, Corrosion Materials Science.
Textbook:
1. Kern, D. Q., “Process Heat Transfer”, Mc.Graw-Hill International Book Company, 1984.
2. Ludwid, Applied Process Design for

Chemical and Petrochemical Plant, Vol. 2, Gulf Publishing Co.

ENCH600023
ENCH610023
CHEMICAL PRODUCT DESIGN
4 SKS

Learning Objectives: Students are able to design chemical products systematically and structured, and analyze the technical and economic feasibility.

Syllabus: An understanding of consumer needs, product specifications, creating and selecting the product concept, product formulation, manufacturing, supply chain, economic.

Prerequisites: Chemical Reaction Engineering 1 (already pass or on taking), Economic Engineering

Textbook:

1. Cussler, L., G. D. Moggridge, 2001, Chemical Product Design, Cambridge University Press
2. Ulrich K. T., Eppinger S. D., 2003, Product Design and Development, 3rd ed., McGraw-Hill
3. Seider W. D., J. Seader D., Lewin D. R., 2004, Product and Product Design Principles. Synthesis, Analysis and Evaluation, Wiley and Sons Inc.
4. Wesselingh, J.A, et al. 2007, Design and Development of Biological, Chemical, Food, and Pharmaceutical Product, John Wiley & Sons

ENCH600024
ENCH610024
NATURAL GAS PROCESSING
3 SKS

Learning Objectives: Students are able to design the most appropriate process for the removal of natural gas impurities with the process simulator and able to evaluate the energy consumption of refrigeration system and natural gas liquefaction system

Syllabus: Front-end natural gas processing and products, the physical properties of hydrocarbon systems, systems of units of gas, natural gas dehydration (absorption, adsorption), gas sweetening, sulfur recovery, mercury removal, LPG processing, processing CNG, LNG processing.

Prerequisite: Chemical Engineering Thermodynamics

Textbook:

1. R.N. Maddox and D.J. Morgan, Gas Conditioning & Processing, Vol. 2 & Vol. 4, 4th ed., Campbell Petroleum Series, 2006.
2. John M. Campbell, Gas Conditioning and Processing, Vol. 1 and 2, 2nd Edition Campbell Petroleum Series 1988
3. Arthur L Kohl, Fred C. Riesenheld, “Gas Purification”, chapter 4, 5, 6. Gulf Publishing Company 3rd Ed., 1980.
4. Bukacek, Reading for LNG Processing I & II, 1984.

ENIE600020
ENIE610020
INDUSTRIAL PROJECT MANAGEMENT
2 SKS
Refer to Page 359

ENCH600025
ENCH610025
PLANT DESIGN
4 SKS

Learning Objectives: Students are able to design processes and chemical plant and able to analyze the technical and economic feasibility.

Syllabus: Conceptual design of the process / plant, development of PFD,synthesis and analysis the process heuristically, process simulation, rule of thumb the process design and contruction material, heat integrity/process, plant layout, and economic analysis.

Prerequisite: Process Controlling, Equipment Process Design, Simulation of Chemical Engineering, Engineering Economics

Textbook:

1. Douglas, J. M., 1998, Conceptual Design of Chemical Processes, McGraw-Hill.
2. Seider W. D., Seader J. D., Lewin D. R., Sumatri Widagdo, 2008, Product and Product Design Principles. Synthesis, Analysis and Evaluation, Wiley and Sons Inc, 3 edition.
3. Turton, R., R. C. Bailie, W. B. Ehiting and J. A. Shaeiwitz, 1998, Analysis, Synthesis, and Design of Chemical Process, Prentice-Hall
4. Gavin Towler, R K Sinnott, 2012, Chemical Engineering Design: Principles, Practice and Economics of Plant and Process Design, Butterworth-Heinemann, Second Edition.
5. Peter, M. S, and K. D. Timmerhaus, Ronald West, and Max Peters, 2002, Plant Design and Economic for Chemical Engineering, 5 Edition, McGraw-Hill.
6. Biegler L. T, I. E, Grossmann and A. W. Westerberg, 1997, Systematic Methods for Chemical Process Design, Prentice-Hall.
7. Branan, C., 1998, Rule of Thumb for Chemical Engineers : A manual of quick, accurate solutions to everyday process engineering problems, 2nd edition, Gulf Publishing, Co.
8. Wallas, Stanley M. 1990, Chemical Process Equipment : Selection and Design, Buther

Worths.
9. Ed Bausbacher, Roger Hunt, 1993, Process Plant Layout and Piping Design, Prentice Hall; 1 edition
10. CHEMCAD Manual, HEATEXET Manual, HYSYS/UNISIM Manual

ENCH600026
ENCH610026
INTERNSHIP
2 SKS
Learning Objectives: Students get field experience, capable of analyzing the processes / systems / operations and products in the chemical process industry, and able to apply the process skills: problem solving, interpersonal communication, working in groups, conduct assessment
Syllabus: -
Prerequisites: Students have to take a minimum of 110 SKS (minimum value of D) with a GPA of 2.0
Textbook: -

ENCH600027
ENCH610027
RESEARCH METHODOLOGY AND SEMINAR
2 SKS
Learning Objectives: Students are able to determine the appropriate method for research activities and produce the ideas, processes, and scientific research in writing and oral.
Syllabus: Introduction, techniques to identify problems and arrange hypotheses, think logically, the techniques of scientific writing, technical writing research proposals, designing research techniques, presentation techniques, techniques to collect data, analyze it and present it.
Prerequisites: Students have to take a minimum of 90 SKS (minimum value of D) with a GPA of 2.0
Textbook:
1. Handout
2. Research Proposal Format The preparation of various agencies

ENCH600028
ENCH610028
UNDERGRADUATE THESIS
3 SKS
Learning Objectives: Students are able to analyze the chemical process engineering problems, and use knowledge and science comprehensively to obtain alternative solution, able to make a paper systematically according to rules and able to explain systematically, analytical, orderly, and correct according to thesis contents.
Syllabus: Guide and rule related to undergraduate thesis, the topic is suitable with research topic.
Prerequisite: In accordance with the regulations
Textbook: Guide the practical implementation of the Constitutional Court. Thesis, Depok, 1999.

ENCH600029
ENCH610029
CAPITA SELECTA
2 SKS
Learning Objectives: Students are able to explain the development of industry and engineering, business opportunities and the problems it faces in general.
Syllabus: Held with invited guest lecturers who are competent in fields that fit the requirement of each program study (can be different in each semester).
Prerequisite:-
Textbook: -

ENCH600030
ENCH610030
COMPOSITE MATERIAL
3 SKS
Learning Objectives: Students are able to:
1. Explain the characteristics of composite materials and compare it with conventional materials.
2. Explain the manufacturing process, and research development of composite materials.

Syllabus: The position of composite materials in materials science in general, common characteristics of composite materials, the type of composite based on the composition, the types of polymer matrix and reinforcement, the role of surface treatment in the strength of composite materials, manufacturing processes, durability, the process of splicing and repair of composite materials, code and standards for application of composite materials, the development of composite materials research.
Prerequisites: Organic Chemistry
Textbook:
1. Fiber-reinforced Composites (Materials Engineering, Manufacturing and Design), P. K. Mallick, Marcel Dekker, Inc., 1993.
2. Handbook of Plastics, Elastomers, and Composites, 3rd ed., Charles A. Harper, McGraw-Hill, 1996.
3. Reinforced Plastics - Theory and Practice, 2nd ed., M. W. Gaylord, Chaners Books, 1974.

ENCH600031
ENCH610031
APPLIED THERMODYNAMICS
3 SKS

Learning Objectives: Students are able to analyze problems of thermodynamics based on a thorough review including fundamental aspects of thermodynamics, experimental, and green chemistry, based on current information from scientific journals

Syllabus: The case study of industrial thermodynamic, example cycle processes, phase equilibrium, and chemical reaction equilibrium to process and product engineer; friendly solvents such as supercritical CO_2 and ionic liquid

Prerequisites: Chemical Engineering Thermodynamics

Textbook:

1. References relevant to a given problem.
2. Mulia, K and Wulan, PPDK, Textbook of Chemical Thermodynamics

ENCH600032
ENCH610032
DYNAMIC SYSTEMS
3 SKS

Learning Objectives: Students are able to build dynamic models of process systems, biological, industrial, social and economic.

Syllabus: Introduction to dynamical systems, causal loops, model and validation, analysis, case study.

Prerequisites: Numerical Computation

Textbook:

1. Forrester, J. W., 2002, Principles of Systems, Productivity Press
2. Goodman, Michael R., 1998, Study Notes in System Dynamics, Productivity Press
3. Richardson, George P. and Pugh III, Alexander L., 1999, Introduction to System Dynamics Modeling, Pegasus Communications
4. Andersen, David, etc., Introduction to Computer Simulation - A System Dynamics: Systems Thinking and Modeling for a Complex World, McGraw-Hill

ENCH600033
ENCH610033
THERMODYNAMIC PROPERTIES OF HYDROCARBONS
3 SKS

Learning Objectives: Students are able to predict the magnitude of thermodynamic properties of hydrocarbons and the phase condition, either manually or using software calculations.

Syllabus: introduction to hydrocarbon thermodynamics properties, basic thermodynamic concepts, P-V-T data correlations, physical properties of hydrocarbon fluids, computing aided thermodynamics properties, the vapor-liquid behavior of two-phase systems, water-hydrocarbon system behavior, product specifications in the disposal lease of hydrocarbon

Prerequisites: Chemical Engineering Thermodynamics

Textbook:

1. Wayne C. Edmister, Byung Ik Lee, Applied hydrocarbon thermodynamics, Volume 1, Gulf Publishing Company (1988), Houston, Texas.
2. John M. Campbell, Gas Conditioning and Processing, Vol. 1, 8th Edition Campbell Petroleum Series 2001.

ENCH600034
ENCH610034
LUBRICANT ENGINEERING
3 SKS

Learning Objectives: Students are able to explain the working principles of lubrication, lubricant function and several parameter of the quality and lubricant classification, lubricant chemical, and its production technology either mineral lubricant, synthesis, and vegetal.

Syllabus: Principles of lubrication on friction and wear phenomena on the two surfaces of solid objects are moving together; mode lubrication: hydrodynamic and elastohydrodynamic; lubricants: mineral, synthetic, and vegetable; additives, formulations, degradation, contamination, and maintenance of lubricants; latest development of lubricant technology .

Prerequisites: Organic Chemistry

Textbook:

1. E. Richard Booster, Handbook of Lubricant: Theory and Practice of Tribology, Vol. I, Vol. II, Vol. III, CRC Press (1984), Inc., Boca Raton, Florida
2. Mervin H. Jones, Industrial Tribology: The Practical Aspect of Friction, Lubricant, and Wear., Elsevier Scientific Publishing Co., New York, 1983.
3. J. Halling, Principle of Tribology, Macmillan Press Ltd., London, 1978
4. Handout

ENCH600035
ENCH610035
BIOPROCESS TECHNOLOGY
3 SKS

Learning Objectives: Students can explain the fundamentals of bioprocess engineering including systems, equipment and industrial applications.

Syllabus: Introduction to bioprocess technology, the design of fermentors, cell separation system, vessel for biotechnology, pipes, valves and pumps for biotech, cleaning, sterilization and water systems for pharmaceutical levels, heating, ventilation and air system, biowaste.

Prerequisites: Molecular Biology

Textbook:

1. J. Bailey E and D. F Ollis, Biochemical Engineering Fundamentals, McGraw-Hill Inc., New York, 1986
2. J. W. Dale and M. Von Schantz, From Gene to genomes: Concept and Application of DNA Technology, John Wiley & Sons, Ltd.., London, 2002
3. J. Matthews E., Handbook of Bioremedation, Lewis Publishers, London, 1994
4. Schrugerl K., and K. H. Belghardt (Eds.), Bioreaction Engineering: Modelling and Control, Verlaag Springer, Berlin Heidelberg, 2000

ENCH600036
ENCH610036
CRYOGENIC ENGINEERING
3 SKS

Learning Objectives: Students are able to explain the various processes to liquefy gas in cryogenic technology

Syllabus: History and development of cryogenic, cryogenic scope of work. Refrigeration and liquefaction of natural gas, air, oxygen, nitrogen, helium, neon and argon.

Prerequisites: Chemical engineering thermodynamics

Textbook:

Timmerhaus, K.D., Cryogenic Process Engineering, Plenum Press 1989, New York.

ENCH600037
ENCH610037
PLASMA AND OZONE ENGINEERING
3 SKS

Learning Objectives: Students are able to explain the physics and chemistry phenomena of plasma formation and release of electromagnetic energy and the use of plasma and ozone technology.

Syllabus: basic phenomena and physical-chemical processes of gases that are given an electrical charge (corona discharge), the generation process or formation of ozone, role and use of plasma technology and ozone in chemical engineering processes, the potential of ozone technology in control technology environmental pollution, the ozone generator module manufacturing equipment.

Prerequisite: Physics Electricity Magnetism

Textbook:

1. E. T. Protasevich: "Cold Non-Equilibrium Plasma", Cambridge International science Publishing, Cambridge, 1999.
2. Rice, R. G., and M. E. Browning: "Ozone Treatment of Industrial Water wate", Notes Data Corroraion, Park Ridyl, 1981.
3. Metcalf & Eddy, Inc. (Tchobano-glous, G., and FL Burton): "Wastewater Engineering: Treatment, Disposal, and Reuse", McGraw-Hill Book. Co., Singapore, 1991.

ENCH600038
ENCH610038
HETEROGENEOUS CATALYSIS
3 SKS

Learning Objectives: Students are able to explain the phenomenon of basic concepts heterogeneous catalysts and its application

Syllabus: The general property of catalyst, thermodynamic of the reaction with catalyst, the distribution of the catalyst based on the type of reaction, the core function is active, the method of selecting catalysts for certain reactions, characterization of the corresponding want to know the nature of the target, the catalyst test methods, methods of development of the catalyst, and reaction products.

Prerequisites: Chemical Reaction Engineering 1

Textbook:

1. Satterfield, C. N., heterogeneous Catalysis in Industrial Practice, McGraw-Hill Inc., New York, 1991.
2. Rase, F. R., Commercial Catalyst, CRC Press, New York, 1991
3. Richardson, T, J., Principles of Catalyst Development, Plenum Press, New York, 1989
4. Thomas J.M. And WJ Thomas, Principles and Practice of Heterogenous Catalysis, VCH, Weinhem, Germany, 1997
5. Emmet, R. H., Catalysis, Reinhold Publishing Corporation, New York, 1961

ENCH800014
ENCH810014
SUSTAINABLE ENERGY
3 SKS
Refer to Page 499

ENCH600039
ENCH610039
RISK MANAGEMENT
3 SKS

Learning Objectives: Students can explain and apply risk management in a risk assessment.

Syllabus: Introduction to the risk, the basic principles and guidelines concerning risk, risk management standards, risk assessment, risk analysis, risk analysis and simulation, simulation of the risk with Montecarlo method, the risk of using software simulation crystal ball.
Prerequisites:
Textbook: J. F. A. Stoner, Management, 1986

ENCH600041
ENCH610041
PROBLEM SOLVING SKILLS
3 SKS
Learning Objectives: Students are able to apply problem-solving strategies in a variety of real cases.
Syllabus: The awareness of thinking, creativity, problem-solving heuristics and techniques (problem-solving); techniques of defining the problem; situation analysis includes the analysis of Kepner-Tregoe problem by, decision analysis, and analysis of potential problems.
Prerequisites: -
Textbook:
1. Fogler, HS. and LeBlanc, SE., Strategies for Creative Problem Solving, Prentice Hall, 1995
2. Woods, DR, Problem-Based Learning: How to gain the Most from PBL, 1994.

ENCH600042
ENCH610042
ADVANCED CHEMICAL ENGINEERING MATHEMATICS
3 SKS
Learning Objectives: Students are able to solve the problems in engineering and design the system of chemical engineering with numerical application
Syllabus: The differential equation of the ordinary linear, The differential equation of the ordinary not linear – initial value problem; The differential equation of the ordinary not linear - boundary value problem; the partial differential equation: finite difference method.
Prerequisites: Modelling of Chemical Engineering
Textbook:
1. Constantinides, A. dan Mostouvi, N., Numerical Methods for Chemical Engineers with MATLAB Applications, Prentice Hall, 1999.
2. Davis, M.E., Numerical Methods and Modeling for Chemical Engineer, John Willey & Sons, New York, 1984.
3. Griffiths, D.F. dan Higham, D.J., Numerical Methods for Ordinary Differential Equations, Springer, 2010.
4. Hoffman, J.D., Numerical Methods for Engineers and Scientists, Marcel Dekker, Inc., 2001.

ENCH600043
ENCH610043
ADVANCED CHEMICAL ENGINEERING THERMODYNAMICS
3 SKS
Learning Objectives: Students are able to understand the basics of thermodynamics, fluid properties, phase equilibrium and reaction and be able to apply it to solve problems of chemical engineering.
Syllabus: Analysis the system using the several form of the first and second laws, the equation network of thermodynamic for thermodynamic properties, condition equation, fluid phase equilibrium, chemical reaction equilibrium
Prerequisites: Chemical Engineering Thermodynamics
Textbook:
1. Kyle, BG, Chemical and Process Thermodynamics, 2nd ed., Prentice Hall, 1992.
2. Hand-out lecture
3. Smith J.M. and van Ness, HC, Introduction to Chemical Engineering Thermodynamics, 4th ed., McGraw-Hill, 1985
4. Callen, HB, Thermodynamics and An Introduction to Thermostatic, 2nd ed., John Wiley and Sons, 1985.

ENCH600044
ENCH610044
HEALTH AND SAFETY IN CHEMICAL INDUSTRY
3 SKS
Learning Objectives: Students are able to identify the condition of health and safety in the chemical industry and propose the ways of overcoming problems of health and safety with observe to safety laws and regulations relating to the work environment.
Syllabus: The law and regulations relating to safety, national standards and international standards related to safety analysis work, Dual-function chemicals, Hazard Identification and Risk Assessment (HIRA), Hazard Identification (HAZID) and Hazard Operability Study (HAZOPS).
Prerequisites: -
Textbook:
1. Safety Act of 1970 1
2. Regulation of the Minister of Labor, Technical Guidelines for Safety Audit management system and Occupational Health, 1996.
3. International Labor Office, Prevention of Major Industrial Accidents, 1991.

4. Chemical Process Safety Modules

ENCH600045
ENCH610045
HYDROCARBONS ENGINEERING
3 SKS
Learning Objectives: Students are able to analyze the hydrocarbon technology which includes the aspects of: chemical properties, supply-demand of hydrocarbons and their derivative products, the impact of use on the environment, and economic aspects of conversion technologies and policies.
Syllabus: The chemistry of fossil resources and fuels; utilization of resources as fossil fuels and raw materials; Consumption and regional and international production, and reserves; The environmental impact of utilization; limitation, damage to the environment, emissions of CO_2, NO_x, SO_x, carbon taxes; the further conversion process of petroleum products and the reformulation of gasoline; Natural gas as a fuel and chemical raw materials, process gas purification, and conversion of natural gas, gas transportation; utilization of coal and biomass into energy and chemical aspects of the economy (the price of hydrocarbons, hydrocarbon market) , and policies.
Prerequisites: Chemical Engineering Thermodynamics and Chemical Raction Engineering 1
Textbook:
1. Keim, W., Cl-Catalysis in Chemistry, Reidel Publish Co., 1983.
2. Gillies, MT, Cl-based Chemical and Carbon Monoxide from Hydrogen, Noyes Data So., 1982.
3. Sheldon, RA, Chemical from Synthesis Gas, Catalytic Reactions of CO and H2, Reidel Publish Co., 1983.
4. Kirk-Othmer, Encyclopedia of Chemical Technology, 3rd ed, John Wiley Coover HW and R.C Hart, Chemical from Coal, AIChE, 1982. Van Krevelen, Coal, Elsevier, 1981.

ENBP601022
ENBP6110282
FOOD TECHNOLOGY
3 SKS
Refer to Page 342

ENBP601024
ENBP611024
PROTEIN ENGINEERING
3 SKS
Refer to Page 342

ENBP601025
ENBP611025
HERBAL TECHNOLOGY
3 SKS
Refer to Page 343

ENBP601021
ENBP611021
OLEOCHEMICAL INDUSTRY
3 SKS
Refer to Page 341
ENCH600046
ENCH610046
PETROLEUM PROCESSING
3 SKS
Learning Objectives: Students are able to explain petroleum characteristic and its refine product and the stages of the process from various petroleum processing technologies.
Syllabus: Introduction terminology, oil composition, thermal properties of petroleum, chemical processing of petroleum processing, distillation, hydrogenation and dehydrogenation, cracking processes, the processes of reforming, gas processing and petroleum light products, product improvement.
Prerequisites: Fluid and Particle Mechanics, Thermodynamics, Mass Transfer.
Textbook:
1. James G. Speight, The Chemistry and Technology of Petroleum, Marcel Dekker, 1991.
2. James H. Gary and Glenn E. Handwerk, Petroleum Refining, Marcel Dekker, 1974.
3. D. S. J. Jones, Elements of Petroleum Processing, John & Sons Woley

ENCH600047
ENCH610047
PETROCHEMICAL PROCESSES
3 SKS
Learning Objectives: Students are able to explain the development of petrochemical products and raw material potential, upstream / downstream petrochemical production lines (olefin center, aromatic center, and the pathways of methane) and the major production processes of several petrochemical industry through methane, olefins and aromatics; able to analyze impact of industrial processes and petrochemical products to the environment.
Syllabus: History of the general petrochemical products development and raw material potential, the scope of the petrochemical industry, petrochemical classification process, the type and processing raw materials into petrochemical products, the details of various petrochemical industry: olefins center, aromatics and the center line of methane, industrial

and environmental impact of products petrochemicals.
Prerequisites: Organic Chemistry
Textbook:
1. Martyn V. Twigg, "Catalyst Handbook", 2nd Ed., Wolfe Pub. Ltd..
2. Lewis T. Hatch, Sami Matar, "From Hydrocarbon to Petrochemical".
3. Wells, Margaret G., "Handbook of Petrochemicals and Processes", Gower Publishing Company Ltd., 1991.
4. Pandjaitan Maraudin, Petrochemical Industry and The effect of environment, Gadjah Mada University Press, 2002.

ENCH600048
ENCH610048
COMBUSTION ENGINEERING
3 SKS
Learning Objectives: Students are able to explain the phenomenon of combustion and resolve the problems that rendered correctly.
Syllabus: chemical kinetics and combustion, the flame, premix flame, diffusion flame, the combustion process applications.
Prerequisite: Transport Phenomena, Chemical Reaction Engineering 1, Chemical Engineering Thermodynamics
Textbook:
1. Warnatz, J., Maas, U. dan Dibble, R.W., Combustion: Physical and Chemical Fundamentals, Modeling and Simulation, Experiments, Pollutant Formation, 2nd ed., Springer, Heidelberg, 1999.
2. Turns, S.R., An Introduction to Combustion: Concepts and Applications, 2nd ed, McGraw-Hill, 2000.
3. Glassman, I., Combustion, Academic Press, 1997.
4. El-Mahallawy dan el-Din Habik, S., Fundamental and Technology of Combustion, Elsevier, 2002.
5. Combustion, T. J. Poinsot and D. P. Veynante, in Encyclopedia of Computational Mechanics, edited by Erwin Stein, Ren´e de Borst and Thomas J.R. Hughes, 2004 John Wiley & Sons, Ltd.
6. Introduction to Combustion, Concepts and Applications, Stephen R. Turns, 2nd edition, McGraw Hill, 2000
7. Introduction to Combustion Phenomena, A. Murty Kanury, Gordon and Breach Science Publishers, 1975
8. Heat Transfer from Burners, Charles E. Baukal, in Industrial Burners Handbook, edited by Charles E. Baukal, CRC Press, 2004.

ENCH600049
ENCH610049
PHOTOCATALYSIS TECHNOLOGY
3 SKS
Learning Objectives: Students are able to understand the basic concepts and photocatalysis and apply it in the various the simple daily problem, especially related with environment, health, and energy.
Syllabus: The basic concept photocatalysis processes, thermodynamics and kinetics of photocatlytic process, semiconductor photocatalyst materials, the basic parameters of photocatlytic process, Photocatalyst Nanomaterial Engineering, photocatlytic applications for degradation of organic pollutants and heavy metals, photocatalysis c applications for self-cleaning and anti fogging, photocatalysis applications for anti-bacterial and cancer therapy, photocatalysis applications for engineering 'daily life tools', photocatalysis applications in renewable energy sector, solar detoxification engineering with photocatalysis, intensification of photocatalysis process.
Prerequisites: Chemical Reaction Engineering 1
Textbook:
1. M. Schiavello, *Heterogeneous Photocatalysis*, John Wiley & Sons, 1997.
2. A. Fujishima, K. Hashimoto, and T. Watanabe, *TiO_2 Photocatalysis: Fundamentals and Applications*, BKC Inc. Japan, 1999.
3. J.B. Galvez, et.al., *Solar Detoxification*, Natural Sciences, Basic and Engineering Sciences, UNESCO.
4. M. Kaneko, I. Okura, *Photacatalysis Science and Technology*, Springer USA, 2002.
5. C.A. Grimes, G.K. Mor, *TiO_2 Nanotube Arrays: Synthesis, Properties, and Applications*, Springer, New York, 2009.
6. Paper-paper dan bahan lain dari berbagai Jurnal Ilmiah dan website.

ENCH600050
ENCH610050
ANALYSIS AND SYNTHESIS OF CHEMICALPROCESS SYSTEMS
3 SKS
Learning Objectives: Students are able to analyze and synthesize the chemical processes in an integrated system of technical and economic aspects
Syllabus: The strategy of synthesis and analysis process, design concepts development and the determination of the best flow sheet, a preliminary optimization process, the retrofit process, the use of computer aided design system for

simulation and analysis process.
Prerequisites: Simulation of Chemical Processes
Textbook:
1. James M Douglas, Conceptual Design of Chemical Process, McGraw-Hill International Edition, 1988.
2. Hartman, Klaus, and Kaplick, Klaus, Analysis and Synthesis of Chemical Process Systems
3. Lorenz T Biegler, Systematic Methods of Chemical Process Design, Prentice Hall Inc., 1997.

ENCH600051
ENCH610051
POLYMER ENGINEERING
3 SKS
Learning Objectives: Students are able to explain the basic principles and characteristics of polymer manufacturing until being able to keep abreast of the latest technology.
Syllabus: The concept of polymer and polymer characteristics, synthesis / polymerization, kinetics of polymerization, the polymer solution, characterization, process of making plastics.
Prerequisites: Organic Chemistry
Textbook:
1. R. J. Lovell, Introduction to Polymers, P. A. Lovell, Chapman & Hall.
2. R. B., Seymour, Polymers for Engineering Applications, ASM International.
3. F. W. Billmeyer, Textbook of Polymer Science, Wiley.
4. R. J. Crawford, Plastic Engineering, Pergamon Press.
5. Donald R. Woods, Problem Based Learning: How to gain the most PBL, 1994, Mc-Master University, Hamilton, ON L8S 4L8.

ENCH600052
ENCH610052
POLLUTION PREVENTION
3 SKS
Learning Objectives: Students are able to explain the concepts of pollution prevention and able to design the waste treatment system.
Syllabus: Introduction to the concept of pollution prevention, waste water treatment outline and preparation, waste water treatment in physical, biological, and chemical as well as the operating unit, bioremediation, bioseparation and biodegradation, advanced oxidation processes, the handling of waste gas, waste handling B3, solid waste handling , effluent treatment, gas, is unconventional.
Prerequisites: Chemical Reaction Engineering 1.
Textbook:
1. Freeman, H. M., Industrial Pollution Prevention Handbook, McGraw-Hill, New York, 1995.
2. Eckenfelder, W. W., Jr.., Industrial Water Pollution Control. 3rd ed. McGraw-Hill International Editions, New York, 2000.
3. Metcalf & Eddy. (Revised by Tchobanoglous, G. & F. L. Burton). Waste Water Engineering: Treatment, Disposal, Reuse, 3rd ed., McGraw-Hill, Singapore, 1991.
4. Heinson R. J. & R. L. Cable. Source and Control of Air Pollution. Prentice Hall. New Jersey. Of 1999.
5. Legislation on the prevention of pollution and waste management.
6. Journals, the Internet.

ENCH600053
ENCH610053
EXPLORATION AND PRODUCTION OF HYDROCARBONS
3 SKS
Learning Objectives: Students are able to explain the economic concept of natural gas and analyze the 4e economy.
Syllabus: Introduction of hydrocarbon, life cycle of field development, hydrocarbon form and hydrocarbon property and reservoir, hydrocarbon exploration: geology, geophysics, and drilling, field appraisal, reservoir development, drilling development, hydrocarbon production, HSE, hydrocarbon economy and lease, coal and hydrocarbon unconventional (CBM, Shale gas, and HYDRAT GAS)
Prerequisites:-
Textbook:
1. Frank Jahn et all, 2008, Hydrocarbon Exploration and Production, Developments in Petroleum Science, second edition
2. Babusiauz et al, 2004, Oil and Gas Exploration and Production. Reserves, Cost and Contracts, IFP-Technip,
3. M. Kelkar, 2008, Natural Gas Production Engineering, PennWell Publications
4. Norman J. Hyne, 2001, Nontechnical Guide to Petroleum Geology, Exploration, Drilling and Production, Pennwell Books, 2 edition.

ENCH600055
ENCH610055
DRUG CONTROLLED RELEASE TECHNOLOGY
3 SKS
Learning Objectives: Students are able to explain the principles of controlled drug release system or bioactive compounds for medical purposes and use these principles to the application of controlled release of drugs.

Syllabus: easily degradable polymeric biomaterials, various encapsulation techniques of drug and bioactive compounds in nano / microspheres, diffusion and permeation, controlled release strategy, the discussion of the case.
Prerequisites: Organic Chemistry
Textbook:
1. Saltzman, WM, Drug Delivery: Engineering Principles for Drug Therapy, Oxford University Press, 2001.
2. Wen, H. and Park, K, ed., Oral Controlled Release Formulation Design and Drug Delivery, Wiley, 2010.

ENCH600056
ENCH610056
ADVANCED TRANSPORT PHENOMENA
3 SKS
Learning Objectives: Students are able to understand the transport phenomenon of momentum, mass and heat simultaneously and able to apply it at the unit processes that involve the flow of single phase or multiple phase
Syllabus: Review of the theory of transfer of momentum, mass and heat simultaneously; analysis and application of single-phase system: mixing and dispersion, mixer; analysis and application of a combination system of gas-liquid phase, gas-solid, liquid-liquid, liquid-solid, gas -liquid-solid: hydrodynamics, mass transfer / heat, appliances
Prerequisites: Transport Phenomena
Textbook:
1. Bird et al, Transport Phenomena, Wiley, 1960.
2. Gordon, RJ, Transport: Momentum Transport and Fluid Flows, AIChE Modular Instruction, AIChE, 1980.
3. Chereminisof, N.P., ed., Fluid Mechanics. Vol 1 s / d 6, Gulf Publishing Co., 1987.
4. Brodkey, Flersley, H.C., Transport Phenomeria. A Unified Approach, McGraw Hill, 1988.

ENCH600057
ENCH610057
ADVANCED CHEMICAL REACTION ENGINEERING
3 SKS
Learning Objectives: Students are able to analyze the phenomenon of chemical kinetics, the kinetics reaction data to determine the equation mechanistic reaction rate; able to design and analyze the performance of non ideal homogeneous and multi phase chemical reactors.
Syllabus: Thermodynamics of the reaction; definitions and basic concepts: the rate of reaction, the reaction rate equation, the Arrhenius equation: reaction modeling and data analysis for the determination of reaction rate equations; the introduction of gas-solid heterogeneous catalysts: a reduction in reaction rate equations and data of heterogeneous catalytic reactions of solid-gas; effects of diffusion and heat transfer in the catalytic reaction data interpretation. design of batch reactor and CSTR (isothermal, non-isothermal) reactor design PFR and PBR (isothermal, non-isothermal) sphere and the membrane reactor design; design-solid heterogeneous catalytic reactors with interstage gas cooler / heater; design of reactors for multiple reactions and mss (multiple steady state). design of non-ideal reactor (residence time distribution).
Prerequisites: Chemical Reaction Engineering 2
Textbook:
1. Fogler, HS, Elements of Chemical Reaction Engineering, 3rd ed., 1999. Prentice-Hall,
2. Smith, JM, Chemical Engineering Kinetics, 3rd ed., 1981, McGraw-Hill
3. Thomas, JM, and WJ Thomas., Principles and Practice of heterogeneous Catalysis, VCH, Weinheim, 1997.

ENCH600058
ENCH610058
TRANSPORTATION AND UTILIZATION OF NATURAL GAS
3 SKS
Learning Objectives: Students are able to analyze the utilization of several gas options for energy and feedstock.
Syllabus: Overview of natural gas: property and quality, historical milestones, environmental, international issues, and gas production, transportation and storage of natural gas in the gas phase and liquid phase; utilization of natural gas: gas as fuels, gas to synfuels and chemicals, gas to wires / power.
Prerequisites: Chemical Engineering Thermodynamics
Textbook:
1. Handbook of Natural Gas Engineering, Kartz D.
2. Handbook of Natural Gas Utilization, Pritchard G.
3. Combustion Engineering and gas utilization, JR Cornforth
4. Oil and Gas Pipeline Fundamentals by John L. Kennedy
5. Tussing AR, B. Tippee, The Natural Gas Industry, Evolution, Structure and Economics, Penwell Books, 1995

A. Bisio, S. Boots, Energy Technology and The Environment and Environmental, 1995.

ENCH600059
ENCH610059
ADVANCED HETEROGENEOUS CATALYSIS
3 SKS
Learning Objectives: Understand the photo-catalysis phenomenon reaction, the catalyst function; select the catalyst, catalyst characterization and catalytic test, Able promising the creation of the reaction, the catalyst and products.
Syllabus: The general property of the catalyst, the catalytic reaction thermodynamic, Division of catalysts based on the type of reaction, the active core function, method of selection of catalysts for specific reactions, characterization of properties to suit the target is known, the catalyst test methods, method of development of the catalyst, reaction and products.
Prerequisites:
Textbook:
1. Satterfield, C. N., heterogeneous Catalysis in Industrial Practice, McGraw-Hill Inc., New York, 1991.
2. Rase, F. R., Commercial Catalyst, CRC Press, New York, 1991
3. Richardson, T, J., Principles of Catalyst Development, Plenum Press, New York, 1989
4. J. Thomas, M. And Thomas W., J., Principles and Practice of Heterogenous Catalysis, VCH, Weinhem, Germany, 1997
5. Emmet, R. H., Catalysis, Reinhold Publishing Corporation, New York, 1961

ENCH600060
ENCH610060
COMMERCIAL CATALYST DESIGN
3 SKS
Learning Objectives: Students are able to design a catalyst for an industrial scale catalytic reaction techno economically in order to applied it on production system in the industry
Syllabus: The design of the catalyst (reaction thermodynamic calculations, the determination of surface reaction mechanisms, the choice of the active center, the determination of an alternative catalyst), catalyst characterization to determine the model catalysts deactivation and determination of the age of the catalyst, the catalyst and the reaction kinetics model of economic calculations on the catalyst in a catalytic reaction system industry.
Prerequisites:
Textbook:
1. Rase, F. R., Commercial catalyst, CRC Press, New York, 2000
2. Morbidelli, M, Catalyst Design, Cambridge University Press, 2001
3. Richardson T. J., Principle of Catalyst Development, Plenum Press, New York, 1989

ENBP601027
PACKAGING AND STORAGETECHNOLOGY
3 SKS
Refer to Page 343

ENBP601028
BIOINFORMATICS
3 SKS
Refer to Page 320

ENBP611029
DRUG CONTROLLED RELEASE TECHNOLOGY
3 SKS
Refer to Page 320

ENBP601030
DRUGS AND COSMETICS TECHNOLOGY
3 SKS
Refer to Page 320

ENBP601031
BIOMATERIAL
3 SKS
Refer to Page 320

ELECTIVE COURSE FROM MASTER PROGRAM

ENCH801017
COMPOSITE MATERIAL
3 SKS
Refer to Page 474

ENCH801018
APPLIED TERMODYNAMICS
3 SKS
Refer to Page 474

ENCH801019
DYNAMIC SYSTEM
3 SKS
Refer to Page 475

ENCH801020
THERMODYNAMIC PROPERTIES OF HYDROCARBONS
3 SKS
Refer to Page 475

ENCH801021
LUBRICANT ENGINEERING
3 SKS

Refer to Page 475

ENCH801022
BIOPROCEES ENGINEERING
3 SKS
Refer to Page 475

ENCH801023
CRYOGENIC ENGINEERING
3 SKS
Refer to Page 476

ENCH801024
PLASMA AND OZONE ENGINEERING
3 SKS
Refer to Page 476

ENCH801025
HETEROGENEOUS CATALYST
3 SKS
Refer to Page 476

ENCH801026
RISK MANAGEMENT
3 SKS
Refer to Page 476

ENCH801027
SPECIAL TOPIC 1
3 SKS
Refer to Page

ENCH801028
PROBLEM-SOLVING SKILLS
3 SKS
Refer to Page 476

ENCH801029
HEALTH AND SAFETY IN CHEMICAL INDUSTRY
3 SKS
Refer to Page 477

ENCH801014
SUSTAINABLE ENERGY
3 SKS
Refer to Page 473

ENCH801030
PETROLEUM PROCESSING
3 SKS
Refer to Page 477

ENCH801031
PETROCHEMICAL PROCESSES
3 SKS
Refer to Page

ENCH801032
COMBUSTION ENGINEERING
3 SKS
Refer to Page 477

ENCH801033
PHOTOCATALYSIS TECHNOLOGY
3 SKS
Refer to Page 478

ENCH801034
ANALYSIS AND SYNTHESIS OF CHEMICAL PROCESSES
3 SKS
Refer to Page 478

ENCH801035
POLYMER ENGINEERING
3 SKS
Refer to Page 478

ENCH801036
POLLUTION PREVENTION
3 SKS
Refer to Page 478

ENCH801037
EXPLORATION AND PRODUCTION OF HYDROCARBONS
3 SKS
Refer to Page 479

ENCH801038
UTILITIES AND PLANT MAINTENANCE
3 SKS
Refer to Page

ENCH801011
NATURAL GAS TRANSPORTATION AND UTILIZATION
3 SKS
Refer to Page 473

ENCH801039
SPECIAL TOPIC 2
3 SKS
Refer to Page

4.11. UNDERGRADUATE PROGRAM IN BIOPROCESS ENGINEERING

Program Specification

1	**Awarding Institution**		Universitas Indonesia
2	**Teaching Institution**		Universitas Indonesia
3	**Programme Title**		Undergraduate Program in Bioprocess Engineering
4	**Type of Class**		Regular
5	**Degree Given**		Sarjana Teknik (S.T)
6	**Accreditation status**		BAN-PT: A Accredited AUN-QA
7	**Medium Language**		Indonesia
8	**Study Scheme(Full time/Part time)**		Full time
9	**Entry requirement**		SMA Graduate/equal
10	**Duration of Study**		Scheduled for 4 years
	Type of Semester	Number of semester	Number of weeks /semester
	Regular	8	17
	Short (optional)	3	8

11 Graduate Profiles:

Engineers who are capable of managing systems and processes of biological products and provide alternative solutions for biological engineering problem solving in accordance with professional ethics.

12 Expected Learning Outcomes:

1. Able to apply the knowledge of mathematics and science in solving engineering problems.
2. Able to apply bioprocess reaction engineering concepts in solving bioprocess problems.
3. Able to apply heat and mass balance concepts in solving bioprocess problems.
4. Able to apply transport phenomena concepts in solving bioprocess problems.
5. Able to design components, systems, processes, and products related to bioprocess engineering profession by considering the aspects of engineering, economic, social, health, safety, and enviromental.
6. Develop themselves continously to contribute in solving local and global problems.
7. Communicate effectively and work in multidisciplinary team.
8. Able to use the modern bioprocess engineering tools.
9. Able to conducts experiments and analyze the data of experimental results.
10. Capable of critical thinking, creative, and innovative, and also have the intellectual ability to solve the problems at individual and group level
11. Able to do the research and study in the field of bioprocess engineering that is guided.
12. Capable of utilizing information communication technology.
13. Able to identify the kind of entrepreneuerial effort which includes innovative and independent characteristics based on ethics.
14. Good at both spoken and written in Bahasa Indonesian and English for academic and non academic activity.
15. Able to provide the solutions of various problems occurred in community, nation, and state.

13	**Course Composition**		
No	Type of Course	Credits	Percentage
i	University General Subjects	18	12.4 %
ii	Basic Engineering Subjects	30	20.7 %
iii	Core Subjects	69	47.6 %
iv	Elective Subjects	12	8.3 %
v	Internship , Seminar, Undergraduate Thesis, Project	16	11.0 %
	Total	145	100 %
14	Total Credit Hours to Graduate		145 SKS

Employment Prospects

The graduates be able to carrier in food industry; pharmaceutical ,cosmetics and biotechnology industries; oleochemicals; consulting and engineering company; environmental and renewable energy industry; govermnent; education and so on.

Competency Network

The competency network of PSTB-FTUI graduate is shown in Figure 1. The main competencies (green color) are those generally possessed by chemical engineering graduates. Achievement of main competencies is supported by the achievement of the additional competencies (blue color) whereas the other competencies (yellow) are those usually set by the Faculty of Engineering and University of Indonesia.

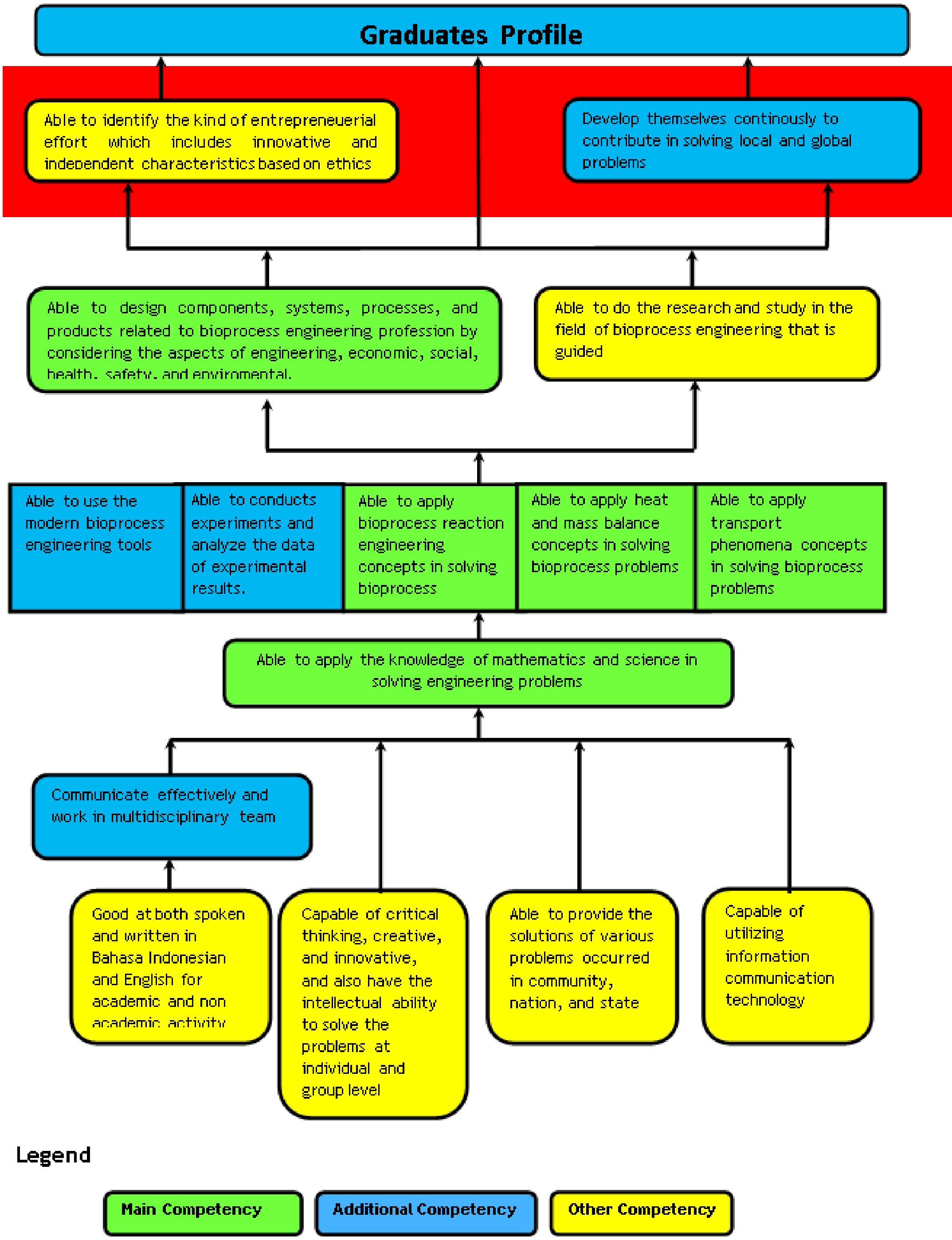
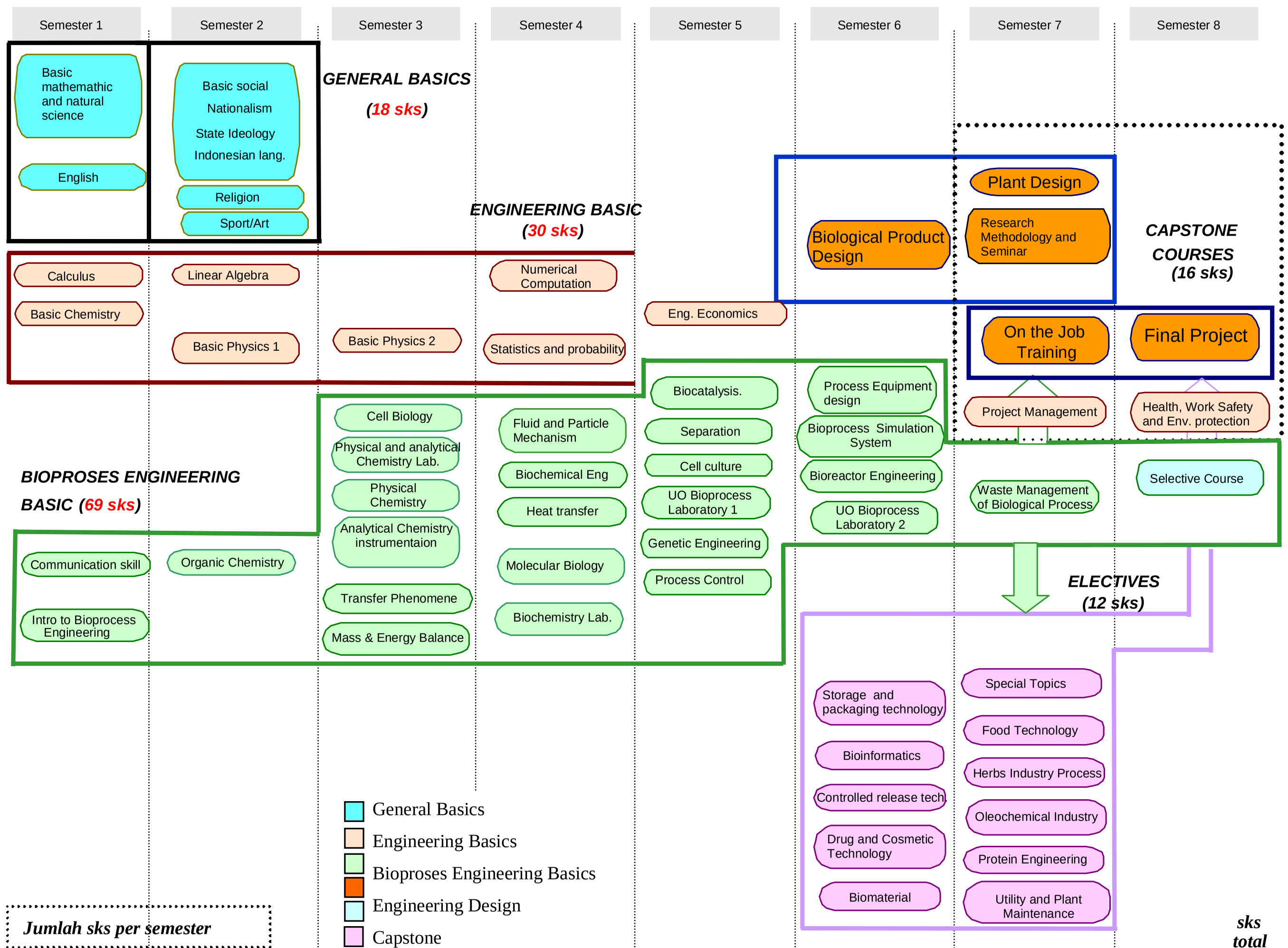


Figure 1. Competence network of bachelor graduates of PSTB-FTUI.

FLOW DIAGRAM OF SUBJECTS



Jumlah sks per semester									sks total
MK Wajib	20	20	20	19	19	14	13	8	133
MK Pilihan	(0)	(0)	(0)	(0)	(0)	(6)	(6)	(0)	(12)

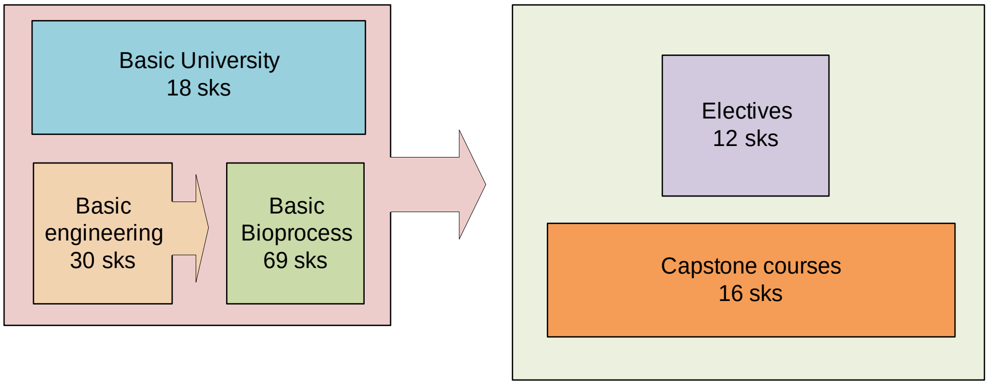


Figure 3. Curriculum framework undergraduate progam PSTB-FTUI.

Curriculum structure undergraduate program – PSTB-FTUI

Undergraduate curriculum structure of PSTB-FTUI given in Table 1 and list of the elective courses is given in Table 2.

Table 1. Course Structure of Undergraduate Program in Bioprocess Engineering.

KODE	MATA AJARAN	SUBJECT	SKS
	Semester 1	**1st Semester**	
UIGE600004	MPK Terintegrasi B	Integrated Character Building Subject B	6
UIGE600002	Bahasa Inggris	English	3
ENGE600001	Kalkulus	Calculus	4
ENGE600010	Kimia Dasar	Basic Chemistry	2
ENBP600001	Pengantar Teknologi Bioproses	Introduction to Bioprocess Engineering	3
ENCH600002	Kecakapan Komunikasi	Communication Skill	2
		Sub Total	**20**
	Semester 2	**2nd Semester**	
UIGE600001	MPK Terintegrasi A	Integrated Character Building Subject A	6
ENGE600003	Fisika Dasar 1	Basic Physics 1	4
ENGE600002	Aljabar Linear	Linear Algebra	4
ENCH600003	Kimia Organik	Organic Chemistry	3
UIGE600005-9	Agama	Religious Studies	2
UIGE600003	Olah Raga/ Seni	Sports/ Arts	1
		Sub Total	**20**
	Semester 3	**3rd Semester**	
ENGE600004	Fisika Dasar 2	Basic Physics 2	4
ENCH600005	Kimia Analitik Instrumental	Analytical Chemistry Instrumental	3
ENCH600006	Kimia Fisika	Physical Chemistry	3
ENCH600007	Praktikum Kimia Fisika dan Kimia Analitika	Physical Chemistry and Analytical Chemistry Lab.	1
ENCH600008	Neraca Massa dan Energi	Mass and Energy Balance	3

ENBP600002	Biologi Sel	Cell Biology	3
ENCH600009	Peristiwa Perpindahan	Transport Phenomena	3
		Sub Total	**20**
	Semester 4	**4th Semester**	
ENEE600031	Komputasi Numerik	Numerical Computation	2
ENCH600011	Mekanika Fluida dan Partikel	Fluid Mechanics and Particles	3
ENBP600003	Biologi Molekuler	Molecular Biology	3
ENBP600004	Rekayasa Biokimia	Biochemistry Engineering	3
ENGE600005	Statistik dan Probabilias	Statistics and Probability	2
ENCH600013	Perpindahan Panas	Heat Transfer	3
ENBP600005	Praktikum Biokimia	Biochemistry Lab.	2
		Sub Total	**18**

	Semester 5	**5th Semester**	
ENBP600006	Biokatalisis	Biocatalysis	3
ENCH600019	Pengendalian Proses	Process Controlling	3
ENBP600007	Kultur Sel	Cell Culture	3
ENBP600008	Rekayasa Genetika	Genetics Engineering	3
ENBP600009	Separasi	Separation	3
ENGE600007	Ekonomi Teknik	Engineering Economics	3
ENBP600010	Praktikum Unit Operasi Bio-proses 1	Bioprocess Unit Operation Lab 1.	1
		Sub Total	**19**
	Semester 6	**6th Semester**	
ENBP600011	Rekayasa Bioreaktor	Bioreactors Engineering	3
ENBP600012	Simulasi Sistem Bioproses	Bioprocess System Simulation	3
ENBP600013	Praktikum Unit Operasi Bio-proses 2	Bioprocess Unit Operation Lab 2.	1
ENCH600023	Perancangan Alat Proses	Process Equipment Design	3
ENBP600014	Perancangan Produk Hayati	Biological Product Design	4
	Pilihan	Elective	3
	Pilihan	Elective	3
		Sub Total	**20**
	Semester 7	**7th Semester**	
ENBP600015	Perancangan Pabrik	Plant Design	4
ENIE600020	Manajemen Proyek Industri	Industrial Project Management	2
ENBP600016	Kerja Praktek	Internship	2
ENBP600017	Pengelolaan Limbah Proses Hayati	Waste Management of Biological Pro-cess	3
ENBP600018	Metodologi Penelitian & Seminar	Research Methodology & Seminar	2
	Pilihan	Elective	3
	Pilihan	Elective	3
		Sub Total	**19**

	Semester 8	8th Semester	
ENBP600019	Skripsi	Undergraduate Thesis / Final Project	4
ENCH600029	Kapita Selekta	Capita Selecta	2
ENGE600008	Kesehatan, Keselamatan Kerja & Lingkungan	Health, Safety & Environment	2
		Sub Total	**8**
		Total	**145**

Tabel 2. List of elective courses available for undergraduate PSTB-FTUI students (also for fast-track students).

Odd Semester			
KODE	**MATA AJARAN**	**SUBJECT**	**SKS**
ENBP601021	Industri Oleokimia	Oleochemical Industry	3
ENBP601022	Teknologi Pangan	Food Technology	3
ENBP601023	Utilitas dan Pemeliharaan Pabrik	Utilities and Plant Maintenance	3
ENBP601024	Rekayasa Protein	Protein Engineering	3
ENBP601025	Teknologi Herbal	Herbal Technology	3
ENBP601026	Topik Khusus	Special Topic	3
Even Semester			
ENBP601027	Teknologi Penyimpanan dan Pengemasan	Packaging and Storaging Technol-ogy	3
ENBP601028	Bioinformatika	Bioinformatic	3
ENBP601029	Teknologi Pelepasan Terken-dali obat	Controlled Release Technology	3
ENBP601030	Teknologi Obat dan Kosmetik	Drugs and Cosmetics Technology	3
ENBP601031	Biomaterial	Biomaterial	3

Table 3. Curriculum Structure of Bioprocess Engineering - Fast Track Program

KODE	MATA AJARAN	SUBJECT	SKS
	Semester 1	**1st Semester**	
UIGE600004	MPK Terintegrasi B	Integrated Character Building Subject B	6
UIGE600002	Bahasa Inggris	English	3
ENGE600001	Kalkulus	Calculus	4
ENGE600010	Kimia Dasar	Basic Chemistry	2
ENBP600001	Pengantar Teknologi Bio-proses	Introduction to Bioprocess Engineering	3
ENCH600002	Kecakapan Komunikasi	Communication Skill	2
		Sub Total	**20**
	Semester 2	**2nd Semester**	
UIGE600001	MPK Terintegrasi A	Integrated Character Building Subject A	6
ENGE600003	Fisika Dasar 1	Basic Physics 1	4
ENGE600002	Aljabar Linear	Linear Algebra	4
ENCH600003	Kimia Organik	Organic Chemistry	3
UIGE600005-9	Agama	Religious Studies	2
UIGE600003	Olah Raga/ Seni	Sports/ Arts	1
		Sub Total	**20**
	Semester 3	**3rd Semester**	
ENGE600004	Fisika Dasar 2	Basic Physics 2	4
ENCH600005	Kimia Analitik Instrumental	Analytical Chemistry Instrumentation	3
ENCH600006	Kimia Fisika	Physical Chemistry	3
ENCH600008	Neraca Massa dan Energi	Mass and Energy Balance	3
ENCH600007	Praktikum Kimia Fisika dan Kimia Analitik	Physical Chemistry and Analytical Chem-istry Lab.	1
ENBP600002	Biologi Sel	Cell Biology	3
ENCH600009	Peristiwa Perpindahan	Transport Phenomena	3
		Sub Total	**20**
	Semester 4	**4th Semester**	
ENEE600031	Komputasi Numerik	Numerical Computation	3
ENCH600011	Mekanika Fluida dan Partikel	Fluid Mechanics and Particles	3
ENBP600003	Biologi Molekuler	Molecular Biology	3
ENBP600004	Rekayasa Biokimia	Biochemistry Engineering	3
ENGE600005	Statistik dan Probabilias	Statistics and Probability	2
ENCH600013	Perpindahan Kalor	Heat Transfer	3
ENBP600005	Praktikum Biokimia	Biochemistry Lab.	2
		Sub Total	**19**

	Semester 5	5th Semester	
ENBP600006	Biokatalisis	Biocatalysis	3
ENCH600019	Pengendalian Proses	Process Controlling	3
ENBP600007	Kultur Sel	Cell Culture	3
ENBP600008	Rekayasa Genetika	Genetics Engineering	3
ENBP600009	Separasi	Separation	3
ENGE600007	Ekonomi Teknik	Engineering Economics	3
ENBP600010	Praktikum Unit Operasi Bioproses 1	Bioprocess Unit Operation Lab 1.	1
		Sub Total	**19**
	Semester 6	**6th Semester**	
ENBP600011	Rekayasa Bioreaktor	Bioreactors Engineering	3
ENBP600012	Simulasi Sistem Bioproses	Bioprocess System Simulation	3
ENBP600013	Praktikum Unit Operasi Bioproses 2	Bioprocess Unit Operation Lab 2.	1
ENCH600023	Perancangan Alat Proses	Process Equipment Design	3
ENBP600014	Perancangan Produk Hayati	Biological Product Design	4
	Pilihan	Elective	3
	Pilihan	Elective	3
		Sub Total	**20**
	Semester 7	**7th Semester**	
ENBP600015	Perancangan Pabrik	Plant Design	4
ENIE600020	Manajemen Proyek Industri	Industrial Project Management	2
ENBP600016	Kerja Praktek	Internship	2
ENBP600017	Pengelolaan Limbah Proses Hayati	Waste Management of Biological Process	3
ENBP600018	Metodologi Penelitian & Seminar	Research Methodology & Seminars	2
ENCH600017	Teknik Reaksi Kimia 1	Chemical Reaction Engineering 1	3
	Pilihan	Elective	3
		Sub Total	**19**
	Semester 8	**8th Semester**	
ENBP600019	Skripsi / Tugas Akhir	Undergraduate Thesis / Final Project	4
ENCH600029	Kapita Selekta	Capita Selecta	2
ENGE600008	Kesehatan, Keselamatan Kerja & Lingkungan	Health, Safety & Environment	2
ENCH800004	Teknik Reaksi Kimia Lanjut	Advance Techniques of Chemical Reactions	3
ENCH600012	Termodinamika Teknik Kimia	Chemical Engineering Thermodynamics	3
		Sub Total	**14**

	Semester 9	9th Semester	
ENCH800005	Metodologi penelitian	Research Methodology	3
ENCH800006	Seminar	Seminar	3
ENCH800001	Pemodelan Teknik Kimia Lanjut	Advance Modeling Chemical Engineering	3
ENCH800002	Termodinamika Teknik Kimia Lanjut	Advance Chemical Engineering Thermodynamics	3
		Sub Total	12
	Semester 10	10th Semester	
ENCH800003	Peristiwa Perpindahan Lanjut	Advance Transport Phenomena	5
ENCH800007	Tesis	thesis	7
	Pilihan	Elective	3
		Sub Total	15
		Total	178

ELECTIVE COURSES OF CHEMICAL ENGINEERING

KODE	MATA AJARAN	SUBJECT	SKS
Odd Semester			
ENCH801017	Material Komposit	Composite Material	3
ENCH801018	Termodinamika Terapan	Applied Termodynamics	3
ENCH801019	Sistem Dinamik	Dynamic System	3
ENCH801020	Sifat Termodinamika Hidrokarbon	Thermodynamic Characteristic of Hidrocarbon	3
ENCH801021	Teknologi Pelumas	Lubricant Engineering	3
ENCH801022	Teknologi Bioproses	Bioprocees Engineering	3
ENCH801023	Teknologi Kriogenik	Cryogenic Engineering	3
ENCH801024	Teknologi Plasma Ozon	Plasma and Ozon Engineering	3
ENCH801025	Katalis Heterogen	Heterogen Catalyst	3
ENCH801026	Manajemen Resiko	Risk Management	3
ENCH801027	Topik Khusus	Special Topic	3
ENCH801028	Kecakapan Pemecahan Masalah	Problem-Solving Skills	3
ENCH801029	K3 dalam Industri Kimia	Health and Safety in Chemical Industry	3
Even Semester			
ENCH801030	Pengolahan Minyak Bumi	Petroleum Processing	3
ENCH801031	Proses Petrokimia	Petrochemical Processing	3
ENCH801032	Teknik Pembakaran	Combustion Engineering	3
ENCH801033	Teknologi Fotokatalis	Photocatalyst Technology	3
ENCH801034	Analisis dan Sintesis sistem Proses Kimia	Analysis and Synthesis of Chemical Processes	3
ENCH801035	Teknologi Polimer	Polimer Engineering	3
ENCH801036	Pencegahan Pencemaran	Pollution Prevention	3
ENCH801037	Eksplorasi dan Produksi Hidrokarbon	Exploration and Production of Hydrocarbons	3

Course Description

UIGE600001
UIGE610001
MPKT A / INTEGRATED CHARACTER BUILDING A
6 SKS
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UIGE600004
UIGE610004
MPKT B / INTEGRATED CHARACTER BUILDING B
6 SKS
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UIGE600002
ENGLISH
UIGE610002
ACADEMIC WRITING
3 SKS
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UIGE600003
UIGE610003
SPORTS / ARTS
1 SKS
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ENGE600001
ENGE610001
CALCULUS
4 SKS
Refer to Page 74

ENGE600010
ENGE610010
BASIC CHEMISTRY
Refer to Page 75

ENGE600003
ENGE610003
BASIC PHYSICS 1
4 SKS
Refer to Page 79

ENGE600004
BASIC PHYSICS 2
4 SKS
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ENGE600002
ENGE610002
LINEAR ALGEBRA
4 SKS
Refer to Page 75

UIGE600005-9
UIGE610005-9
RELIGIOUS STUDIES
2 SKS
Refer to Page 76-77

ENGE600005
ENGE610005
STATISTICS AND PROBABILITY
2 SKS
Refer to Page 78

ENGE600008
ENGE610008
HEALTH, WORK SAFETY, AND ENVIROMENT
2 SKS
Refer to Page 78

ENBP600001
ENBP610001
INTRODUCTION TO BIOPROCESS ENGINEERING
3 SKS
Learning Objectives: Students are able to explain the scope of bioprocess technologies and industries associated with it.
Syllabus: Microbial Structure, Microbial Growth, Nutrition & Culture Medium, Control of biochemistry, physiology, stoichiometry and kinetics of growth and metabolism, Basic of prokaryotes and fungi genetic engineering, Food Industry, Healthcare Industry. Energy Industry.
Prerequisite: -
Handbook:
1. Hand Out/diktat lectures from lecturer
2. Mosler, N. S, Modern Biotechnology, John Wiley & Sons, 2009
3. Bioprocess Engineering: Basic Concepts by Michael Shuler. Pearson

ENCH600002
ENCH610002
COMMUNICATION SKILL
2 SKS
Refer to Page 286

ENCH600003
ENCH610003
ORGANIC CHEMISTRY
3 SKS
Refer to Page 286

ENCH600005
ENCH610005
ANALYTICAL CHEMISTRY INSTRUMENTAL
3 SKS
Refer to Page 287

ENCH600006
ENCH610006
PHYSICAL CHEMISTRY
3 SKS
Refer to Page 287

ENCH600008
ENCH610008
ENERGY AND MASS BALANCE
3 SKS
Refer to Page 287

ENCH600007
ENCH610007
PHYSICAL CHEMISTRY AND ANALYTICAL CHEMISTRY LAB.
1 SKS
Refer to Page 287

ENBP600002
ENBP610002
CELL BIOLOGY
3 SKS
Learning Objectives: Student able to explain the difference between prokaryotic cells, arkhea and eukaryotic cells,cell genetic and organization, the technics to see and manipulate the cells, and the interaction between cells and cells life cycle.
Syllabus: Cells and tissues, microscopy technics and analysis of cells, membranes and organels, role of DNA and protein, energy in cells, potential work, intercellular communication, mechanical molecule, cell life cycle, apoptosis.
Prerequisite: -
Handbook:
1. Bolsover et al., Cell Biology, John Willey and Son 2004
2. Essential Cell Biology by Bruce Alberts, Dennis Bray, Karen Hopkin and Alexander Johnson (Mar 27, 2009). Garland Science
3. Molecular Cell Biology (Lodish, Molecular Cell Biology) by Harvey Lodish, Arnold Berk, Chris A. Kaiser and Monty Krieger. W. H. Freeman; 6th edition
4. Biological Science Volume 1 (4th Edition) by Scott Freeman (Feb 13, 2010). Benjamin Cummings

ENCH600009
ENCH610009
TRANSPORT PHENOMENA
3 SKS
Refer to Page 288

ENEE600031
ENEE610031
NUMERICAL COMPUTATION
2 SKS
Refer to Page 171

ENCH600011
ENCH610011
FLUID MECHANICS AND PARTICLES
3 SKS
Refer to Page 288

ENBP600003
ENBP610003
MOLECULAR BIOLOGY
3 SKS
Learning Objectives: Able to explain structure and chemical compounds in living things including the function, the synthesis and metabolism of chemical compounds that occur in cells. Chemical compounds include nucleic acids, proteins, carbohydrates, and lipids.
Syllabus: Molecular biology, nucleic acids, structure and replication of DNA and RNA, transcription and translation, amino acids, synthesis and structure of proteins, enzymes, and metabolism.
Prerequisite: -
Handbook:
1. Lehninger Principles of Biochemistry & eBook by Albert Lehninger, David L. Nelson and Michael M. Cox (Jun 15, 2008)
2. Biochemistry (3rd Edition) by Christopher K. Mathews, Kensal E. van Holde and Kevin G. Ahern (Dec 10, 1999)

ENBP600004
ENBP610004
BIOCHEMISTRY ENGINEERING
3 SKS
Learning Objectives: Students are able to explain the concepts of biochemistry engineering in cell growth, metabolism and product of biochemistry process.
Syllabus: metabolic reactions, energetic, catabolism carbon, respiration, photosynthesis, biosynthesis, transport in cell membrane, the last product of metabolism, microbes and cell growth, substrate utilization, product synthesis
Prerequisite: -
Handbook:
1. James E. Bailey, David F. Ollis, Biochemical Engineering Fundamentals, McGraw-Hill International Editions, second edition, 1986.
2. Douglas S Clark, Harvey W Blanch, Biochemical Engineering, Marcel Dekker Inc, 1997.

ENCH600013
ENCH610013
HEAT TRANSFER
3 SKS
Refer to Page 289

ENBP600005
ENBP610005
BIOCHEMISTRY LAB.
2 SKS

Learning Objectives: Student is able to arrange initial report about theory of the experiments, perform lab experiments, analys the data of experiments, and submit final reports.
Syllabus: separation process, alcohol and phenol identification, carbonil compounds identification, carbohydrates, lypids analysis, fat acids extraction and identification from corn oil, bacteria identification, aseptic technics.
Prerequisite: -
Handbook: -
1. Fessenden, alih bahasa: A. Hadiyana Pujatmaka, Kimia Organik, Erlangga 1986
2. Morrison, RT and Boyd, RN, Organic Chemistry, 6th ed., Prentice Hall 1998.
3. Vogel, Practical Organic Chemistry
4. Penuntun Praktikum Kimia Dasar dan Kimia Organik, Departemen Teknik Kimia, FTUI
5. Moran, L. dan Masciangioli, T. Keselamatan dan Keamanan Laboratorium Kimia, the National Academies Press, 2010
6. Brown, T.L., H. E. LeMay and B.E. Bursten, Chemistry, ed. 8, Prentice Hall, 2000.
7. Vogel, Analisis Anorganik Kualitatif, PT. Kalman Media Pustaka, 1985.
8. Lehninger Principles of Biochemistry & eBook by Albert Lehninger, David L. Nelson and Michael M. Cox (Jun 15, 2008)
9. Biochemistry (3rd Edition) by Christopher K. Mathews, Kensal E. van Holde and Kevin G. Ahern (Dec 10, 1999)

ENBP600006
ENBP610006
BIOCATALYSIS
3 SKS
Learning Objectives: Student able to explain biocatalyst in chemical and biological reactions and the factors influenced it and its application in industry.
Syllabus: catalysis and biocatalysis, enzymes classification and activity, immobilization of enzyme methods, the factors influence biocatalyst performance, inactivations of biocatalyst, biocatalyst reaction kinetics, enzyme productions methods, product recovery, applications of biocatalyst in industry.
Prerequisite: Molecular biology
Handbook:
1. Enzyme biocatalysis: principles and applications by Andres Illanes. Springer 2008
2. Biocatalysts and Enzyme Technology by Klaus Buchholz , Volker Kasche , Uwe Theo Bornscheuer. Wiley-VCH, 2005
3. James E. Bailey, David F. Ollis, Biochemical Engineering Fundamentals, McGraw-Hill International Editions, second edition, 1986.
4. Douglas S Clark, Harvey W Blanch, Biochemical Engineering, Marcel Dekker Inc, 1997.
5. Heri Hermansyah, Kinetika Reaksi Biokatalisis, UI Press, 2010
6. Ching T Hou, Handbook of Industrial Biocatalysis, CRC Press, 2005

ENCH600019
ENCH610019
PROCESS CONTROLLING
3 SKS
Refer to Page 291

ENBP600007
ENBP610007
CELL CULTURE
3 SKS
Learning Objectives: Student able to explain technique of cells culture and able to design cell culture in industrial level.
Syllabus: introduction to mammalian cell culture, procedures of cell culture, developing of growth media, bioprocess development of line cell.
Prerequisite: Cell Biology
Handbook:
1. Cell Culture Engineering (Advances in Biochemical Engineering Biotechnology) by Wei Shu Hu (Editor). Springer
2. Cell Culture Engineering VI by Michael J. Betenbaugh. Springer

ENBP600008
ENBP610008
GENETIC ENGINEERING
3 SKS
Learning Objectives: Student able to explain the basic concepts, technics, and application of genetic engineering process.
Syllabus: Introduction, basic technics of genetic engineering, cutting and pooling DNA, plasmid, cloning strategy, aplication of genetic engineering technology.
Prerequisite: cell biology and molecular biology
Handbook:
1. Primrose SB, Twyman RM, and Old RW. “Principles of Gene Manipulation” sixth edition, Blackwell science Ltd. 2001
2. An Introduction to Genetic Engineering by Desmond S. T. Nicholl (Jun 23, 2008). Cambridge University Press
3. Genetic Engineering: Manipulating the Mechanisms of Life (Genetics & Evolution) by Russ Hodge and Nadia Rosenthal (May 2009). Facts on File

4. Principles of Gene Manipulation and Genomics by Sandy B. Primrose and Richard Twyman. Wiley-Blackwell
5. Introduction to Biotechnology and Genetic Engineering by A. J. Nair. Jones & Bartlett Publishers

ENBP600009
ENBP610009
SEPARATION
3 SKS
Learning Objectives: Understanding basic separation technic, able to design separation process which is effective and efficient, able to design quality control process from the isolated product.
Syllabus: separation concept, mass transport concept, Distillation, Absorption and Stripping, Extraction, Leaching, Membrane process, Ion exchange, cristalization, Bubble and Foam Separation, chromatography, Ultrafiltration dan Reverse osmosis, Membrane dialysis process, selection strategy of separation process.
Prerequisite: Transport phenomena
Handbook:
1. Warren L. McCabe, Julian C. Smith, Peter Harriot. Unit Operation of Chemical Engineering, Mc. Graw Hill. 1993
2. Coulson and Richardson's Chemical Engineering: Chemical Engineering Design v. 6 (Coulson & Richardson's chemical engineering) by R.K. Sinnott. Butterworth-Heinemann Ltd

ENGE600007
ENGINEERING ECONOMIC
3 SKS
Refer to Page 78

ENBP600010
ENBP610010
BIOPROCESS UNIT OPERATION LAB I
1 SKS
Learning Objectives: Student have experience to operate process equipment and conduct the experiment, able to analysis and explain the phenomena occurred in each experiment acticity.
Syllabus: Fluid sircuit mechanic, conduction heat transfer in multiple pipe systems, filtration process, fluidization process and its effect on heat transfer system, fermentation process in biofermentor reactor system.
Prerequisite: -
Handbook:
1. Buku Petunjuk Praktikum Proses dan Operasi Bioproses 1, DTK FTUI
2. Literatur untuk mata kuliah prasyarat

ENBP600011
ENBP610011
BIOREACTOR ENGINEERING
3 SKS
Learning Objectives: Students are able to design bioreactor.
Syllabus: Introduction to reactor and bioreactor, fermentation technology, reactor engineering for animal and plant cell, ideal reactor, modeling of stirred-tank bioreactor, modeling bubble column bioreactor, reactor dynamic, non-ideal bioreactor, sterilization of bioreactor, bioreactor multiphase, philosophy and rule of thumb in designing bioreactor, design agitation system, analysis and design bioreactor.
Prerequisite: Biochemistry engineering
Handbook:
1. Blanch HW and DS Clark, Biochemical Engineering, Marcel Dekker Inc., New York, 1997.
2. Bailey JE and Ollis, Biochemical Engineering Fundamental, McGraw Hill Book Co., New York, 1986.
3. John Viladsen, Jens Nielsen, Gunar Liden, Bioreaction engineering fundamental, springer, 2011
4. K Schugerl, KH Bellgardt, Bioreaction Engineering Modelling and Control

ENBP600012
ENBP610012
BIOPROCESS SYSTEM SIMULATION
3 SKS
Learning Objectives: Students are capable of synthesizing and modeling the biological chemistry process,and have an experience with commercial simmulation software.
Syllabus: benefits and position of bioprocess simulation, software requirement (installation, unit structure, task, economic, etc), simple system: fermentation and filtration, pure components registration which are available/ not available on software, mixture components registration, unit selection, case study: galactosidase.
Prerequisite: Numerical Computation
Handbook:
1. SuperPro Designer Manual, Intelligen, Inc.
2. Biorefineries – Industrial Processes and Products: Status Quo and Future Directions (Volume 1-2), by Birgit Kamm and Patrick R. Gruber.

ENBP600013
ENBP610013
BIOPROCESS OPERATION UNIT LAB II
1 SKS
Learning Objectives: Student have experience to operate process equipment and conduct the experiment, able to analysis and explain the phenomena occurred in each experiment

acticity.
Syllabus: Absorption process, Flow control, Wet Wetted Column, Pressure Control, Biofilter/ Biofixation CO_2.
Prerequisite: -
Handbook:
1. Buku Petunjuk Praktikum Proses dan Operasi Bioproses 1, DTK FTUI
2. Literatur untuk mata kuliah prasyarat

ENCH600023
ENCH610023
PROCESS EQUIPMENT DESIGN
3 SKS
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ENBP600014
BIOLOGICAL PRODUCT DESIGN
4 SKS
Learning Objectives: student able to design product based on natural resource and analysis their economic value.
Syllabus: Understanding consumer needs, product spesification, product formulation, product manufacturing, and supply chain.
Prerequisite: process equipment design (parallel), economic engineering.
Handbook:
1. Cussler, L., G. D. Moggridge, 2011, Chemical Product Design, Cambridge University, 2 edition
2. Ulrich K. T., Eppinger S. D., 2003, Product Design and Development, 3rd ed., McGraw-Hill
3. Seider W. D., Seader J. D., Lewin D. R., Soemantri Widagdo, 2008, Product and Product Design Principles. Synthesis, Analysis and Evaluation, Wiley and Sons Inc, 3 edition
4. Wesselingh, J.A., et al., 2007, Design and Development of Biological, Chemical, Food, and Pharmaceutical Products, John Wiley & Sons.

ENBP600015
ENBP610015
PLANT DESIGN
4 SKS
Learning Objectives: Student able to design process and plant of natural product and analysis their economic value.
Syllabus: the concepts in designing process/ plant, flow diagram processes, synthesis and analysis process using heuristic, process simulation, rule of thumb to construct process and material of equipment design, integration heat/process, plant flow sheet, and economic analysis
Prerequisite: Process controlling, engineering economic, Bioprocess system simulation, process equipment design.
Handbook:
1. Douglas, J. M., 1998, Conceptual Design of Chemical Processes, McGraw-Hill.
2. Seider W. D., Seader J. D., Lewin D. R., Sumatri Widagdo, 2008, Product and Product Design Principles. Synthesis, Analysis and Evaluation, Wiley and Sons Inc, 3 edition.
3. Turton, R., R. C. Bailie, W. B. Ehiting and J. A. Shaeiwitz, 1998, Analysis, Synthesis, and Design of Chemical Process, Prentice-Hall
4. Gavin Towler, R K Sinnott, 2012, Chemical Engineering Design: Principles, Practice and Economics of Plant and Process Design, Butterworth-Heinemann, Second Edition.
5. Peter, M. S, and K. D. Timmerhaus, Ronald West, and Max Peters, 2002, Plant Design and Economic for Chemical Engineering, 5 Edition, McGraw-Hill.
6. Biegler L. T, I. E, Grossmann and A. W. Westerberg, 1997, Systematic Methods for Chemical Process Design, Prentice-Hall.
7. Branan, C., 1998, Rule of Thumb for Chemical Engineers : A manual of quick, accurate solutions to everyday process engineering problems, 2nd edition, Gulf Publishing, Co.
8. Wallas, Stanley M. 1990, Chemical Process Equipment : Selection and Design, Buther Worths.
9. Ed Bausbacher, Roger Hunt, 1993, Process Plant Layout and Piping Design, Prentice Hall; 1 edition
10. CHEMCAD Manual, HEATEXET Manual, HYSYS/UNISIM ManualBerk, Z, Food Process Engineering and Technology, Academic Press, 2009
11. Lydersen BK, Bioprocess Engineering: System, Equipment and Facilities, John & Wiley & Sons, Inc., New York, 1993.
12. Peter, M. S. dan K. D. Timmerhaus, Plant design and Economic for Chemical Engineering, 4th Ed., McGraw Hill.
13. SuperPro Designer Manual. Intelligen, Inc

ENCV800501
ENCV810501
PROJECT MANAGEMENT
2 SKS
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ENBP600016
ENBP610016
INTERNSHIP
2 SKS
Learning Objectives: Student able to explain the process, operation, equipment, control system, utility, waste management, management and organization of company. Able to complete

the case study from the company and written in form of job training report.
Syllabus: Understanding process, operation, equipment, control system, utility, waste management, management and organization of company. The job training report is presented in front of lecturers.
Prerequisite: Students had to take a minimum of 110 SKS (minimum value of D) with a 2.0 GPA.
Handbook: Publication and references about the appropriate industry.

ENBP600017
ENBP610017
WASTE MANAGEMENT OF BIOLOGICAL PROCESS
3 SKS
Learning Objectives: Understanding the concepts of pollution prevention and waste management in clean production, and also design waste management system.
Syllabus: Introduction to pollution prevention concepts, waste water treatment and its preparation, physical, biological, and chemical waste water, unit operation, bioremediation, bioseparation and biodegradation, advanced oxidation process, waste gas treatment, B3 treatment, solid waste treatment, inconventional liquid and gas waste treatment.
Prerequisite: -
Handbook:
1. Biowaste and biological waste treatment by Gareth Evarts. James & James, 2001

ENBP600018
ENBP610018
RESEARCH METHOD AND SEMINAR
2 SKS
Learning Objectives: Able to determine the appropriate method for research activities and produce the ideas, processes, and scientific research in writing and oral.
Syllabus: Introduction, technics of identifying problem and make a hypothesis, thinking logically, Pendahuluan, Teknik mengidentifikasi permasalahan dan menyusun hipotesa, Berpikir secara logika, technics of scientific writing, technics of writing research proposal, technics of designing research, presentation technics, technics of collecting, analyzing, and presenting data.
Prerequisite: Students had to take a minimum of 90 SKS (minimum value of D) with a 2.0 GPA.
Handbook:
1. Suitable with task
2. Handout
3. Research proposal format

ENBP600019
ENBP600019
UNDERGRADUATE THESIS
4 SKS
Learning Objectives: Able to analyze the Bioprocess engineering problems, and use knowledge and science comprehensively to obtain alternative solution, able to make a paper sistematically according to rules and able to explain sistematically, analytical, orderly, and correct according to thesis contents.
Syllabus: Guide and rule related to undergraduate thesis, the topic is suitable with research topic.
Prerequisite: Research method and seminar
Handbook:
1. Suitable with task
2. Guide book of undergraduate thesis, Depok, 1999.

ENBP600020
ENBP610020
CAPITA SELECTA
2 SKS
Learning Objectives: Able to explain the development of industry and engineering, business opportunities and the problems it faces in general.
Syllabus: Held with invited guest lecturers who are competent in fields that fit the requirement of each program study (can be different in each semester).
Prerequisite:-
Handbook: -

ENBP601021
ENBP611021
OLEOCHEMICAL INDUSTRY (3 SKS)
Learning Objectives: Students able to explain process used in oleochemical industries, can make plans to develop the manufacture of oleochemical from vegetable oil.
Syllabus: Fatty acid, Biodiesel, Polymer and dye, Detergent, Soap, Fatty alcohol, Glycerin, Oil and fat, Lubricant and grease, Oleochemicals development, Vegetable oil manufacturing, Process technology in vegetable oil.
Prerequisite: Organic chemistry
Handbook:
Oleochemical Manufacture and Applications by Frank D. Gunstone, Richard J. Hamilton. Blackwell

ENBP601022
ENBP611022
FOOD TECHNOLOGY (3 SKS)
Learning Objectives: Student able to explain the processes of making food in the food industry which includes the selection, handling

and processing of raw materials, the operating unit of food production, packaging, storage and control the process from beginning to end.
Syllabus: Introduction, physical properties of raw material, the basic concepts of energy and mass transfer, reaction kinetics, process control, mixing, filtration, and centrifugation. Membrane processes and extraction, adsorption and ion exchange column, with the temperature setting, drying, preservation, packaging and storage of food, hygiene.
Prerequisite: -
Handbook:
1. Berk Zeki, Food process Engineering and Technology, Academic Press, Elsevier 2009
2. Food Technology : an introduction by Anita Tull. Oxford University Press, 2002
3. Introduction to Food Engineering by R. Paul Singh, R. Paul Singh and Dennis R. Heldman. Academic Press
4. Introduction to Food Process Engineering by P. G. Smith. Springer
5. Fundamentals of Food Process Engineering by Romeo T. Toledo. Springer

ENBP601023
ENBP611023
UTILITY AND PLANT MAINTENANCE
3 SKS
Learning Objectives: Student able to explain the concepts of waste water treatment, manufacture, and use of water vapor, and the refrigeration cycle. Explain the different equipment used to operate the refinery process with different tools and calculations. Understanding the basic concepts of making the calculation of water vapor, psychometric and refrigeration operations. Can explain the maintenance strategy aimed to adress issues related to tools damage.
Syllabus: Inroduction utilities, water utilities and water vapor, utilities refrigeration, air and other utilities, maintenance introduction, consideration of process equipment design, equipment design and operation of thermal, fluid equipment design and operation, degradation and assesment of processes equipment, piping systems and equipment: failure, prevention, and repair, maintenance inspection plant, operation and maintenance, general procedures for maintenance of equipment.
Prerequisite: -
Handbook:
1. P. L. Balleney, *Thermal Engineering* Khanna Publisher New Delhi
2. S.T. Powel, *Industrial Water Treatment*, McGraw Hill, New York
3. Chattopadhya, *Boiler operations*, Tata McGraw Hill, New Delhi
4. R.H.Perry, D.W. Green, *Perry's Chemical Engineer'sHandbook*, McGraw Hill, New York
5. R.C. Patel, C.J. Karmchandani, Elements of Heat Engines Vol – II,III Acharya Book Depot., Vadodara
6. P .N .Ananthanarayan, *Refrigeration & Air conditioning*, Tata McGraw Hill
7. JAIN & JAIN *Industrial Chemistry* -

ENBP601024
ENBP611024
PROTEIN ENGINEERING
3 SKS
Learning Objectives: Students able to determine protein engineering strategies for the benefit of separation, biocatalysts and medic.
Syllabus: Introduction, Protein docking methods, Protein tagging strategies, Gen synthesis design, Enzyme stabilization, Molecular exploration, Protein engineering, Case study.
Prerequisite: Organic chemistry
Handbook:
1. Protein Engineering in Industrial Biotechnology, Lilia Alberghina, harwood academic publisher, 2005
2. Proteins: Biotechnology and Biochemistry by Dr. Gary Walsh. Wiley
3. Protein engineering and design by Sheldon J. Park, Jennifer R. Cochran. CRC Press
4. Protein Engineering and Design by Paul R. Carey. Academic Press
5. Protein Engineering: Principles and Practice. Wiley-Liss

ENBP601025
ENBP611025
HERBAL TECHNOLOGY
3 SKS
Learning Objectives: Students able to distinguish between herbs, describe herbs separation techniques, make herbs basic formula, describe herbs regulation and distinguish it from other pharmaceutical products.
Syllabus: Definition and basic concept of Herbal, Herb raw materials, Herb separation technologies, Herb formulations, Herb regulations.
Prerequisite: Organic Chemistry
Handbook:
The Complete Technology Book on Herbal Perfumes & Cosmetics by H. Panda. National Institute of Industrial Research 2003

ENBP601027
ENBP611027
PACKAGING AND STORAGING TECHNOLOGY
3 SKS
Learning Objectives: Students able to describe

the characteristic and technique of food storage and packaging, relationship between food quality and packing and storage, describe the factors that cause deviation of food quality, and able to choose type of packaging and storage techniques that appropriate for the food ingredients.
Syllabus: Hidratation, Food materials and products storage engineering, Deviation of quality of food material and product, Microbial contamination, Objectives and function of food packaging, Food packaging interaction, Type of packaging material.
Prerequisite: -
Handbook:
1. Examining Food Technology by Anne Barnett. Heinemann Secondary,1996

ENBP601028
ENBP611028
BIOINFORMATICS
3 SKS
Learning Objectives: Students be able to explore database and programs for the application in the sector of genomic engineering, proteomic, etc.
Syllabus: database, genomic, genetic molecular, phylogenic, etc, structure protein, metabolism, and tissue
Prerequisite: -
Handbook:
1. Bioinformatics by Shalini Suri. APH Publishing, 2006
2. Bioinformatics: A Primer by Charles Staben and Staben. Jones & Bartlett Publishers, 2005

ENBP601029
ENBP611029
CONTROLLING DRUG RELEASE TECHNOLOGY
3 SKS
Learning Objective: Student able to explain principles of controlling drug or active compounds release for medicine and use the principles to design the technology of controlling drug release.
Syllabus: Biodegradable polymeric materials, nano/microsphere drug encapsulator, difusion and permeasi, strategy of control drug release, cases.
Prerequest: Organic Chemistry
Handbook:
1. Saltzman, W.M., Drug Delivery: Engineering Principles for Drug Therapy, Oxford University Press, 2001.
2. Wen, H. and Park, K, ed., Oral Controlled Release Formulation Design and Drug Delivery, Wiley, 2010.

ENBP601030
ENBP611030
DRUG AND COSMETIC TECHNOLOGY
3 SKS
Learning Objectives: Students able to describe the development of cosmetic and pharmaceutical industries, able to distinguish between cosmetic and drug, able to describe cosmetic and drug regulations, able to describe bioprocess techniques used in cosmetic and pharmaceutical industries.
Syllabus: Cosmetic and drug definition, Types and characteristics of the skin, Types of cosmetic, Ethics and regulations of drug and cosmetic, Development technology of new drug, Process technology in cosmetic and drug industries, Packaging technique of cosmetic and drug industries.
Prerequisite: Organic chemistry
Handbook:
1. Handbook of Cosmetic Science and Technology by Andre O. Barel, Marc Paye, Howard I. Maibach. INFRMA-HC 2009
2. Biodesign: The Process of Innovating Medical Technologies by Stefanos Zenios, Josh Makower , Paul Yock , Todd J. Brinton, Uday N. Kumar, Lyn Denend, Thomas M. Krummel. Cambridge University Press 2009

ENBP601031
ENBP611031
BIOMATERIAL
3 SKS
Learning Objectives: Students understand the principles and concepts of biomaterial technology and LCA (*Life Cycle Assessment*) studies, organic and inorganic material for biomaterial, apply and develop knowledge of the biomaterial for life.
Syllabus: Introduction, Solid structure, Material Characterization, Metallic material for Implant, Bioceramic material, Biomaterial composite, Relation to the structural properties of biomaterial, Tissue response to implant biomaterials, Replacement of soft body tissue, Replacement of hard body tissue, Transplantation, Biological Tissue Engineering.
Prerequisite: -
Handbook:
1. Joon Park, R.S. Lakes. Biomaterials an Introduction, springer
2. Biomaterials: Principles and Applications by Joon B. Park, Joseph D. Bronzino. CRC Press

4.12. UNDERGRADUATE PROGRAM IN INDUSTRIAL ENGINEERING

Program Specification

1	**Awarding Institution**		Universitas Indonesia
2	**Teaching Institution**		Universitas Indonesia
3	**Programme Title**		Undergraduate Program in Industrial Engineering
4	**Class**		Regular, Parallel, International
5	**Final Award**		Sarjana Teknik (S.T)
6	**Accreditation / Recognition**		BAN-PT: A - accredited AUN - QA
7	**Language(s) of Instruction**		Bahasa Indonesia and English
8	**Study Scheme (Full Time / Part Time)**		Full Time
9	**Entry Requirements**		High school /equivalent, or D3 / Polytechnique / equivalent, AND pass the entrance exam.
10	**Study Duration**		Designed for 4 years
	Type of Semester	Number of semester	Number of weeks /semester
	Regular	8	17
	Short (optional)	3	8
11	**Graduate Profiles:** *An Industrial engineer who has the capabilities of designing, improving, operating and maintaining integrated and multi-level manufacturing and service systems by means of analytical, computational and experimental methods with regard to professionalism values in order to increase the productivity and quality.*		
12	**Expected Learning Outcomes:** 1. Be able to implement the knowledge of mathematics, science and engineering principles 2. Be able to design and perform research projects, and analyze and interpret data. 3. Be able to design a system, component or process to fulfill the needs in a realistic limitations such as economics, environment, social, politics, ethics, health and safety, feasibility and sustainability. 4. Be able to identify, analyze and solve engineering problems. 5. Be able to use techniques, tools and methods in engineering practices. 6. Be able to take part of a multidisciplinary team. 7. Understands the professionalism values and ethics. 8. Has a broad knowledge to understand the impact of engineering problem solving in a global, economical, environmental and social context. 9. Be able to learn independently and continuously (lifelong learning). 10. Be able to use verbal and non-verbal communications in Bahasa and English for academic and non-academic purposes.		

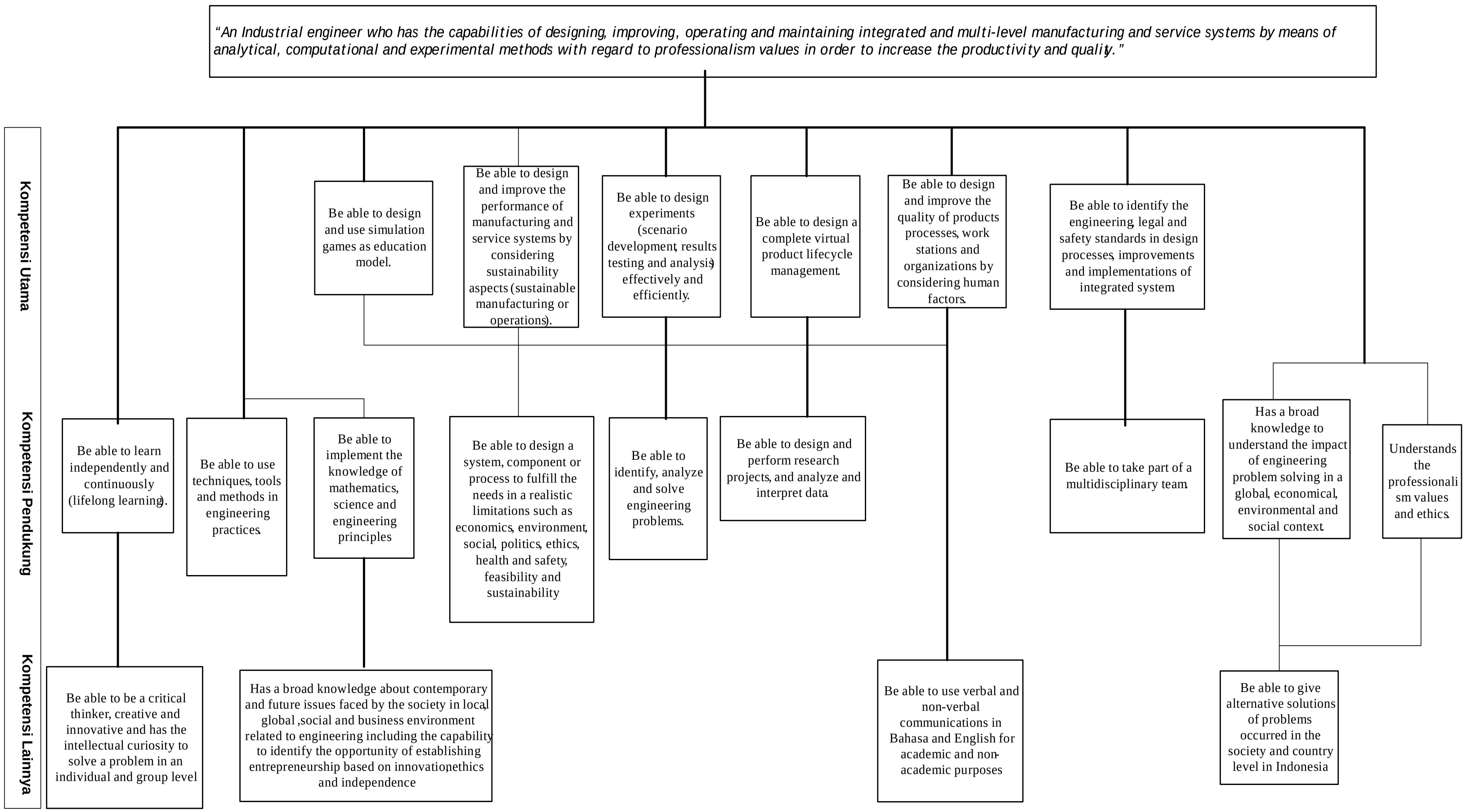
12	11. Has a broad knowledge about contemporary and future issues faced by the society in local, global ,social and business environment related to engineering including the capability to identify the opportunity of establishing entrepreneurship based on innovation, ethics and independence (UI competency). 12. Be able to be a critical thinker, creative and innovative and has the intellectual curiosity to solve a problem in an individual and group level (UI competency). 13. Be able to give alternative solutions of problems occurred in the society and country level in Indonesia (UI competency). 14. Be able to identify the engineering, legal and safety standards in design processes, improvements and implementations of integrated system. 15. Be able to design and use simulation games as education model. 16. Be able to design experiments (scenario development, results testing and analysis) effectively and efficiently. 17. Be able to design a complete virtual product lifecycle management. 18. Be able to design and improve the performance of manufacturing and service systems by considering sustainability aspects (sustainable manufacturing or operations). 19. Be able to design and improve the quality of products processes, work stations and organizations by considering human factors.
13	**Classification of Subjects**

No	Classification	Credit Hours (SKS)	Percentage
i	University General Subjects	18	12.5 %
ii	Basic Engineering Subjects	25	17.4 %
iii	Core Subjects	71	49.3 %
iv	Elective Subjects	21	14.6 %
v	Internship, Seminar, Undergraduate Thesis, Project	9	6.2 %
	Total	144	100 %
14	**Total Credit Hours to Graduate**		**144 SKS**

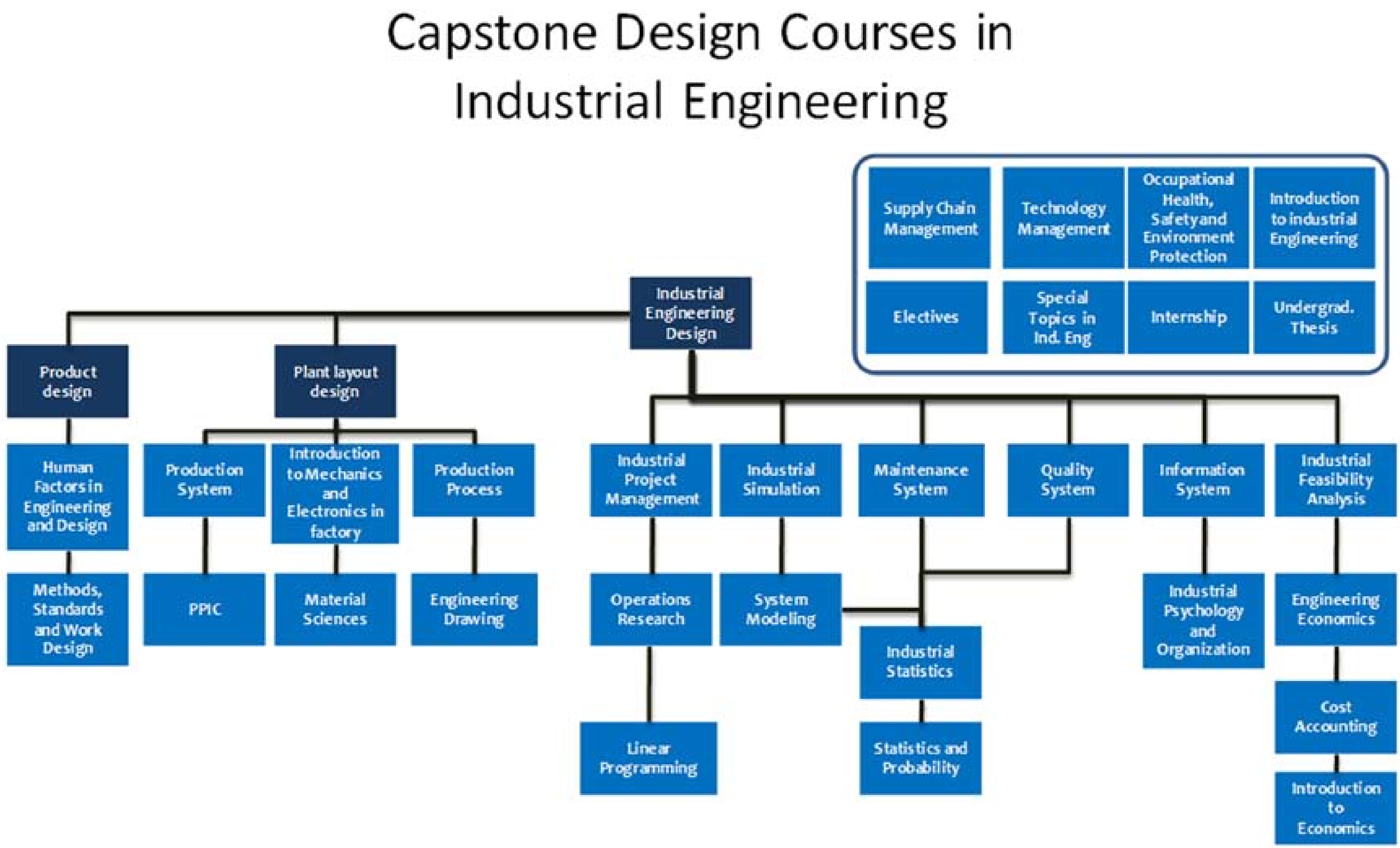
Career Prospects

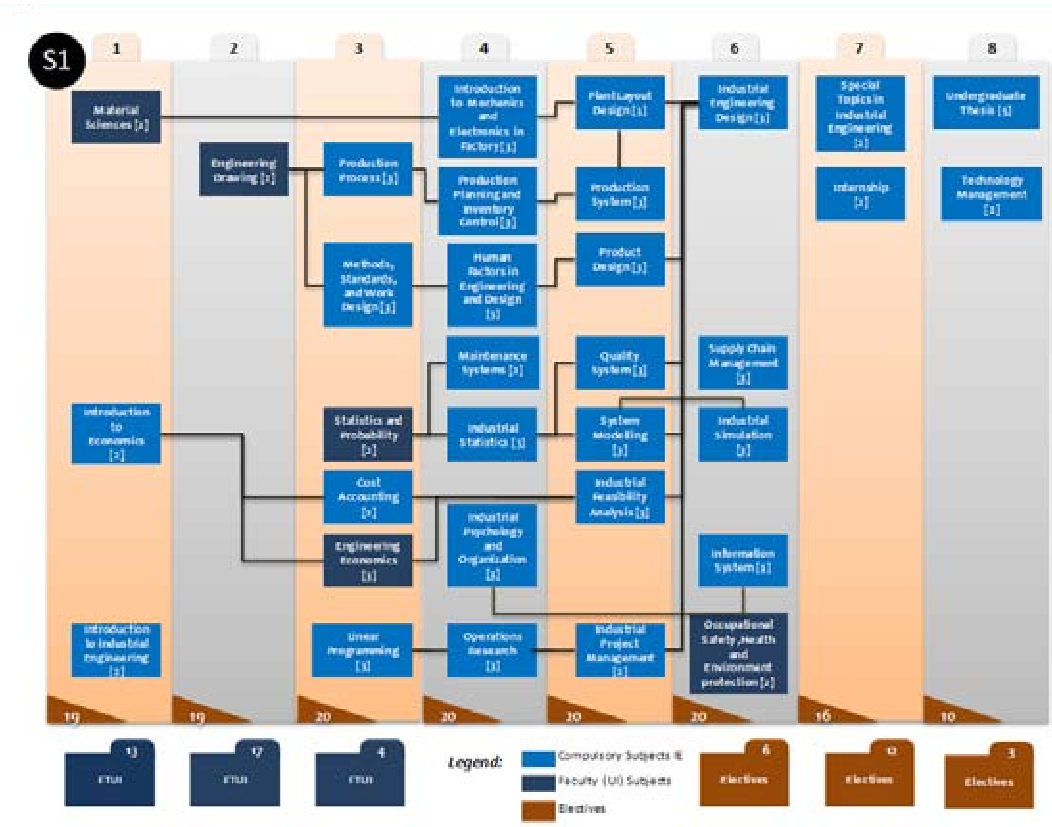
Public or private manufacturing and service industries, such as production management, HR, maintenance system, logistics and supply chain management, finance and banking, management and IT consulting services.

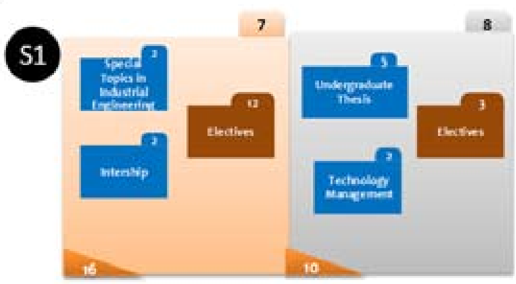
Learning Outcomes Flow Diagram

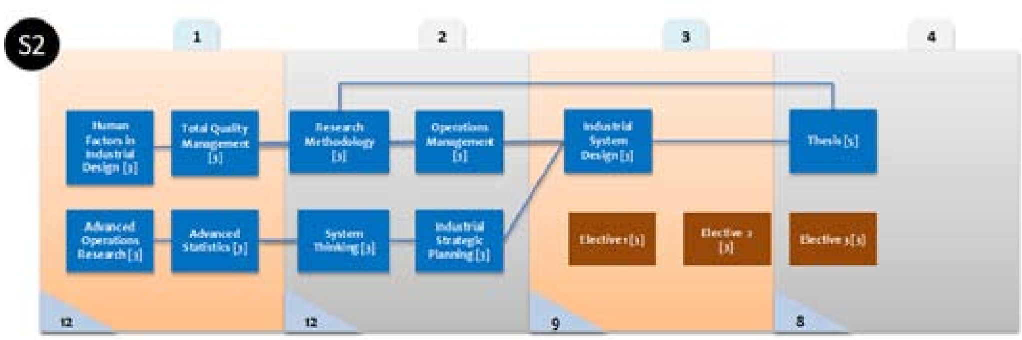


Flow Diagram of Subjects




S1
1
2
3
4
5
6
7
8
Material Sciences [2]
Introduction to Mechanics and Electronics in Factory [3]
Plant Layout Design [3]
Industrial Engineering Design [3]
Special Topics in Industrial Engineering [2]
Undergraduate Thesis [5]
Engineering Drawing [2]
Production Process [3]
Production Planning and Inventory Control [3]
Production System [3]
Internship [2]
Technology Management [2]
Methods, Standards, and Work Design [3]
Human Factors in Engineering and Design [3]
Product Design [3]
Maintenance Systems [2]
Quality System [3]
Supply Chain Management [3]
Introduction to Economics [2]
Statistics and Probability [2]
Industrial Statistics [3]
System Modelling [3]
Industrial Simulation [3]
Cost Accounting [2]
Industrial Feasibility Analysis [3]
Engineering Economics [3]
Industrial Psychology and Organization [3]
Information System [3]
Introduction to Industrial Engineering [2]
Linear Programming [3]
Operations Research [3]
Industrial Project Management [3]
Occupational Safety, Health and Environment protection [2]
19
19
20
20
20
20
16
10
13
FTUI
17
FTUI
4
FTUI
Legend:
Compulsory Subjects IE
Faculty (UI) Subjects
Electives
6
Electives
12
Electives
3
Electives


S1
7
8
Special Topics in Industrial Engineering
2
12
Electives
Intership
2
5
Undergraduate Thesis
3
Electives
2
Technology Management
16
10


S2
1
2
3
4
Human Factors in Industrial Design [3]
Total Quality Management [3]
Research Methodology [3]
Operations Management [3]
Industrial System Design [3]
Thesis [5]
Advanced Operations Research [3]
Advanced Statistics [3]
System Thinking [3]
Industrial Strategic Planning [3]
Electives [3]
Elective 2 [3]
Elective 3 [3]
12
12
9
8

Course Structure of Undergraduate Program in Industrial Engineering (Regular / Parallel / International)

KODE	MATA AJARAN	SUBJECT	SKS
	Semester 1	**1st Semester**	
UIGE600004	MPKT B	Integrated Characteristic Building Subject B	6
UIGE600002	Bahasa Inggris	English	3
ENGE600001	Kalkulus	Calculus	4
ENIE600001	Pengantar Teknik Industri	Introduction to Industrial Engineering	2
ENIE600002	Pengantar Ilmu Ekonomi	Introduction to Economics	2
ENMT600001	Pengantar Material Teknik	Introduction to Engineering Materials	2
		Sub Total	**19**
	Semester 2	**2nd Semester**	
UIGE600005-9	Agama	Religious Studies	2
ENGE600002	Aljabar Linear	Linear Algebra	4
ENGE600003	Fisika Dasar I	Basic Physics 1	4
UIGE600001	MPKT A	Integrated Characteristic Building Subject A	6
UIGE600003	Olah Raga/Seni	Sport/Art	1
ENGE600009	Menggambar Teknik	Engineering Drawing	2
		Sub Total	**19**
	Semester 3	**3rd Semester**	
ENGE600004	Fisika Dasar 2	Basic Physics 2	4
ENIE600003	Perancangan Kerja, Metode, dan Standar Kerja	Methods,Standards and Work Design	3
ENIE600004	Akuntansi Biaya	Cost Accounting	2
ENIE600005	Proses Produksi + Praktikum	Production Process + Lab	3
ENGE600007	Ekonomi Teknik	Engineering Economics	3
ENGE600005	Statistik dan Probabilitas	Statistics & Probability	2
ENIE600006	Programa Linear	Linear Programming	3
		Sub Total	**20**
	Semester 4	**4th Semester**	
ENIE600007	Pengantar Mekanika dan Elektronika Pabrik	Introduction to Mechanics and Electronics in Factory	3
ENIE600008	Faktor Manusia dalam Rekayasa dan Desain + Praktikum	Human Factors in Engineering & Design + Lab	3
ENIE600009	Sistem Pemeliharaan	Maintenance Systems	2
ENIE600010	Statistik Industri + Praktikum	Industrial Statistics + Lab	3
ENIE600011	Perencanaan Produksi dan Pengendalian Persediaan + Praktikum	Production Planning and Inventory Control + Lab	3
ENIE600012	Organisasi & Psikologi Industri	Industrial Psychology & Organization	3
ENIE600013	Penelitian Operasi	Operations Research	3
		Sub Total	**20**

	Semester 5	5th Semester	
ENIE600014	Perancangan Tata Letak Pabrik	Plant Layout Design	3
ENIE600015	Perancangan Produk + Praktikum	Product Design + Lab	3
ENIE600016	Analisa Kelayakan Industri	Industrial Feasibillity Analysis	3
ENIE600017	Sistem Kualitas	Quality System	3
ENIE600018	Pemodelan Sistem + Praktikum	System Modelling + Lab	3
ENIE600019	Sistem Produksi + Praktikum	Production Systems + Lab	3
ENIE600020	Manajemen Proyek Industri	Industrial Project Management	2
		Sub Total	**20**
	Semester 6	**6th Semester**	
ENGE600008	Kesehatan, Keselamatan Kerja dan Lindung Lingkungan	Occupational Health, Safety & Environment Protection	2
ENIE600021	Manajemen Rantai Pasok	Supply Chain Management	3
ENIE600022	Simulasi Industri + Praktikum	Industrial Simulation + Lab	3
ENIE600023	Perancangan Teknik Industri + Praktikum	Industrial Engineering Design + Lab	3
ENIE600024	Sistem Informasi	Information System	3
	Pilihan 1	Elective 1	3
	Pilihan 2	Elective 2	3
		Sub Total	**20**
	Semester 7	**7th Semester**	
ENIE600025	Kapita Selekta	Capita Selecta	2
ENIE600026	Kerja Praktek	Internship	2
	Pilihan 1	Elective 1	3
	Pilihan 2	Elective 2	3
	Pilihan 3	Elective 3	3
	Pilihan 4	Elective 4	3
		Sub Total	**16**
	Semester 8	**8th Semester**	
ENIE600028	Skripsi / Tugas Akhir	Undergraduate Thesis / Final Project	5
ENIE600027	Manajemen Teknologi	Technology Management	2
	Pilihan 1	Elective 1	3
		Sub Total	**10**
		Total	**144**

ELECTIVES

Semester Gasal

KODE	MATA AJARAN	SUBJECT	SKS
ENIE601029	Analisis Multivariat	Multivariate Analysis	3
ENIE601030	Keterampilan Interpersonal	Interpersonal Skills	3
ENIE601031	Manajemen Siklus Hidup Produk	Product Lifecycle Management	3
ENIE601032	Makro Ergonomi	Macro Ergonomics	3
ENIE601033	Sistem Keuangan dan Investasi	Finance and Investments	3
ENIE601034	Manajemen Inovasi	Innovation Management	3
ENIE601035	Manajemen Hubungan Konsumen	Customer Relationship Management	3
ENIE601036	Lean Operations	Lean Operations	3
ENIE601037	Analisis dan Perencanaan Fasilitas Manufaktur	Manufacturing Facilities Planning and Analysis	3

Semester Genap

KODE	MATA AJARAN	SUBJECT	SKS
ENIE601038	Data Mining	Data Mining	3
ENIE601039	Rekayasa Sistem	Systems Engineering	3
ENIE601040	Analisis Daya Saing Perusahaan	Enterprise Competitiveness Analysis	3
ENIE601041	Optimasi Lanjut	Advanced Optimization	3
ENIE601042	Manufaktur dan Inovasi Berkelanjutan	Sustainable Manufacturing and Innovation	3
ENIE601043	Simulasi dan Pemodelan Digital Manusia	Human Digital Modelling and Simulation	3
ENIE601044	Keputusan, Ketidakpastian dan Risiko	Decision, Uncertainties and Risks	3

Fast Track Program Structure:

Compulsory subjects for undergraduate program (S1) in 7th and 8th semester remain compulsory for the “fast track” graduate program (S2), and should be taken together with graduate program’s compulsory subjects in 1st and 2nd semester. To fulfill the requirements of 144 credit hours of undergraduate program (S1) graduation:

- All of the compulsory subjects of graduate program (S2) in 1st semester will be electives for undergraduate students (S1) in 7th semester (12 credit hours)
- In 8th semester undergraduate program (S1), students should take 1 out of 4 compulsory subjects in graduate program (S2) as their electives in undergraduate program (S1) (3 credit hours).
- The grades obtained from graduate’s compulsory subjects in 1st and 2nd semester will be transferred to electives grade of undergraduate electives.

Description of Subjects

UIGE600001
UIGE610001
MPKT A / INTEGRATED CHARACTER BUILDING A
6 SKS
Refer to Page 74

UIGE600004
UIGE610004
MPKT B / INTEGRATED CHARACTER BUILDING B
6 SKS
Refer to Page 74

UIGE600002
ENGLISH
UIGE610002
ACADEMIC WRITING
3 SKS
Refer to Page 74

UIGE600003
UIGE610003
SPORTS / ARTS
1 SKS
Refer to Page 77

ENGE600001
ENGE610001
CALCULUS
4 SKS
Refer to Page 74

ENGE600010
ENGE610010
BASIC CHEMISTRY
Refer to Page 75

ENGE600003
ENGE610003
BASIC PHYSICS 1
4 SKS
Refer to Page 75

ENGE600004
BASIC PHYSICS 2
4 SKS
Refer to Page 77

ENGE600002
ENGE610002
LINEAR ALGEBRA
4 SKS
Refer to Page 75

UIGE600005-9
UIGE610005-9
RELIGIOUS STUDIES
2 SKS
Refer to Page 76-77

ENGE600005
ENGE610005
STATISTICS AND PROBABILITY
2 SKS
Refer to Page 78

ENGE600008
ENGE610008
HEALTH, WORK SAFETY, AND ENVIROMENT
2 SKS
Refer to Page 78

ENGE600007
ENGINEERING ECONOMICS (3 SKS)
3 SKS
Refer to Page 78

ENGE600009
ENGINEERING DRAWING (2 SKS)
Refer to Page 124

ENIE600001
INTRODUCTION TO INDUSTRIAL ENGINEERING (2 SKS)
Learning Objective(s): Early understanding about the Industrial Engineering Discipline scope and contributions, which includes concepts, methods and tools and how it relates to each other in service or manufacturing industry.
Syllabus: History of Industrial Engineering, Scope of Industrial Engineering, Brief introduction and explaination of component system which build Industrial Engineering, Explanation of curiculum structure in Industrial Engineering, Example of contribution of Industrial Engineers in service and manufacturing industry, Development of Industrial Engineering in the future, Profesionalism definition and Ethics Engineering, and Cases in Ethics and Profesionalism.
Pre-requisite(s): -
Text Book(s):
1. Maynard Harold B. (ed.), Maynard's Handbook of Industrial Engineering. McGraw-Hill Professional, 2001.
2. Badiru, Adedeji B., Handbook of Industrial and System Engineering, CRC Taylor-Francis, 2006.

ENIE600002
INTRODUCTION TO ECONOMICS (2 SKS)
Learning Objective(s): Introduce the scope of economics science and business as an integral part of human activities to survive.
Syllabus: Basic Concepts. Supply, Demand and Market. Workforce, Land and Assets. Trade and Tax. Economic activities and National Income.

Consumption and Investment. Money, Financial Market and Moneter. Unemployment, Inflation, and Economic Policy. Growth and Development. The purpose of Business. Business Plan. Start up. Business Operations. Capital. Marketing Principles. Financial Management. Resource Management. Service, Productivity and Information.
Pre-requisite(s): -
Text Book(s):
1. Samuelson, Paul E. dan William D. Nordhaus. 2005. Economics. Boston: McGraw-Hill.).
2. Griffin, Ricky W. and Ronald J. Ebert. 2002. Business. Upper Saddle River: Prentice Hall.

ENMT600001
MATERIAL SCIENCES (2 SKS)
Refer to Page 211

ENIE600003
METHODS, STANDARDS AND WORK DESIGN + LAB (3 SKS)
Learning Objective(s): Course participants are able to measure, analyze, design and increase the effectiveness and efficiency of human work through methods improvements and work standards.
Syllabus: Introduction of Human Factors, History of Human Factors and Future Trends, Problem Solving Tools, Operation Analysis, Man Machine Chart and Flow Process Chart, Anthropometry, Time Study, Performance Rating & Allowances, Work Sampling. Standard Data, Predetermined Time Study, Wage Design, Training and Learning Curves.
Pre-requisite(s): Statistics and Probability
Text Book(s):
1. Method, Standard and Work Design, 11th edition, Benjamin Niebel & Andris Freivalds, McGraw-Hill International, 2003
2. The Ergonomics Kit for general industry, dan Macleod, Taylor & Francis, 2006
3. Motion and Time Study: Design and Measurement of Work, Barnes, Ralph M., John Wiley and Sons, 1980

ENIE600004
COST ACCOUNTING (2 SKS)
Learning Objective(s): Course participants understand accounting principles and are able to calculate accounting problems systematically and present them as a financial report. They should also be able to analyze and evaluate the conditions of the company based on those reports.
Syllabus: Accounting Equation. Basic Production Cost of Manufacturing. Cost of Goods Sold (COGS). Profit and Loss Statement. Balance Sheets. Penilaian Persediaan (Perusahaan Dagang). Depresiasi. Working Capital. Profit Planning and Control. Overhead Cost Allocation. Activity Based Costing. Job Order Cost Accounting. Process Cost Accounting.
Pre-requisite(s): Introduction to Economics
Text Book(s):
1. Lawrence H. Hammer, William K. Carter, Milton F Usry, Cost Accounting, ITP Co., Ohio, 2004
2. Weygrandt, Kieso, Kell, Accounting Principles, John Willey and Sons CO., Canada, 2003

ENIE600005
PRODUCTION PROCESS + LAB (3 SKS)
Learning Objective(s): Course participants have the knowledge about technology and process to understanding how a product is made through manufacturing processes.
Syllabus: Casting and Cost Analysis. Heat Forming. Cold Forming. Plastics, Ceramics and Composite Forming. Pressure forming and cost analysis. Extraction & cost analysis. Gas Flame Process and Arc Process. Resistance Welding and Other Welding Process. Joining and Fastening.
Pre-requisite(s): Introduction to Industrial Engineering
Text Book(s):
Kalpakjian, Serope, Manufacturing Engineering and Technology, 3rd edition, Addison-Wesley, 1995

ENIE600006
LINEAR PROGRAMMING (3 SKS)
Learning Objective(s): Course participants are able to implement mathematical model in developing solutions for engineering and management problems.
Syllabus: Linear programming model & graphical solutions, Simplex methods, Duality and sensitivity analysis, Transportation models, Assignment model, Integer Programming. Multi-Goal Mathematical Programming, Network.
Pre-requisite(s): -
Text Book(s):
1. Hamdy A. Taha, Operations Research, 7th ed., Prentice-Hall, Inc. 2006
2. Hellier, Liebermen, Introduction to Operations Research, Mc Graw Hill, 2005

ENIE600007
INTRODUCTION TO MECHANICS AND ELECTRONICS IN FACTORY (3 SKS)
Learning Objective(s): Course participants understand basic concepts from engineering mechanics and also can identify various factory facility based on prime movers and electric power.
Syllabus: Introduction to engineering mechanics; Introduction to prime movers; Gasoline Ignition Engine; Diesel Ignition Engine; Turbine Principle; Basic definition of electric power system; Electric power system element (Transformator, Machine AC, Machine DC); PLC; Pneumatic System.
Pre-requisite(s): Material Sciences

Text Book(s):

1. Timoshenko, Strength of Material, Prentice Hall, 1976
2. Popov, Mechanics of Materials, MIR Publisher, 1979

ENIE600008

HUMAN FACTORS IN ENGINEERING AND DESIGN + LAB (3 SKS)

Learning Objective(s): Course participants are able to analyze and design a human machine interaction and its workplace

Syllabus: Introduction to human factors in engineering design, Interface design, Human controls systems, Work tools and hand tools, Workplace layout and design, Applied anthropometry, Interpersonal aspects in Engineering and Design, Climate and Lights, Human Error, Overview of Occupational Health and Safety.

Pre-requisite(s): -

Text Book(s):

1. Sanders, Mark S. & Ernest J. McCormick. Human Factors in Engineering and Design. McGraw-Hill. New York. 1993
2. Chapanis, Alphonse. Human Factors in Systems Engineering. John Wiley & Sons. New York. 1996
3. Wickens, D Christoper,. An Introduction to Human Factors Engineering, 2nd Edition. Prentice-Hall. 2004

ENIE600009

MAINTENANCE SYSTEMS (2 SKS)

Learning Objective(s): Course participants understand the important aspects in the maintenance system management and the type of approach that is currently used in the industry.

Syllabus: Organizing for Maintenance Operations. Paperwork Control. Maintenance Job Planning and Scheduling. Maintenance Work Measurement and Standards. Preventive Maintenance Measuring and Appraising Maintenance Performance. Total Productive Maintenance. Maintenance Management in Action

Pre-requisite(s): Production Process

Text Book(s):

1. Lawrence Mann, Jr., Maintenance Management, Lexington Books, 1978
2. Seiichi Nakajima, Introduction to Total Productive Maintenance, 1988
3. Antony Corder, di alih bahasa oleh Ir. Kusnul Hadi, Teknik Manajemen Pemeliharaan, Erlangga, 1996.
4. Palmer, Doc Richard., Maintenance Planning and Schedulling Handbook 2nd Edition. McGraw-Hill Professional. 2004.

ENIE600010

INDUSTRIAL STATISTICS + LAB (3 SKS)

Learning Objective(s): Course participants are able to organize the collection, process, and analysis of data using statistics and engineering principles to support decision making process, within DOE - Design of Experiment.

Syllabus: Review of Basic Statistical Concepts. Single Factor Experiment (Fixed Effect Model). Single Factor Experiment (Random Effect Model). Randomized Complete Block Design. Latin Square Design. General Factorial Design. 2k Factorial Design. Blocking in Factorial Design. Factorial Experiments with Random Factors. Fractional Factorial Design. Nested Design. Response Surface Model.

Pre-requisite(s): Statistics and Probability

Text Book(s):

1. Design and Analysis of Experiments, Douglas C. Montgomery. John Wiley & Sons, 2000
2. Design and Analysis of Experiments, Angela Dean and Daniel Voss, Springer-Verlag, 2000
3. Experimental Design with Applications in Management, Engineering, and the Sciences, Paul D. Barger and Robert E. Maurer, Thomson Learning, 2002

ENIE600011

PRODUCTION PLANNING AND INVENTORY CONTROL + LAB (3 SKS)

Learning Objective(s): Course participants are able to analyze, design, implement and evaluate an integrated production planning and control system by controlling information flow, scheduling of production resources and internal processes, resulting a high quality product at the right time and the right cost.

Syllabus: Production planning system, Master Requirement Planning (MRP), Material Requirement Plan, Capacity planning, Inventory control, Lot sizing, Production scheduling, Sequencing and evaluation, TOC/DBR concepts, PPIC game.

Pre-requisite(s): -

Text Book(s):

1. Arnold, J.R. Tony and Chapman, Stephen N.; Prentice Hall; Introduction to Materials Management; 2004
2. Chapman, Stephen N.; The Fundamentals of Production Planning and Control; Pearson - Prentice Hall, 2006

ENIE600012

INDUSTRIAL PSYCHOLOGY AND ORGANIZATION (3 SKS)

Learning Objective(s): Course participants are able to analyze the influencing factors of design and organizations management in industry including human capital assets.

Syllabus: Organizational Design. Culture.. Strategic Role of HRM & Effective Management of

People. Ability Motivation & Opportunity. Job Analysis & Planning & Recruitment. Testing, Selection & Interview. Training & Development. Appraising & Managing Performance. Managing Careers & Fair Treatment. Establishing Strategic Pay Plans. Pay for Performance & Incentives. Benefits and Services. Labor Relations & Collective Bargaining. Employee Safety & Health. Linking to Organizational Outcomes. Human Resource Capital Management. Human Resource System for TQM.
Pre-requisite(s): -
Text Book(s):
1. Strategic Human Resource Management, Mike Millmore, Philip Lewis, Prentice Hall 2007
2. Human Resource Management, Gary Dessler, Prentice Hall, 10th edition, 2007
3. Human Resource Strategy, Dreher & Dougherty, Mc Graw Hill, 2001

ENIE600013
OPERATIONS RESEARCH (3 SKS)
Learning Objective(s): Course participants are able to use mathematical optimization model to solve engineering and management problems that could be converted to deterministic and stochastic quantitative model
Syllabus: Dynamic Programming. Markov Analysis. Decision Tree. Game Theory. Non-Linear Programming. Queuing theory. Optimization Simulation
Pre-requisite(s): Linear Programming
Text Book(s):
1. Hamdy A. Taha, Operations Research, 7th ed., Prentice-Hall, Inc. 2006
2. Hellier, Liebermen, Introduction to Operations Research, McGraw-Hill, 2005

ENIE600014
PLANT LAYOUT DESIGN (3 SKS)
Learning Objective(s): Course participants are able to design the layout of a plant based on constraint and optimum goals.
Syllabus: Design function, Design procedure, Process planning, Material flow planning, Analysis technique, Relationship planning between activities, Plant and production support services, Space calculations, Area allocation, Material handling equipment, Plant layout development, Plant location considerations.
Pre-requisite(s): -
Text Book(s):
1. Richard L. F., Facility Layout and Location, Prentice Hall, 1992
2. Plant Layout and Material Handling, John Wiley & Sons, 1977.
3. Meyers, E Fred,. Plant Layout and Material Handling 1st Edition. Prentice-Hall. 1993

ENIE600015
PRODUCT DESIGN + LAB (3 SKS)
Learning Objective(s): Course participants are able to create new product or service concept ideas according to structural market study based on marketing mix
Syllabus: Idea Generation, Description of Marketing Management, Global Marketing, Consumer Behavior, Marketing Mix, Marketing System, Selling Skill, Blue Ocean Strategy, Strategic Brand Management, Market Research, Consumer Needs Identification, Product Specification Determination, Concept Design, Concept Selection and Testing, Product Architecture, Design for Manufacturing, Design for Assembly, Prototyping, Project Presentation.
Prerequisite(s): Human Factors in Engineering and Design
Text books:
1. Karl. T. Ulrich & Steven D. Epingger. Product Design Development. 3rd Edition. Mc Graw-Hill. 2004
2. Dieter. “Design Engineering”, 3rd edition, Mc.Graw Hill 2000
3. James G. Bralla. Design For Excellence. McGrawHill - 1996
4. Milton D. Rosenav, Jr. et. al. The PDMA Handbook of New Product Development, John Willey & Sons. 1996
5. Hamid Noor & Russel Radford. Production & Operation Management. McGrawHill. 1995

ENIE600016
INDUSTRIAL FEASIBILITY ANALYSIS (3 SKS)
Learning Objective(s): Course participants know the aspects used to analyze industry feasibility and able to identify and analyze investment of facility feasibility
Syllabus: Project feasibility study, scope function, market and marketing aspects, engineering and technology aspects, operation management aspect, environment aspect, law aspect, economics aspect, financial aspect
Prerequisite(s): Cost Accounting, Engineering Economics
Text books:
1. Clifton, Fyffe, Project Feasibility Analysis, John Wiley, 1997
2. Siswanto Sutojo, Studi Kelayakan Proyek, PPM, 1995

ENIE600017
QUALITY SYSTEM (3 SKS)
Learning Objective(s): Course participants are able to design a quality improvement system that able to do assurance and improvement of continuous product and process quality based on the fact (number) using mathematical (statistical) method with world’s quality standard consideration
Syllabus: 3 quality basics: continuous improvement, customer focus and total participation, PDCA concept, 7 tools and 7 new tools, technique of process mapping, standard role, internal standard (SOP, WI, etc), and external standard (ISO,

JIS, etc), Lean Six Sigma
Prerequisite(s): Statistics and Probability
Text books:
1. The Six Sigma Way Team Fieldbook, Peter S Pande et.al. McGraw-Hill, New York, 2002
2. QC Problem Solving Approach: Solving Workplace Problems the Japanese Way, Katsuya Hosotani, 3A Corporation, Tokyo, 1982
3. The Quality Toolbox Taguen Nancy R., ASQ Quality Press. Milwaukee. Wisconsin. 2005

ENIE600018
SYSTEM MODELLING + LAB (3 SKS)
Learning Objective(s): Course participants are able to design a computerized model based on discrete-event modeling from micro industrial system, simulating that model to do feasibility analysis and generating recommendation from the model (becoming discrete-event model)
Syllabus: Modeling concept, general method of system modeling: conceptualization, development, simulation and analysis, modeling case study, validation and verification of discrete model, user requirement method, technique of report design, and presentation of modeling result
Prerequisite(s): Statistics and Probability
Text books:
1. Mastering the Requirement Process, Suzanne Robertson & James Robertson, 2nd Edition, Addison Wesley Professional, 2006
2. Scenarios, Stories and Use Cases: Through the Systems Development Life-Cycle, Ian Alexander and Neil Maiden, John Wiley & Sons. 2004
3. Excel® Dashboards & Reports, Michael Alexander and John Walkenbach, Wiley Publishing, Inc. 2010
4. Information Dashboard Design, Stephen Few, O'Reilly, 2006.

ENIE600019
PRODUCTION SYSTEM + LAB (3 SKS)
Learning Objective(s): Course participants are able to analyze, design, implement and improve the performance of an operation system, especially with significant impact to the long term strategic goals of the organization to produce the right product for the customer.
Syllabus: Production Strategy. Product and Process Development. Location Analysis. Product and Process Layout Analysis. Capacity Analysis. Process Design, Analysis and Performance. Distribution Planning. JIT/Lean Production System. Resource planning, scheduling and allocation Kanban production system (kanban game).
Pre-requisite(s): Production planning and inventory control
Text Book(s):
1. Chase and Aquilano; Operations Management; Pearson-Prentice Hall; 11th , Edition, 2006
2. Heizer, Jay and Render, Barry; Operations Management; Pearson-Prentice Hall; 2006
3. Kanban for The Shopfloor, The Productivity Press; 2002

ENIE600020
INDUSTRIAL PROJECT MANAGEMENT (2 SKS)
Learning Objective(s): Course participants are able to plan, conduct, and control projects in industry
Syllabus: Project management description, system theory, project of PMDA organization, project of human resource, staff organization and project team, time management, special topic of PERT, project graph, cost control
Prerequisite(s): Operational Research
Text books:
1. Kerzner, Harold T., Project Management : A System Approach to Project Planning, scheduling, and Controlling, John Wiley & Sons, 10th edition, 2009

ENGE600008
OCCUPATIONAL HEALTH, SAFETY, AND ENVIRONMENT PROTECTION (2 SKS)
Learning Objective(s): Course participants are able to identify various hazard, characterization, propose suitable method for minimizing and mitigating risks, and also designing management system of safety work. Students is also expected to increase their awareness about health and safety in industry, and understand about framework and safety standard regulation and also environment program.
Syllabus: Introduction to Regulation and Standards; Risk Perception, Assessment and Management; Machinery Hazards; Noise Hazards; Process Safety Hazard; Fire and Explosion Hazard; Electrical Hazard; Toxicology in The Workplace; Environmental Protection; Environmental Protection Control Processes; Hazard Communication to Employees; Personal Protective Equipment (PPE): Types of PPE and Selection of PPE; Safety Audits, Incident and Emergency Planning.
Pre-requisite(s): -
Text Book(s):
1. Charles A. Wentz, Safety, Health and Environmental Protection, MGH, 1998.
2. Asfahl, C.R., Rieske, D.W., Industrial Safety and Health Management, 6th Ed., Pearson Education, Inc. 2010.
3. National Regulations on Safety and Health Management

ENIE600021
SUPPLY CHAIN MANAGEMENT (3 SKS)
Learning Objective(s): Course participants are able to understand about concept and application of SCM to analyze and evaluate the role of operators in a whole supply chain

Syllabus: Introduction to SCM, Strategy and Planning, Enterprise Resource Planning, Purchasing, Transportation Method, Shortest Path, Traveling Salesman Problem, Vehicle Routing Problem, warehousing management, reverse logistics, location theory, network planning process, SCM development
Prerequisite: Quality System
Text books:
1. Novack, R.A., Supply Chain Management: A Logistics Perspectives, 2008.

ENIE600022
INDUSTRIAL SIMULATION + LAB (3 SKS)
Learning objective(s): Course participants are able to design a complex computerized model from industrial systems and simulate and conduct a simple feasibility study and design a recommendation from model simulation result (becoming a continuous system modeler)
Syllabus: Concept of continuous modeling, method of continuous modeling, causal loop diagram, stock and flow diagram, comprehending of behavior overtime, model development based on real case study, technique of scenario development, validation and verification of continuous model, introduction of study concept based on simulation game
Prerequisite: System Modeling
1. **Text books:** Information Dashboard Design, Stephen Few, O'Reilly, 2006.
2. Charles Harrell, Biman K. Ghosh, and Royce O. Bowden, Jr., Simulation Using Promodel, McGraw-Hill Higher Education, New York. 2003
3. SEMS Courses Module, 2011

ENIE600023
INDUSTRIAL ENGINEERING DESIGN + LAB (3 SKS)
Learning objective(s): Course participants are able to conduct product development process by considering the interaction between material, human resources and production process and able to analyze technical and financial aspects of the NPD project for commercialization.
Syllabus: Introduction to NPD Process, Overview of Stage-Gate Model and Concurrent Engineering, Analysis of Material and Technology Utilization, Design Considerations, Financial Analysis of Project, Market and Functionality Testing, Production Capacity Planning, Commercialization, Implementation of NPD Process, Presentation of NPD Project.
Prerequisites: Perancangan Produk, Analisa Kelayakan Industri
1. **Text books:** George, E.D., Engineering Design : *A Material and Processing Approach*, McGraw-Hill, New York, 2000.
2. Trott, P. (2008). *Innovation Management and New Product Development*, 4th Edition.
3. Cooper, R.G. (2007), *Winning at New Products*, 3rd Edition.

ENIE600024
INFORMATION SYSTEM (3 SKS)
Learning Objective(s): Course participants understand the role of information system management and technology in the industry to face the globalization era.
Syllabus: Introduction to information system. Information system as a competitive advantage. IT and Electronic Commerce, Enterprise Information System (ERP), Electronic Commerce. Database dan Relational Database Management System. System Analysis and Design. Business Process, MIS and ist relation with RQM dan QS. CBIS. Accounting Information System. Decision Support System. Executive Information System. Marketing, Manufacturing Information System. Financial, Human Resource Information System.
Pre-requisite(s): Organization and Industrial Psychology
Text Book(s):
1. McLeod, Management Information System, 10th edition, Prentice Hall, 2006
2. Kenneth C. Laudon, Management Information Systems , Prentice Hall, 2011

ENIE600025
SPECIAL TOPICS IN INDUSTRIAL ENGINEERING (2 SKS)
Learning Objective(s): Course participants will have a broad description about the current progress in the service and manufacturing industry, and how industrial engineering could contribute to the enhancement of efficiency and effectiveness.
Syllabus: Inviting guest lecturers from various field of expertise
Pre-requisite(s): 7th semester or above students
Text Book(s): -

ENIE600026
INTERNSHIP (2 SKS)
Learning Objective(s): Course participants are able to understand about industrial engineering implementation in industry and implement all the subjects that have been studied in real world
Syllabus:
Prerequisite(s): Notice the SOP of internship
Text books: -

ENIE600027
TECHNOLOGY MANAGEMENT (2 SKS)
Learning objective(s): Course participants are able to identify technology development that have an impact to industry, identify that technology, and translate into technology plan for improving organization competitiveness
Syllabus: Introduction to technology manage-

ment, business model concept, innovation and technology, chasm and tornado, competence, introduction to change management, introduction to risk management, patents in Indonesia, sustainability issue in technology, outsourcing, ERP trend
Prerequisite(s): Introduction to Industrial Engineering
Text books: Burgelman, Maidique and Wheelwright, Strategic Management of Technology and Innovation, 5th Edition, 2009Tarek Khalil, Management of Technology: The Key to Competitiveness and Wealth Creation, McGraw-Hill, 2000

ENIE600028
UNDERGRADUATE THESIS (5 SKS)
Learning objective(s): Course participants are able to identify problems and opinion in scientific discussion systematically, clearly, and accurately. Capable of sorting ideas/solutions/opinions in a scientific writing based on scientific writing guideline that integrates a whole knowledge.
Syllabus: Industrial Engineering to solve a case in real world
Prerequisite(s): Notice SOP of final project
Text books: Guideline of Undergraduate Thesis in University of Indonesia

ENIE810001
MULTIVARIATE ANALYSIS (3 SKS)
Refer to Page 487

ENIE810002
INTERPERSONAL SKILLS(3 SKS)
Refer to Page 487

ENIE810003
PRODUCT LIFECYCLE MANAGEMENT (3 SKS)
Refer to Page 487

ENIE810004
MACRO ERGONOMICS (3 SKS)
Refer to Page 487

ENIE810005
FINANCE AND INVESTMENTS (3 SKS)
Refer to Page 488

ENIE810006
INNOVATION MANAGEMENT (3 SKS)
Refer to Page 488

ENIE810007
CUSTOMER RELATIONSHIP MANAGEMENT (3 SKS)
Refer to Page 488

ENIE810008
LEAN OPERATIONS (3 SKS)
Refer to Page 488

ENIE810009
MANUFACTURING FACILITIES PLANNING AND ANALYSIS (3 SKS)
Refer to Page 488

ENIE810010
DATA MINING (3 SKS)
Refer to Page 488

ENIE810011
SYSTEM ENGINEERING (3 SKS)
Refer to Page 489

ENIE810012
ENTERPRISE COMPETITIVENESS ANALYSIS (3 SKS)
Refer to Page 489

ENIE810013
ADVANCED OPTIMIZATION (3 SKS)
Refer to Page 489

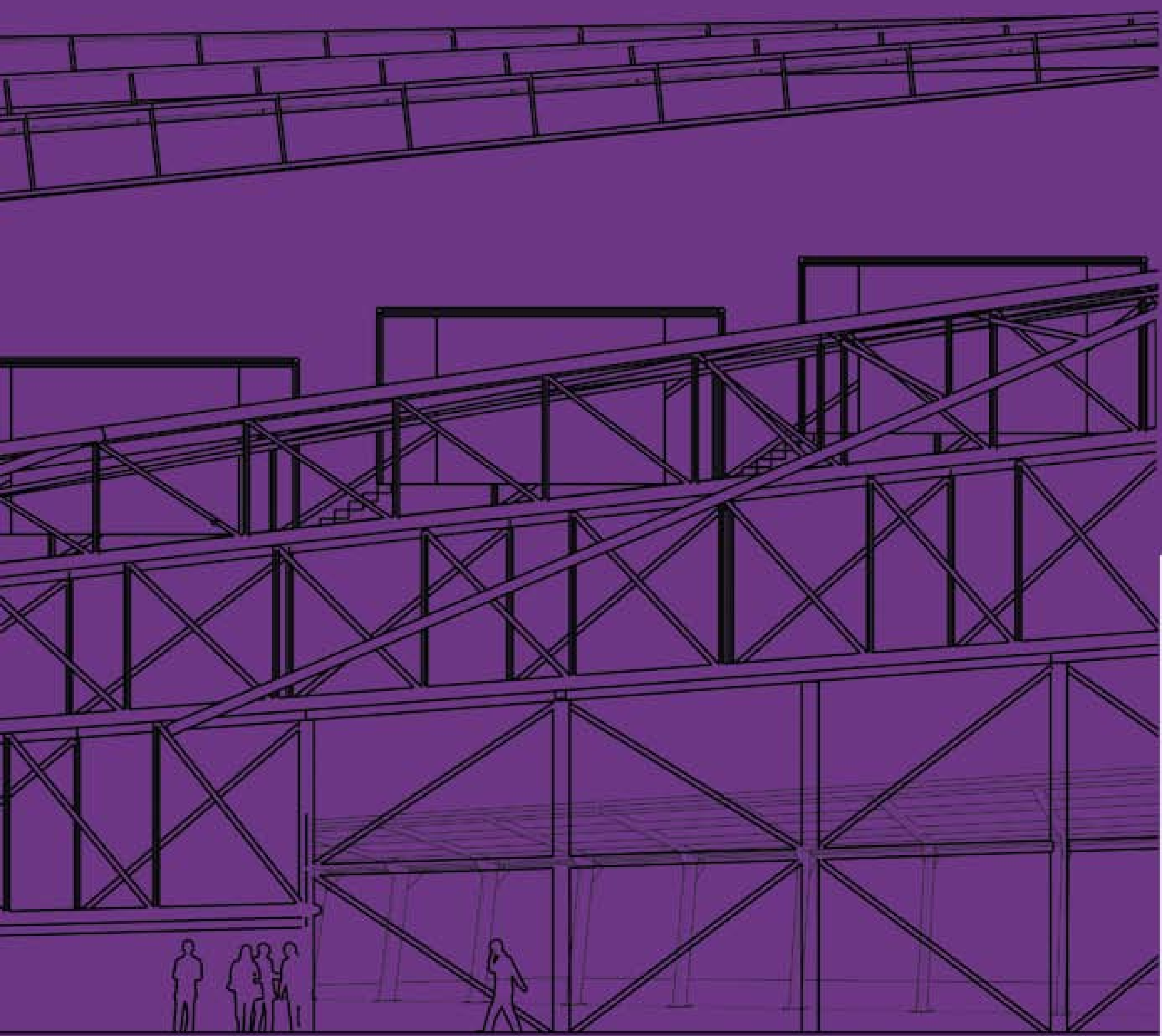
ENIE810014
SUSTAINABLE MANUFACTURING AND INNOVATION (3SKS)
Refer to Page 489

ENIE810015
HUMAN DIGITAL MODELLING AND SIMULATION (3 SKS)
Refer to Page 489

ENIE810016
DECISION, UNCERTAINTIES AND RISKS (3 SKS)
Refer to Page 489

CHAPTER 5

PROFESSIONAL PROGRAM FOR ARCHITECT



5. PROFESSIONAL PROGRAM FOR ARCHITECT

Program Specification

1	**Awarding Institution**	Universitas Indonesia	
2	**Teaching Institution**	Universitas Indonesia	
3	**Program**	Architects Professional Program	
4	**Class**	Regular	
5	**Degree Offered**	Arsitek (Ar.)	
6	**Accreditation / Recognition**	-	
7	**Language of Instruction**	Bahasa Indonesia and English	
8	**Study Scheme (Full Time / Part Time)**	Full Time	
9	**Entry Requirement**	S1 Graduate from Architecture / equivalent	
10	**Duration of Study**	1 year-Program	
	Semester	Total Semester	Weeks/semester
	Regular	2	16-17
	Short (optional)	-	-
11.	**Graduates profile:** Architect is graduate who has the ability to design in a professional manner based on policies / code compliance to fulfill the needs of competence as the architect. Graduate of this program may work in various fields in the architectural design, building and construction industry, as executive architects or construction supervisor. Graduates may also work as are researcher or lecturer at educational institutions associated with the architecture. Other fields of work are in the urban design, real estate, building management, project feasibility studies, housing and settlement, environment and government sector in matters of urban design, building and development.		

13	**Course Composition**		
No	**Type of Courses**	**Credits**	**Percentage**
i	**Compulsory Subjects**	**18**	**75 %**
ii	**Electives**	**6**	**25 %**
	Total	**24**	**100 %**
14.	**Total Credit Hours to Graduate**		**24 Credit Semester Unit**

Curriculum structure of Architects Professional Program

KODE	MATA AJARAN	SUBJECT	SKS
	Semester 1	**1st Semester**	
ENAR700001 ENAR700004	Proyek Perancangan I* Teori Arsitektur Lanjut Pilihan**	Design Project I* Advanced Architectural Theories Elective**	6 3 3
		Sub Total	**12**
	Semester 2	**2nd Semester**	
ENAR700002 ENAR700003	Proyek Perancangan II Teknologi dan Lingkungan Berkelanjutan Pilihan**	Design Project II Technology and Sustainable Environment Elective**	6 3 3
		Sub Total	**12**
		Total	**24**

*) held together with ENAR800002

**) In addition to taking courses Elective Subjects Professions, the student can also take Compulsory Subjects and Elective Subjects available in Master of Architecture Program and other Department.

ELECTIVE COURSES

KODE	MATA AJAR	SUBJECT	SKS
ENAR700005	Etika Keprofesian	Professional Ethics	3
ENAR700006	Kapita Selekta	Capita Selecta	3

Course Description

ENAR700001
DESIGN PROJECT I
(6 CREDIT HOURS)

Learning objectives : Students are able to apply knowledge of design presentation techniques, ethics, code of compliances and administration of projects relating to the pre-design through design development for the purposes of licensing.

Syllabus : Professional ethics; relationship of architect and the reviewer is focused on understanding, expression/presentation of ideas and service to clients as outlined in the pre-draft products; understanding of local building codes; product design development; administrative agencies including the preparation of contracts and payment for services

Prerequisites:

References:

ENAR700004
ADVANCED ARCHITECTURAL THEORIES
3 CREDIT HOURS

Learning objectives:

Students are introduced by advanced architectural theory in general that provides the basic of research of each majority, which are, advanced architectural design (creative process); architecture and the humanities, and architecture and technology (especially sustainability).

The focus remains on the architectural phenomenon - aspects of space, place and form / shape; in a scale from private spaces to urban areas.

Syllabus:

Divided into learning modules for each majority:

1. Architecture as a Discipline: *Space, Place/Non-place* (topia, utopia, heterotopia, dystopia), Architectural Form, Design Thinking and Process (positivism, rationalism, tame/wicked problem, IBIS, pattern language, diagram)
2. Architecture and Property Development
3. *Socio-Cultural aspects in architecture*: historiography, evolution/ history of human settlement (human life-cycle space, culture and the politics of space)
4. Architecture and Sustainability: Building physics, Construction and Technology

Prerequisites: N/A

Assessment:

Group readings and presentation; individual essays; term paper

References:

1. Christopher Alexander, Christopher, Notes on the Synthesis of Form (Harvard: Harvard University Press Publication, 1964).
2. Andrew Balallantyne (ed.), *Architecture Theory, A Reader in Philosophy and Culture* (London, New York: Continuum, 2005).
3. Bernd Evers; ChrisnofThoenes, Christof (eds). *Architectural Theory from the Renaissance to the Present.*Koln: Taschen, 2003.
4. Adrian Forty, *Words and Buildings, A Vocabulary of Modern Architecture*. London: Thames and Hudson, 2000.
5. Michael K Hays, *Architecture Theory since 1968,*Cambridge: MIT Press, 1998.
6. Triatno Y. Hardjoko, *Urban Kampung. Its Genesis and Transformation into Metropolis, with Particular Reference to Penggilingan in Jakarta,* VDM, 2009.
7. Charles Jencks (eds.) *Theories and Manifestoes.*Chicester: Academy Editions, 1997.
8. Paul Alan Johnson. *The Theory of Architecture: Concepts, Themes & Practices.*New York: Van Nostrand Reinhold, 1994.
9. Hanno-WalterKruft, *A History of Architectural Theory from Vitruvius to The Present.*New York: Princeton Architectural Press, 1994.
10. Lefebvre, Henri, translated by Donald Nicholson-Smith, *The Production of Space.* Oxford UK & Cambridge USA: Blackwell, 1991.
11. Miles, Miko E; Berens, Gayle; Weiss, Marc A. *Real Estate Development, Urban Land Institute*, edisiterakhir.
12. Kate Nesbitt (Ed). *Theorizing, A New Agenda for Architecture, An Anthology of Architectural Theory.* 1996.
13. Jean-PierreProtzen and Harris, David J. *The Universe of Design: Horst Rittel's Theories of Design and Planning.* London: Routledge, 2010.
14. Shilling, James D, REAL ESTATE, South Western Thomson Learning, edisiterakhir.
15. D'Arcy Thompson, *On Growth and Form*. Cambridge: Cambridge University Press, 1987.
16. Stephen Cairns, Greig C Crysler, Hilde Heynen. *The SAGE Handbook of Architectural Theory.* SAGE Publications, 2012.

ENAR700002
DESIGN PROJECT II
(6 CREDIT HOURS)
Learning objectives : Students are able to apply knowledge of design presentation techniques, ethics, code of compliances related to the manufacture of completetender documents and project supervision.
Syllabus : Professional ethics; relationships relevant architects and engineers who are focused on collaborative work, the application of engineering standards set to the tender document complete product (drawings, technical specifications and implementation, Budget Planning) project supervision.
Prerequisites:
References:

ENAR700003
TECHNOLOGY AND SUSTAINABLE ENVIRONMENT
(3 CREDIT HOURS)
Learning objectives: Students are able to apply various approaches and strategies in building technology and design-build environment towards a sustainable environment.
Syllabus: Principles of environmentally sustainable building technology, engineering and construction processandbuildingservices and their impact on environmental sustainability;relation between climate, environment, construction, energy consumption and human well-being; application of the technology strategy of building in project design in the context of standards/regulations building and environment related.
Prerequisites: -
References:

1. Y. B. Mangunwijaya, *Teknologi dan Dampak Kebudayaannya*, Jakarta: Yayasan Obor Indonesia. 1993
2. T. Jacob, *Menuju Teknologi Berperikemanusiaan: Pikiran-Pikiran Tentang Indonesia*, Jakrta: Yayasan Obor Indonesia. 1996
3. Max Hueber Verlog Munchen, *Man and Technology*, Gesamthersellung: Verlagsanstalt Man Dillingen/Donau. 1963
4. Charles Susskind, *Understanding Technology*, The Hopkins University Press. 1973
5. Drs. A. Charis Zubair, *Etika Rekayasa Menurut Konsep Islam*, Yogyakarta: Pustaka Pelajar Offset. 1997
6. Peter Graham, *Building Ecology: First Principles For A Sustainable Built Environment*, Blackwell Publishing. 2003
7. *Architecture For A Sustainable Future*, Institute For Building Environmet and Energy Conservation (IBEC). 2005
8. Edward Burtynsky, *Manufactured Landscapes*, Zeitgeist Video. 2007
9. Discovery Channel, *Extreme Engineering: Turning Torso*, Discovery Communication. 2010
10. Discovery Channel, *Next World: Future Megatropolis*, Discovery Communication. 2010

ENAR700005
PROFESSIONAL ETHICS
(3 CREDIT HOURS)
Learning objectives: students understand the code of conduct professional architects in professional practice
Syllabus:

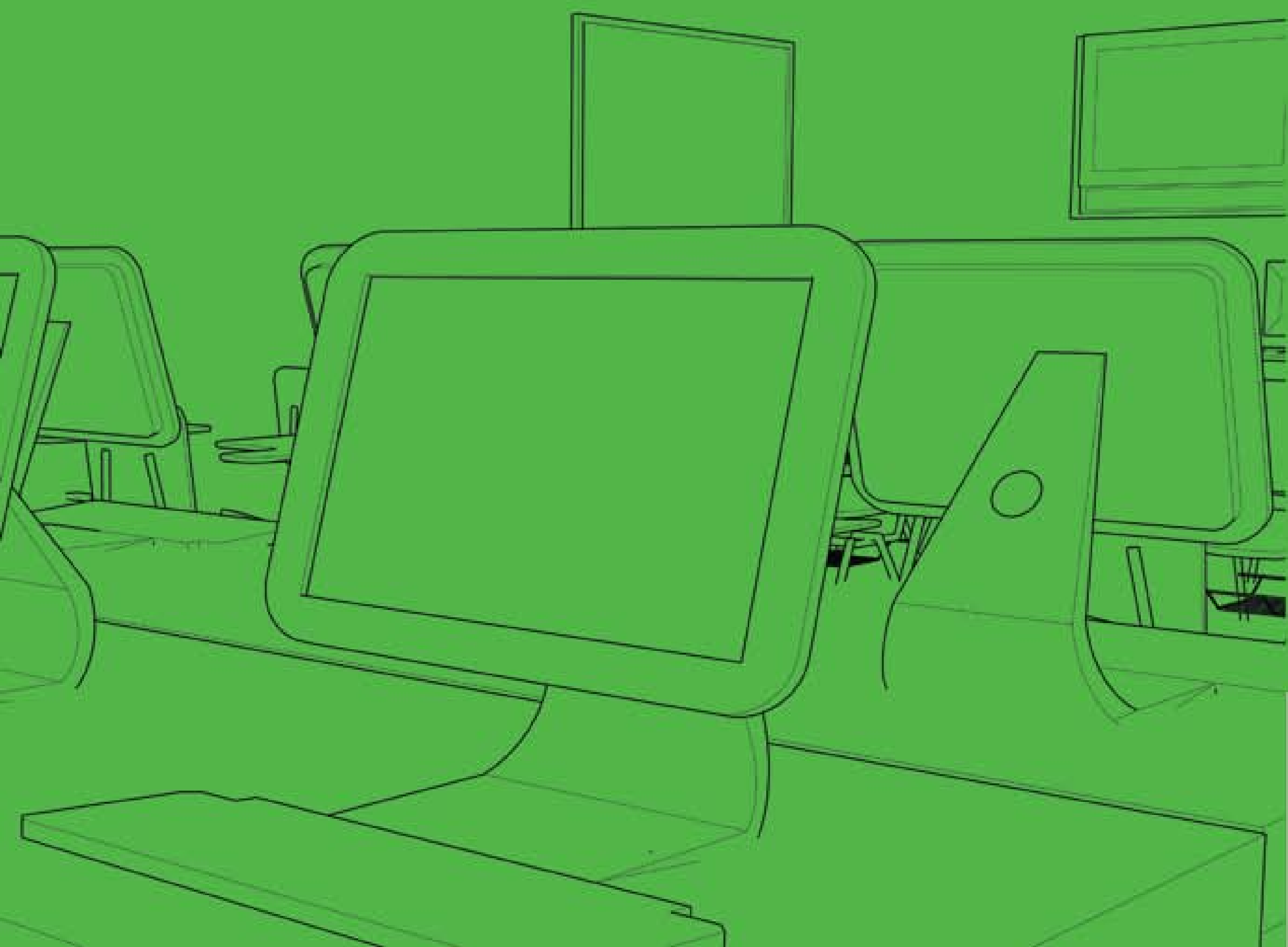
1. Responsibility for the quality of design
2. Responsibility for professional services
3. The relationship between the architect and the employer
4. The relationship between architects to actors other building consultancy services
5. Architects responsibility to the community
6. Architects responsibility to society and the environment

Prerequisites:
References:

1. Kode etik Ikatan Arsitek Indonesia (IAI)
2. Dokumen *Union Internationale des Architectes (UIA)*
3. Landasan etika profesi

ENAR700006
CAPITA SELECTA
(3 CREDIT HOURS)
Learning objectives: this course introduces various aspects of design and management that learned and applied directly in real products
Syllabus: architecturally related design graphics, product; appropriate technology; business proposals. Syllabus is made as required.
Prerequisites:
References:

CHAPTER 6
MASTER PROGRAM



6. MASTER PROGRAM

6.1. MASTER IN CIVIL ENGINEERING

Program Specification

1.	**Awarding Institution**	Universitas Indonesia	
2.	**Teaching Institution**	Universitas Indonesia	
3.	**Programme Title**	Master Program in Civil Engineering	
4.	**Class**	Regular	
5.	**Final Award**	Master Teknik (M.T)	
6.	**Accreditation / Recognition**	BAN-PT: A - accredited	
7.	**Language(s) of Instruction**	Bahasa Indonesia and English	
8.	**Study Scheme (Full Time / Part Time)**	Full Time	
9.	**Entry Requirements**	Bachelor Degree (S1)	
10.	**Study Duration**	Designed for 2 years	
	Type of Semester	Number of Semester	Number of weeks / semester
	Regular	4	17
	Short (optional)	3	8
11.	**Graduate Profiles:** Magister of Engineering who is able to conduct research and solve problems in Civil Engineering specialization with professional ethics.		
12.	Expected Learning Outcomes: 1. Specify an experiment to meet a need and conduct the experiment, analyze and explain the resulting data (C5) 2. Formulate and solve engineering problems appropriate to civil engineering by selecting and apply appropriate techniques and tools (C4) 3. Evaluate a design of a complex design or process, or evaluate a validity of newly created knowledge or technologies in a traditional or emerging advanced specialized technical area appropriate to civil engineering (C6) 4. Apply the principles of sustainability to the design of traditional and emergent engineering systems. (C3) 5. Apply the rules of grammar and composition in verbal and written communications, properly cite sources (C3) 6. Organize, formulate, and solve engineering problems within a global context (C3) 7. Apply leadership principles to direct the efforts of a small, homogenous group (C3) 8. Function effectively as a member of an intradisciplinary team (C3) 9. Demonstrate the ability for self-directed learning (C3) 10. Analyze a situation involving multiple conflicting professional and ethical interests to determine an appropriate course of action (C4)		
13	**Classification of Subjects**		
No.	**Classification**	**Credit Hours (SKS)**	**Percentage**
i	**Total Compulsory Credits**	**30**	**75%**
ii	**Total Elective Credits**	**3**	**8%**
iii	**Seminar & Thesis**	**7**	**17%**
	Total	**40**	**100 %**
14.	**Total Credit Hours to Graduate**		**40 SKS**

	Outcomes number and title	Level of Achievement					
		1	2	3	4	5	6
		Knowledge	Comprehensi	Application	Analysis	Synthesis	Evaluation
	Foundational						
1	Mathematics	B	B	B			
2	Natural Science	B	B	B			
3	Humanities	B	B	B			
4	Social Science	B	B	B			
	Technical						
5	Material Science	B	B	B			
6	Mechanics	B	B	B	B		
7	Experiments	B	B	B	B	M/30	
8	Problem recognition and solving	B	B	B	M/30		
9	Design	B	B	B	B	B	E
10	Sustainability	B	B	B	E		
11	Contemp. issues & hist. perspectives	B	B	B	E		
12	Risk and uncertainty	B	B	B	E		
13	Project Management	B	B	B	E		
14	Breadth in CE ares	B	B	B	B		
15	Technical Specialization	B	M/30	M/30	M/30	M/30	E
	Professional						
16	Communication	B	B	B	E	E	
17	Public policy	B	B	E			
18	Business and public administration	B	B	E			
19	Globalization	B	B	B	E		
20	Leadership	B	B	B	E		
21	Teamwork	B	B	B	E		
22	Attitudes	B	B	E			
23	Lifelong learning	B	B	B	E	E	
24	Profesional and ethical responsibility	B	B	B	B	E	E

B — Portion of the BOK fulfilled through the bachelor's degree

M/30 — Portion of the BOK fulfilled through the master's degree or equivalent

E — Portion of the BOK fulfilled through the prelicensure experience

Figure 1. 2008 ASCE-BOK Competency Areas for Civil Engineering

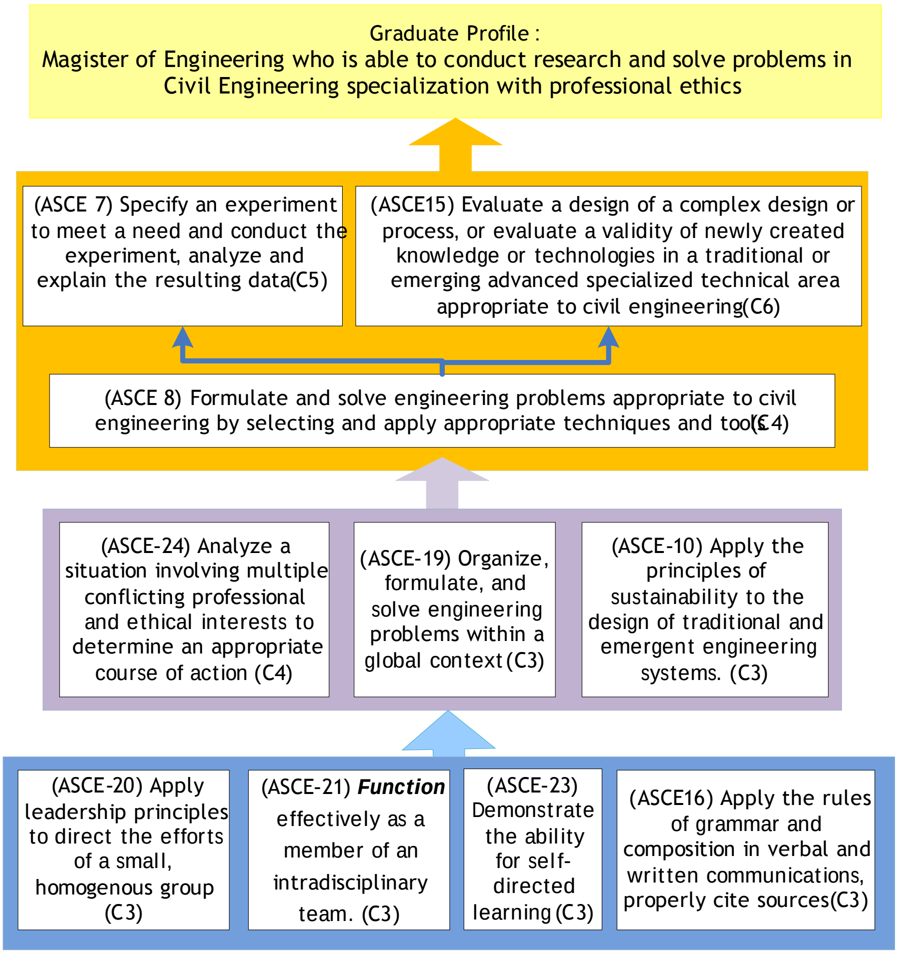
Tabel 1. 2008 ASCE-BOK Competency Areas for Master Level Education

No.	Competency Area	Level of Achievement	
		Undergraduate Level	Master Level
1.	*Experiment (EXP)*	***Analyze*** the results of experiments and evaluate the accuracy of the results within the known boundaries of the tests and materials in or across more than one of the technical areas of civil engineering. (L4)	***Specify*** *an experiment to meet a need and conduct the experiment, analyze and* ***explain*** *the resulting data (L5)*
2.	*Problem Recognition & Solving (PRS)*	***Develop*** problem statements and ***solve*** well-defined fundamental civil engineering problems by ***applying*** appropriate techniques and tools. (L3)	***Formulate*** *and* ***solve*** *engineering problems appropriate to civil engineering by selecting and apply appropriate techniques and tools (L4)*
3.	*Technical Specialization (TS)*	***Define*** *key aspects of advanced technical specialization appropriate to civil engineering. (L1)*	***Evaluate*** *a design of a complex design or process, or evaluate a validity of newly created knowledge or technologies in a traditional or emerging advanced specialized technical area appropriate to civil engineering (L6)*
4.	*Sustainability*	***Apply*** the principles of sustainability to the design of traditional and emergent engineering systems. (L3)	
5	*Communication*	***Apply*** the rules of grammar and composition in verbal and written communications, properly cite sources (L3)	
6	*Globalization*	***Organize, formulate,*** and ***solve*** engineering problems within a global context. (L3)	
7	*Leadership*	***Apply*** leadership principles to direct the efforts of a small, homogenous group. (L3)	
8	*Teamwork*	***Function*** effectively as a member of an intradisciplinary team.(L3)	
9	*Lifelong Learning*	***Demonstrate*** the ability for self-directed learning. (L3)	
10	*Professional & Ethical Responsibility*	***Analyze*** a situation involving multiple conflicting professional and ethical interests to determine an appropriate course of action. (L4)	

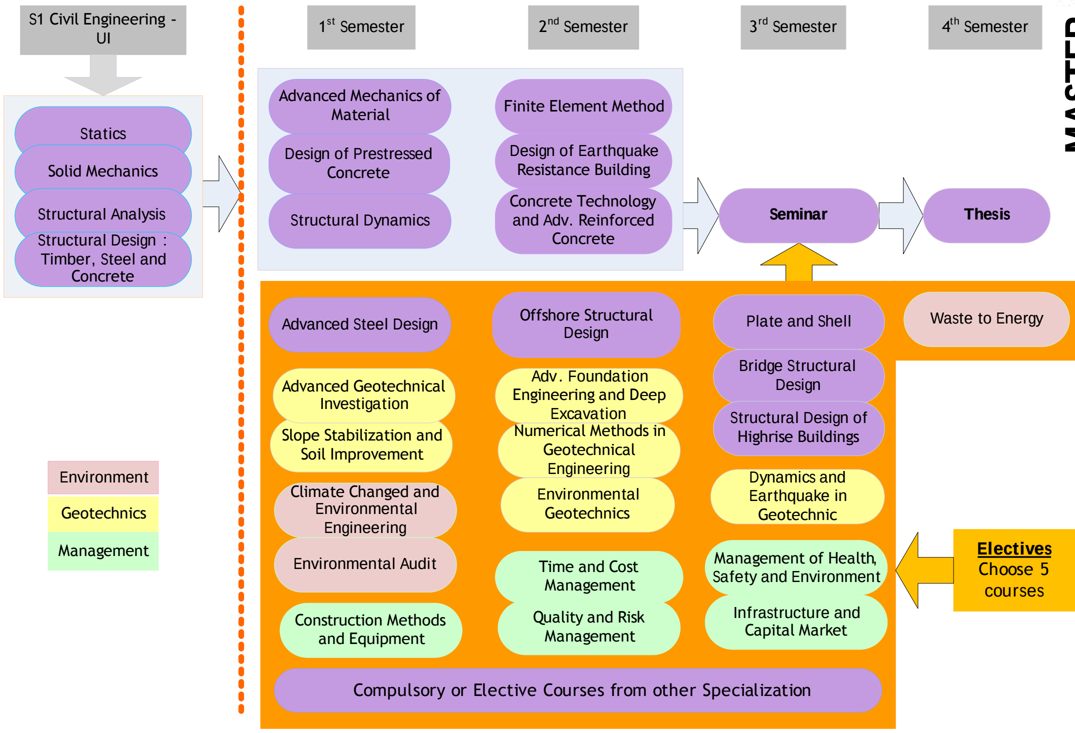
Career Prospects

- Builder
- Innovator
- Communicator
- Leader
- Environmental Stewards

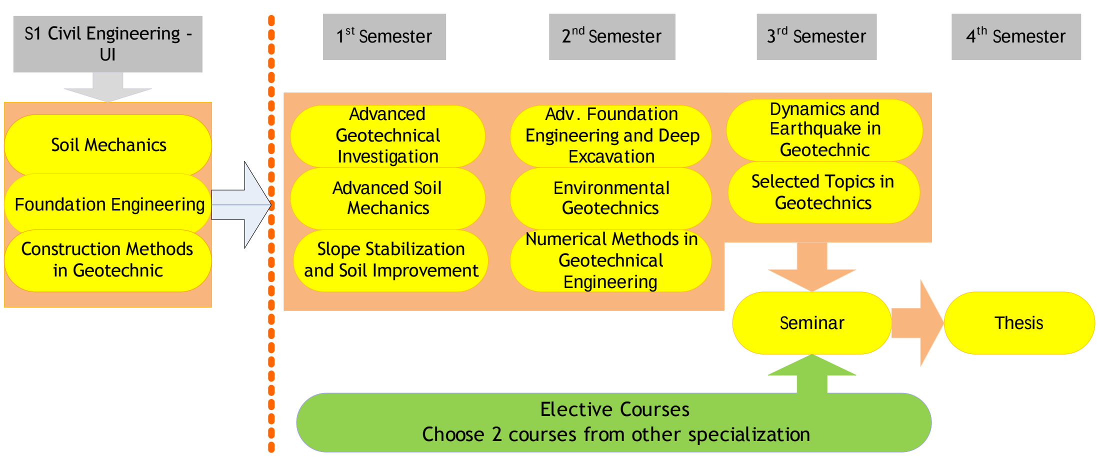
Learning Outcomes Flow Diagram



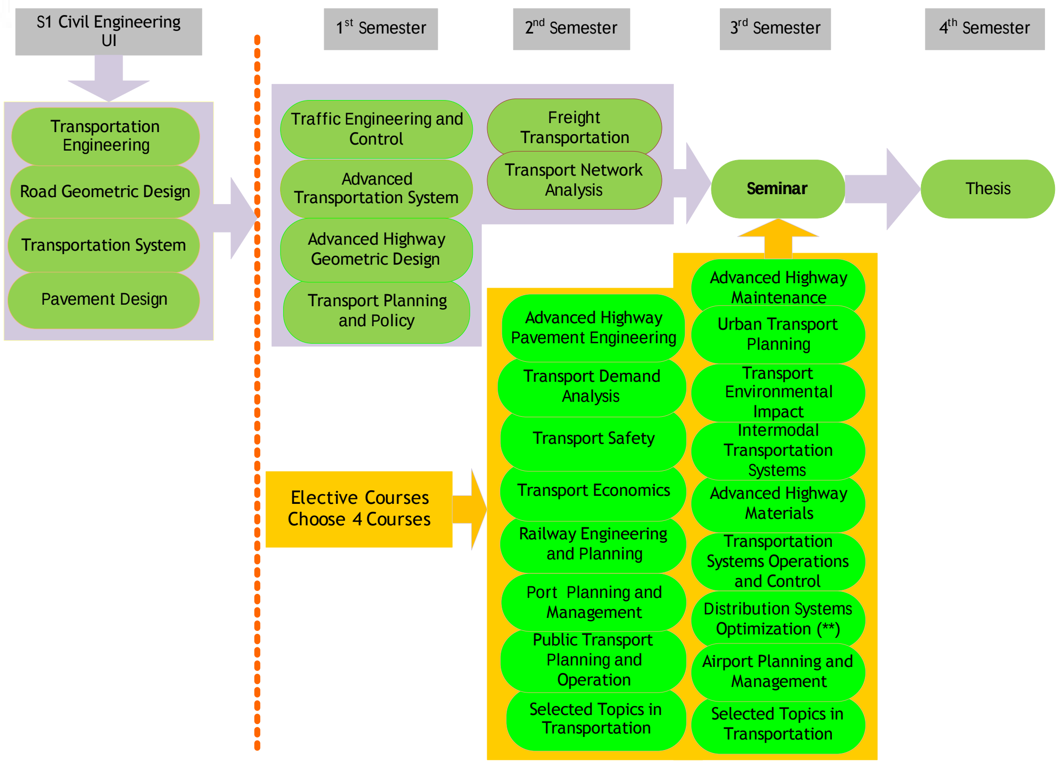
Flow Diagram of Subjects at Master Program, Major in : STRUCTURE



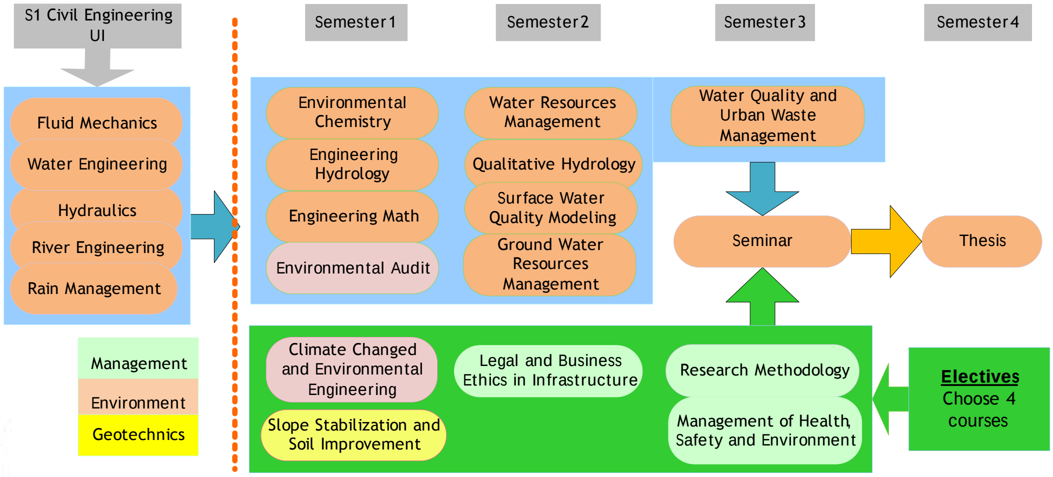
Flow Diagram of Subjects at Master Program, Major in : GEOTECHNICS



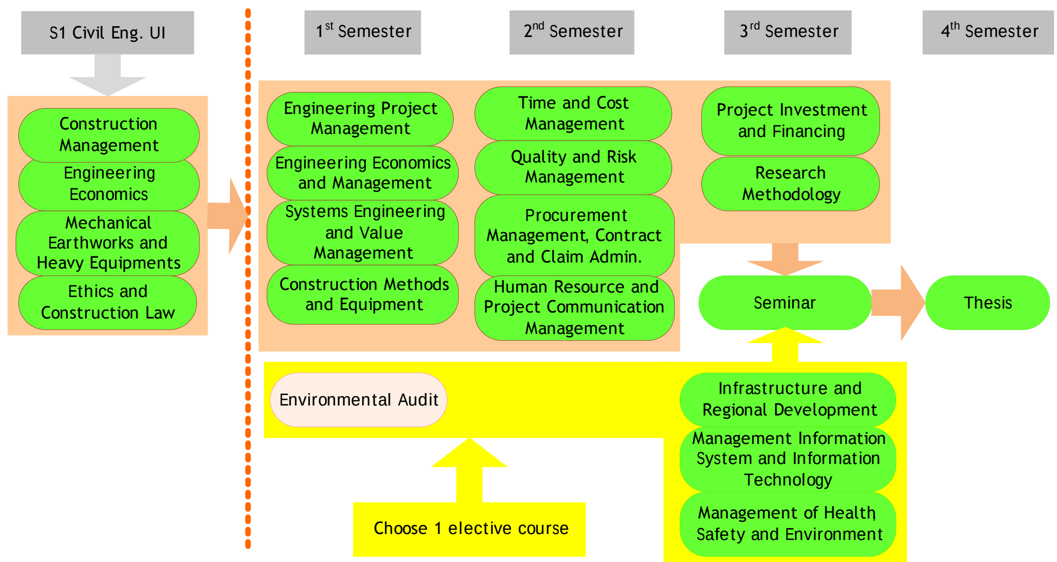
Flow Diagram of Subjects at Master Program, Major in : TRANSPORTATION



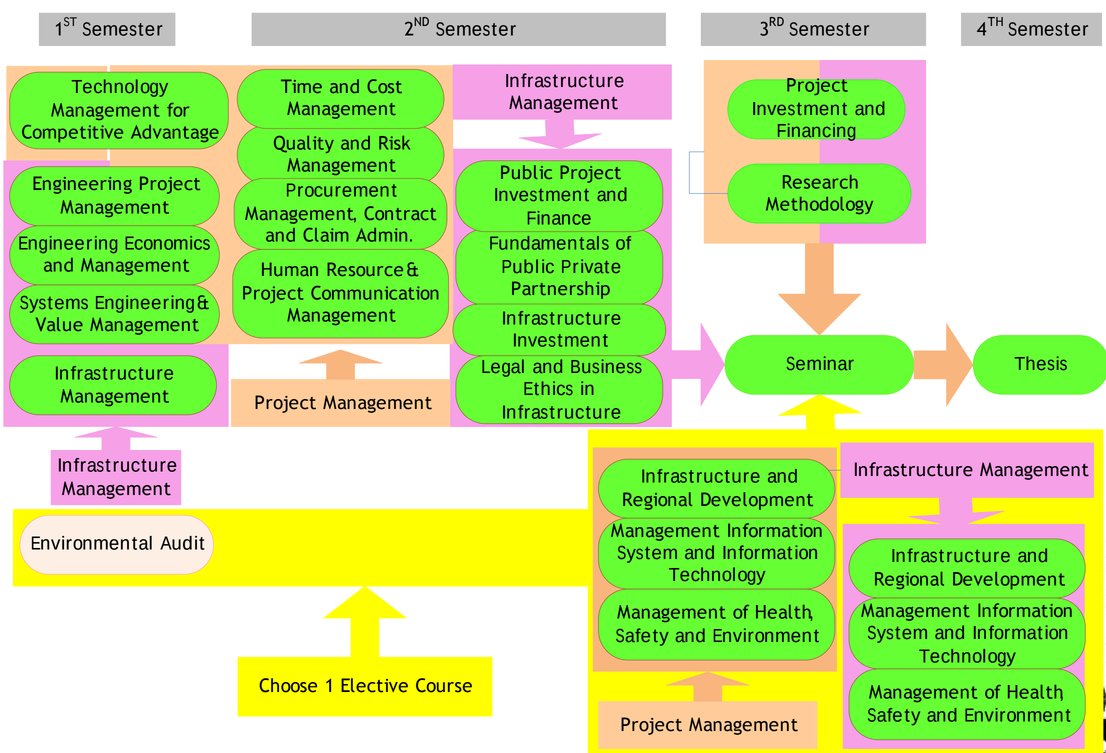
Flow Diagram of Subjects at Master Program, Major in : WATER RESOURCES MANAGEMENT



Flow Diagram of Subjects at Master Program, Major in : CONSTRUCTION MANAGEMENT



Flow Diagram of Subjects at Master Program, Major in : INFRASTRUCTURE AND PROJECT MANAGEMENT



Course Structure of Master Program in Civil Engineering

KODE	MATA AJARAN	SUBJECT	SKS	Major							
				STR	GT	TR	SDA	TL	MK**	MP**	MI
	Semester 1	**1st Semester**									
ENCV 8 0 0101	Mekanika Material Lanjut	Advanced Mechanics of Material	3	3							
ENCV 8 0 0102	Perancangan Struktur Beton Pratekan	Design of Prestressed Concrete	3	3							
ENCV 8 0 0103	Dinamika Struktur	Dynamics of Structure	3	3							
ENCV 8 0 0104	Struktur Baja Lanjut	Advanced Steel Design	3	P							
ENCV 8 0 0201	Mekanika Tanah Lanjut	Advanced Soil Mechanics	3		3						
ENCV 8 0 0202	Investigasi Geoteknik Lanjut	Advanced Geotechnical Investigation	3	P	3	P					
ENCV 8 0 0203	Stabilitas Lereng dan Perbaikan Tanah	Slope Stabilization and Soil Improvement	3	P	3		P				
ENCV 8 0 0301	Perancangan Geometrik Jalan Lanjut	Advanced Highway Geometric Design	3			3					
ENCV 8 0 0302	Sistem Transportasi Lanjut	Advanced Transportation System	3			3					
ENCV 8 0 0303	Rekayasa dan Kendali Lalu Lintas	Traffic Engineering and Control	3			3					
ENCV 8 0 0304	Perencanaan dan Kebijakan Transportasi	Transport Planning and Policy	3			3					
ENCV 8 0 0401	Kimia Lingkungan	Environmental Chemistry	3				3				
ENCV 8 0 0402	Hidrologi Lanjut	Engineering Hydrology	3				3				
ENCV 8 0 0001	Matematika Teknik	Engineering Mathematics	3				3	3			
ENCV 8 0 0801	Pengolahan Fisik, Biologis dan Kimiawi dalam Teknik Lingkungan	Physical, Biological and Chemical Treatment in Enviromental Engineering	3					3			
ENCV 8 0 0802	Perubahan Iklim dan Rekayasa Lingkungan	Climate Changed and Environmental Engineering	3	P			P	3			
ENCV 8 0 0803	Audit Lingkungan	Environmental Audit	3	P			3	3	P	P	P
ENCV 8 0 0501	Manajemen Proyek Teknik	Engineering Project Management	3						3	3	3
ENCV 8 0 0502	Manajerial Ekonomi Teknik	Engineering Economics and Management	3						3	3	3
ENCV 8 0 0503	Manajemen Sistim Rekayasa dan Nilai	Systems Engineering and Value Management	3						3	3	3
ENCV 8 0 0601	Metode dan Peralatan Konstruksi	Construction Methods and Equipment	3	P					3		
ENCV 8 0 0504	Manajemen Teknologi untuk Peningkatan Daya Saing	Technology Management for Competitive Advantage								3	
ENCV 8 0 0701	Manajemen Infrastruktur	Infrastructure Management									3
		Sub Total		9	12	12	12	12	12	12	12
	Semester 2	**2nd Semester**									
ENCV 8 0 0105	Metode Elemen Hingga	Finite Element Method	3	3			P				
ENCV 8 0 0106	Perancangan Struktur Bang. Tahan Gempa	Design of Earthquake Resistance Building	3	3							
ENCV 8 0 0107	Teknologi Beton dan Beton Bertulang Lanjut	Concrete Technology and Adv. Reinforced Concrete	3	3							
ENCV 8 0 0108	Perancangan Bangunan Lepas Pantai	Offshore Structural Design	3	P							
ENCV 8 0 0204	Teknik Pondasi Lanjut dan Galian Dalam	Adv. Foundation Engineering and Deep Excavation	3	P	3						
ENCV 8 0 0205	Metode Numerik Dalam Geoteknik	Numerical Methods in Geotechnical Engineering	3	P	3						
ENCV 8 0 0206	Geoteknik Lingkungan	Environmental Geotechnics	3	P	3						
ENCV 8 0 0305	Transportasi Barang	Freight Transportation	3			3					
ENCV 8 0 0306	Analisa Jaringan Transportasi	Transport Network Analysis	3			3					
ENCV 8 0 0307	Rekayasa Perkerasan Jalan Lanjut	Advanced Highway Pavement Engineering	3			P					
ENCV 8 0 0308	Analisa Permintaan Transportasi	Transport Demand Analysis	3			P					
ENCV 8 0 0309	Keselamatan Transportasi	Transport Safety	3			P					
ENCV 8 0 0310	Ekonomi Transportasi	Transport Economics	3			P					
ENCV 8 0 0311	Perencanaan dan Rekayasa Jalan Rel	Railway Engineering and Planning	3			P					
ENCV 8 0 0312	Perencanaan dan Pengelolaan Pelabuhan	Port Planning and Management	3			P					
ENCV 8 0 0313	Perencanaan dan Pengoperasian Angk Umum	Public Transport Planning and Operation	3			P					
ENCV 8 0 0314	Topik Khusus Transportasi	Selected Topics in Transportation	3			P					
ENCV 8 0 0403	Manajemen Sumber Daya Air	Water Resources Management	3				3				
ENCV 8 0 0404	Hidrologi Kualitas Air	Qualitative Hydrology	3				3				
ENCV 8 0 0405	Pemodelan Kualitas Air Permukaan	Surface Water Quality Modeling	3				3				
ENCV 8 0 0406	Pengelolaan Sumber Daya Air Tanah	Ground Water Resources Management	3				3				

KODE	MATA AJARAN	SUBJECT	SKS	Major							
				STR	GT	TR	SDA	TL	MK**	MP**	MI
ENCV 8 0 0804	Kontrol Emisi Pada Instalasi Pengolahan Limbah Padat	Emision Control on Solid Waste Treatment Unit	3					3			
ENCV 8 0 0805	Teknologi Pengolahan Limbah Padat: Operasional and Desain	Technology of Solid Waste Treatment ; Operation and Design	3					3			
ENCV 8 0 0806	Pengelolaan Limbah Industri dan B3	Hazardous and Industrial Waste Management	3					P			
ENCV 8 0 0505	Manajemen Waktu dan Biaya	Time and Cost Management	3	P					3	3	
ENCV 8 0 0506	Manajemen Kualitas dan Resiko	Quality and Risk Management	3	P					3	3	
ENCV 8 0 0507	Manajemen Pengadaan, Administrasi Kontrak dan Klaim	Procurement Management, Contract and Claim Administration	3						3	3	
ENCV 8 0 0602	Manajemen Sumber Daya dan komunikasi proyek	Human Resource and Project Communication Management	3						3	3	
ENCV 8 0 0702	Investasi dan Pembelajaan Pemerintah	Public Project Investment and Finance	3								3
ENCV 8 0 0703	Kemitraan Pemerintah dan Swasta dalam Infrastruktur	Fundamentals of Public Private Partnership	3								3
ENCV 8 0 0704	Investasi Infrastruktur	Infrastructure Investment	3								3
ENCV 8 0 0705	Kerangka Hukum dan Kelembagaan	Legal and Business Ethics in Infrastructure	3				P				3
		Sub Total		9	9	6	6	6	12	12	12
	Semester 3	**3rd Semester**									
ENCV 8 0 0109	Perancangan Jembatan	Bridge Structural Design	3	P							
ENCV 8 0 0110	Perancangan Bangunan Tinggi	Structural Design of Highrise Buildings	3	P							
ENCV 8 0 0111	Pelat dan Cangkang	Plate and Shell	3	P							
ENCV 8 0 0207	Dinamik dan Kegempaan Geoteknik	Dynamics and Earthquake in Geotechnic	3	P	3						
ENCV 8 0 0208	Topik Khusus Geoteknik	Selected Topics in Geotechnics	3		3						
ENCV 8 0 0315	Pemeliharaan Perkerasan Jalan Lanjut	Advanced Highway Maintenance	3			P					
ENCV 8 0 0316	Perencanaan Transportasi Perkotaan	Urban Transport Planning	3			P					
ENCV 8 0 0317	Dampak Lingkungan Transportasi	Transport Environmental Impact	3			P					
ENCV 8 0 0318	Sistem Transportasi Intermoda	Intermodal Transportation Systems	3			P					
ENCV 8 0 0319	Material Perkerasan Jalan Lanjut	Advanced Highway Materials	3			P					
ENCV 8 0 0320	Operasional dan Kendali Sistem Transportasi	Transportation Systems Operations and Control	3			P					
	Optimasi Sistem Distrbibusi (*)	Distribution Systems Optimization	3			P					
ENCV 8 0 0322	Perencanaan dan Pengelolaan Lapangan Terbang	Airport Planning and Management	3			P					
ENCV 8 0 0323	Topik Khusus Transportasi	Selected Topics in Transportation	3			P					
ENCV 8 0 0407	Manajemen Kualitas Air dan Limbah Perkotaan	Water Quality and Urban Waste Management	3				3				
ENCV 8 0 0807	Efisiensi Sumberdaya dengan Teknologi – Analisis Daur Hidup (LCA) dan Pengelolaan Limbah Padat Terpadu	Technology of Resources Efficiency - Life Cycle Analysis (LCA) and Integrated Solid Waste Management	3					P			
ENCV 8 0 0808	Praktek Rekayasa dan Teknologi Limbah Padat	Engineering Practice and Solid Waste Technology	3					P			
ENCV 8 0 0809	Kontaminasi dan Remediasi Tanah	Contamination and Soil Remediation	3					P			
ENCV 8 0 0603	Investasi Proyek dan Keuangan	Project Investment and Financing	3						3	3	3
ENCV 8 0 0706	Infrastruktur dan Pengembangan Wilayah	Infrastructure and Regional Development	3						P	P	P
ENCV 8 0 0604	Manajemen Sistem Informasi dan Teknik Informatika	Management Information System and Information Technology	3						P	P	P
ENCV 8 0 0508	Manajemen Kesehatan dan Keselamatan Kerja dan Lingkungan	Management of Health, Safety and Environment	3	P			P		P	3	P
ENCV 8 0 0707	Infrastruktur dan Pengembangan Properti	Infrastructure and Property Development	3	P							P
ENCV 8 0 0708	Infrastruktur dan Pasar Modal	Infrastructure and Capital Market	3								P
ENCV 8 0 0002	Metodologi Penelitian	Research Methodology	3				P	3	3	3	3
ENCV 8 0 0003	Seminar	Seminar	1	1	1	1	1	1	1	1	1
		Sub Total		1	7	1	4	4	7	7	7
	Semester 4	**4th Semester**									
ENCV 8 0 0810	Limbah Menjadi Energi	Waste to Energy	3	P				P			
ENCV 8 0 0004	Tesis	Thesis	6	6	6	6	6	6	6	6	6
		Sub Total		6	6	6	6	6	6	6	6
	Mata Kuliah Wajib Kekhususan	Total of Cumpolsory Credits		25	34	25	28	28	37	37	37
	Mata Kuliah Pilihan	Total of Electives Credits		15	6	15	12	12	3	3	3
		TOTAL		40	40	40	40	40	40	40	40

STR: Structure
GT: Geotechnics
TR: Transportation
SDA: Water Resource Management
MK: Construction Management
MP: Project Management
TL: Environmental Engineering

(*) Mata kuliah pada Program S2 Teknik Industri
(*) Offered by Master Program in Industrial Department

(**) Kelas Reguler dan Kelas Khusus Salemba
(**) Regular Class and Special Class in Salemba

Catatan :

1. Mata kuliah pilihan bernotasi P pada kolom masing-masing peminatan atau mata kuliah wajib/pilihan dari peminatan lain.
2. Untuk kekhususan Transportasi, mahasiswa cukup mengambil 5 dari 6 mata kuliah wajib. Mahasiswa yang mengambil keenam mata kuliah, maka kelebihannya dihitung sebagai mata kuliah pilihan.

Note :

1. Elective Courses can be chosen from those with initial P or courses offered by other specialization.
2. For Transportation; choose 5 from 6 compulsasy courses. Taking 6 courses means one course is considered as elective.

Course Description

ENCV 8 0 0101
ADVANCED MECHANICS OF MATERIAL
3 SKS

Learning Objectives : Students should be able to calculate and analyze structural responses due static forces and temperatures based on material properties and elastic and inelastic condition of structures.

Syllabus : Mechanical properties of materials, stress-strain theory, linear relationship of temperature-strain-stress; inelastic material properties; application of energy method; torsion, asymetrical momen on straight beam; shear center in thin-walled beams; circular beams; beams on elastic foundations

Prerequisites : None

Text Books :
1. Boresi A.P. et all, Advance Mechanics of Material, John Wiley & Sons, Inc, 1993
2. R.C. Hibbeler, Mechanics of Materials, Prentice Hall, 2002

ENCV 8 0 0102
DESIGN OF PRESTRESSED CONCRETE
3 SKS

Learning Objectives : Students should be able to understand design critera and prestressed concrete technology in accordance with the standards as well as the application on buildings and long-spanned bridges, comprehend the Load and Resistance Factored Design (LRFD) method on various aspects of strength, stability, and bending as well as prestressed column-beam connection and prestressed anchorage zone

Syllabus : Review on prestressed materials and flexural design based on Serviceability Limit State Design (SLSD), Load and Resistance Factored Design (LRFD) of bending, shear and torsion aspects; Serviceability of flexural aspect; Statically indeterminate structures; Prestress losses due to friction and wobble, elastic shortening of concrete, anchorage slippage, concrete creep and shrinkage, and prestressed steel relaxation; analysis of column and prestressed beam joint; prestress anchorage zone analysis; Application on buildings and long-spanned bridges; External prestressing and special application on cable-stayed bridges.

Prerequisites : None

Text Books :
1. SNI 03-2874-2002: "Tata cara perencanaan struktur beton untuk bangunan gedung", Badan Standardisasi Nasional, 2002.
2. SNI T-14-2004: "Perencanaan struktur beton untuk jembatan", Badan Standardisasi Nasional, 2004.
3. ACI 318-02 & ACI 318R-02: "Building code requirements for structural concrete and commentary", American Concrete Institute, 2002.
4. AASHTO: "Standard specifications for highway bridges", American Association of State Highway and Transportation Officials, 17th Edition, 2002.
5. Y. Guyon: "Limit state design of prestressed concrete", Applied Science Publishers, Essex, 1974.
6. A.S.G. Bruggeling: "Structural concrete; Theory and its application", A.A. Balkema, Rotterdam, 1991.
7. R. Chaussin, A. Fuentes, R. Lacroix, J. Perchat: "Prestressed concrete", Presses de l'Ecole National des Ponts et Chaussees, Paris, 1992.
8. T.Y. Lin, N.H. Burns: "Design of prestressed concrete structures", John Wiley & Sons, New York, 1992.
9. R. Walther, B. Houriet, W. Isler, P. Moia: "Cable stayed bridges", Thomas Telford, London, 1988.
10. ACI Committee 209, "Prediction of creep, shrinkage, and temperature effects in concrete structures", ACI-209R-92, ACI Manual of Concrete Practice.
11. F.X. Supartono: "Beton Pratekan", Seminar HAKI untuk Konstruksi Beton dan Baja berdasarkan SNI-2002, Pekanbaru, 5 Oktober 2004.
12. F.X. Supartono: "External prestressing for building structural repair", FIP International Symposium, Johannesburg, South Africa, 9 – 12 March 1997.
13. F.X. Supartono: "Jembatan cable stayed", Seminar jembatan cable stayed, Direktorat Jendral Binamarga, Jakarta, Maret 1996.
14. F.X. Supartono: "Jembatan segmental beton pratekan dengan cara kantilever", Short course "Perencanaan dan teknologi konstruksi jembatan", Semarang, 11 Maret 1996.

ENCV 8 0 0103
DYNAMICS OF STRUCTURE
3 SKS

Learning Objectives : Students should be able to analyze civil engineering buildings subjected to dynamic forces

Syllabus: Types, structures and responses of dynamic loadings; modeling of single-degree-of-freedom (SDOF) system; SDOF free vibration, SDOF Fored vibration; periodic, harmonic, dynamic and erratic loadings; Response analysis to SDOF using numerical integration method; generalization of SDOF; modelling of Multi-Degrees-of-Freedon (MDOF), application of static condenstation; eigen problems; forced vibration on harmonic loading, spectra responses.

Prerequisites : None

Text Books :
1. Chopra A.K., Dynamics of Structures, Printice Hall, 1995

2. Clough R.W. Penzien J., Dynamic of Structures, McGraw-Hill, 1993

ENCV 8 0 0104
ADVANCED STEEL DESIGN
3 SKS
Learning Objectives : Students should be able to design and calculate advanced connections, beam structures, plate girders, portals and composite structures for low-rise buildings. Students should be able to use both elastic and plastic designs for the buildings.
Syllabus : Plastic design and calculation of continuous beam; Beam-Colums. Theory and analysis of plate girders for buildings. Advanced connection techniques; Portal and Gable fram designs; Structural analysis; Steel-steel composite structures and concrete-prestressed steel composite structures and the application of Preflex system for buildings; Cold form section/Light Gage Member
Prerequisites : None
Text Books :
1. Salmon C.G. dan Johnson J.E., Steel Structures: Design and Behavior, Fourth Edition, Harper Collins Publishers, 1996
2. Bresler B. Lin T.Y., Scalzi J.B., Design of Steel Structures, John Wiley & Sons- Toppan Co., 1968
3. Segui William T., LRFD Steel Design, ITP-PWS Publishing Co., Boston, 1994
4. ________________, Tata Cara Perencanan Struktur Baja untuk Bangunan Gedung, Standar, SNI-03-1729-2021, Badan Standarisasi Indonesia, 2002

ENCV 8 0 0201
ADVANCED SOIL MECHANICS
3 SKS
Learning Objectives : This course is an advanced discussion about the behavior and properties of the soil shear strength and deformation the behavior and introduction of saturated and shear strength properties and deformation of unsaturated soil
Syllabus : Critical state soil mechanics; effect on shear strength testing of the soil; approach to effective stress and total stress; loading and unloading; behavior of short-term and long term consolidation of information; the use of horizontal drainage. Unsaturated soil mechanics; differences in the behavior of saturated and unsaturated soil
Prerequisites : Soil Mechanics
Text Books :
1. Soil Mechanics, R.F. Craig, (TerjemahanProf. Dr.Ir. Budi SusiloSoepandji), Fourth Edition, PenerbitErlangga, Jakarta, 1989.
2. Muni Budhu. Soil Mechanics 3rd Edition. 2010
3. Braja M. Das. Principal of Geotechnical Engineering 5th Edition. 2007

ENCV 8 0 0202
ADVANCED GEOTECHNICAL INVESTIGATION
3 SKS
Learning Objectives : Students are able to understand the basic terms and their usage in the Experimental Advanced Geotechnical Applications in the field and be able to explain, conduct and analyze the results of laboratory tests related to geotechnical work. Students are expected to also be able to understand, explain and interpret the results of the use of the use of geotechnical instrumentation for field work
Syllabus : General introduction of Advanced Experimental Laboratory associated with the Geotechnical; recognition, understanding and use of test results using a Dilatometer, Pressuremeter, Bearing Plate, Swelling, Geotechnical Instrumentation, Centrifuge, Triaxial CU / CD, Triaxial Unsaturated, Cyclic Triaxial, Consolidation of Long-Term (Oedometer / Rowe Cell), Preparation of Test Sample non standard. Further introduction and testing in the laboratory by means of triaxial CU and swelling; and field tests with the pressuremeter.
Prerequisites : None
Text Books :
1. Geotechnical Engineering Portable Handbook; Robert W. Day, McGraw-Hill, 2000.
2. Geotechnical Engineering, S Joseph Spigolon, Phd, PE, McGraw-Hill, 2001.
3. American Society of Testing and Material Annual Book Of ASTM standards, ASTM, 1989.
4. Soil Mechanics, R.F. Craig, (Terjemahan Prof. Dr.Ir. Budi Susilo Soepandji), Fourth Edition, Penerbit Erlangga, Jakarta, 1989.

ENCV 8 0 0203
SLOPE STABILIZATION AND SOIL IMPROVEMENT
3 SKS
Learning Objectives : Give meaning and understanding of the problems that exist in finite and infinite slope with several methods and the methods of soil improvement
Syllabus : Slope stability analysis with finite and infinite fellinius method, bishops, and other methods; Analysis of avalanches by using the software; avalanche hazard analysis and repair / retrofitting of slopes: soil nailing; strengthening the structure of retaining wall; Improved land: stabilization by mechanical means (dynamic compaction, vibro flotation / compaction) with the pole vertical drainage sand (sand pile, sand and drained), stabilization by chemical injection method
Prerequisites : None
Text Books :
1. Bowles, J.E., Foundation Analysis and Design, McGraw-Hill Book Co., Singapore.
2. Ingels, O.G. and Metcalf, J.B., Soil Stabilization, Butterworths, Australia.

3. Muni Budhu, Soil Mechanics & Foundations, John Wiley & Sons. Inc, 2007.
4. Soil Mechanics, R.F. Craig, (TerjemahanProf. Dr.Ir. Budi SusiloSoepandji), Fourth Edition, PenerbitErlangga, Jakarta,
1989.

ENCV 8 0 0301
ADVANCED HIGHWAY GEOMETRIC DESIGN
3 SKS

Learning Objectives : Student is able to design geometric design for urban and rural freeways and interchange based on safety, comfort and convenience, geometric design during construction and improvement of lanes, and parking design and planning.

Syllabus : Overview the concept and philosophy of highway geometric design: design speed, sight distance, vertical and horizontal alignment; Sign and marking: principle and concept, types, codes and standards, posting; Climbing lane: criteria and concept, design consideration, sign and marking; Review intersections: types of intersection, design criteria for urban and rural roads; Interchange: principle of planning and design, type of interchange, ramp on and ramp off, merging- diverging – weaving; Element of geometric interchange and freeway: ramp on and ramp off, merging- diverging – weaving, function and type of guard rail;Road furniture and design for safety consideration; Road-side hazard management; Traffic management at road construction work zone with clear zone concept; Parking facilities: on-street and off street parking, sign and marking, and parking management.recent and innovation on geometric design;

Prerequisites : None

Text Books :

1. AASHTO (American Association of State Highway and Transportation Officials), 2004. A Policy on Geometric Desighn of Highways and Streets, AASHTO, Washington, DC, Amerika Serikat.
2. Lamm, R, B Psarianos dan T Mailander, 2000. Highway Design and Traffic Safety Engineering Handbook. McGraw Hill, New York Amerika Serikat.
3. Tjahjono, T (2011). Analisis Keselamatan Lalu Lintas Jalan, Lubuk Agung, Bandung.
4. Department for Transport, Inggris, 2002. Design Manual for Roads and Bridges: Volume 6, Section 1, Part 1, TD 9/93 Highway Link Design, DFT, London Inggris.
5. Department for Transport, Inggris, 2006. Design Manual for Roads and Bridges: Volume 6, Section 2, Junctions TD 22/06 Layout of Grade Separation Junctions, DFT, London Inggris.
6. Department for Transport, Inggris, 2007. Design Manual for Roads and Bridges: Volume 6, Section 1, Part 1, TD 16/07 Geometric Design of Roundabouts, DFT, London Inggris.
7. Department for Transport, Inggris, 2004. Design Manual for Roads and Bridges: Volume 6, Section 1, Part 1, TD 50/04 Geometric Layout of Signal Controlled Junctions and Signalised Roundabouts, DFT, London Inggris.
8. Department for Transport, Inggris, 1995. Design Manual for Roads and Bridges: Volume 6, Section 1, Part 1, TD 42/95 Geometric Design of Major/Minor Priority Junctions, DFT, London Inggris.
9. AusRoads, 2003. Rural Road Design. A Guide to the Geometric Design of Rural Roads, Ausroads Inc, Sydney, Australia
10. AusRoads, 2007. Urban Road Design. A Guide to the Geometric Design of Major Urban Roads, Ausroads Inc, Sydney, Australia
11. NCHRP (National Cooperative Highway Research Program),1992. NCHRP Report 350: Recommended Procedures for the Safety Performance Evaluation of Highway Features. Transportation Research Board, Washington DC, Amerika Serikat.

ENCV 8 0 0302
ADVANCED TRANSPORTATION SYSTEM
3 SKS

Learning Objectives : Students should be able to analyze the components of transportation system from various dimensions as well as recent issues related to global transportation system and transportation system in Indonesia

Syllabus : Dimension and components of transportation system; transportation of people; urban evolution, history of transportation, private transport, public transport, inter-city transportation, air transportation, railway transportation, ITS; transportation of goods: logistic system and transportation services of goods; strategic, tactical and operational planning of transportation of goods, intermodal transportation, pipes transportation, conveyor belts; recent issues of global transportation and transportation in Indonesia: mobility, safety, congestion, energy, global climate change, transportation problems in developing countries and developed countries, populations, environmental issue, productivity, manufactures and security

Prerequisites : None

Text Books :

1. Sigurd Grava. Urban Transportation System, Choices for Communities. Mc Graw-Hill
2. Marvin L. Manheim , Fundamentals of Transportation Systems Analysis. Vol 1 : Basic Concepts , The MIT Press.
3. W.W. Blunden, J.A. Black. The Land-use / Transport System, Pergamon Press

ENCV 8 0 0303
TRAFFIC ENGINEERING AND CONTROL
3 SKS
Learning Objectives : Students should be able to analyze traffic condition and characteristics using mathematical models and micro and macro modeling techniques as a tool for traffic flow analysis
Syllabus : Introduction; road users, vehicles and infrastructure characteristics in traffic analysis, intersectioncontrol, traffic flow survey, traffic flow volume characteristics; traffic flow speed characteristics; traffic flow density characteristics; Queueing and bottle-neck analysis; Traffic flow model: shock-wave analysisa; Traffic management
Prerequisites : None
Text Books :
1. MAP Taylor, W.Young, (1988), TRAFFIC ANALYSIS & NEW SOLUTION, Hargreen Publishing
2. Ministry of Public Works; 1997, Indonesian Highway Capacity Manual.
3. May, (19..), Traffic Flow Fundamental,
4. Martin WOHL, (19..), Traffic Engineering,

ENCV 8 0 0304
TRANSPORT PLANNING AND POLICY
3 SKS
Learning Objectives : Students should be able to formulate transportation policy and planning and optional supporting policies for government or transportation authority
Syllabus : Current concepts and process of transportation policy making in Indonesia; Concepts of transportation policies: strategic element of transportation, policies and institutional. Logical structures: challenge in creating sustainable mobility, policy making context, approaches to policy making, logical structure of policy making and performance evaluation framework; SWOT analysis; Basics of SWOT, study case analysis development, market and government failure: characteristics of arket failure, failure of government intervention and regulation transition. Regulation: (De)regulation and impacts on economic and financial aspects; Privatization: pro-con towards privatization, public and private partnership (PPP), and; Saptial development: travel behavior, relationship between land-use development and transportation options, urban planning cases, transportation system integration
Prerequisites : None
Text Books :
1. Prospects, 2003. Deliverable No. 15: Decision Makers Guidebook. EU project: Procedures for Recommending Optimal Sustainable Planning of European City Transport System (Prospect).
2. Prospects, 2003. Deliverable 14: A Methodological Guidebook. EU project: Procedures for Recommending Optimal Sustainable Planning of European City Transport System (Prospect).
3. Kenneth Button, 2010., Transport Economics 3rd edition, Edward Elgar Publisher.
4. Button, KJ dan Hensher, DA. 2005. Handbook of Transport Strategy and Policy, Elsevier

ENCV 8 0 0402
ENGINEERING HYDROLOGY
3 SKS
Learning Objectives : Understanding various components of existing input in an open-surfaced water system as well as understanding the behavior of water as one component input on the current through the related system. Enable to develop delivered knowledge by analyzing case studies. Enable to present the results of the case study in the form of a written report and presentation
Syllabus : Introduction, hydrologic cycle element and terminology, relation between parameter of hydrologic cycle element. Mathematic model concept, rainfall runoff models, flood routing, analysis distribution and frequency and case study.
Prerequisites : None
Text Books :
1. Chow V.T.,et al.,1998, Applied Hydrology. McGraw Hill, Inc.
2. Maidment, D.R.,ed.,1993, Handbook of Hydrology. McGraw Hill, Inc.

ENCV 8 0 0001
ENGINEERING MATHEMATICS
3 SKS
Learning Objectives : (1) Student becomes familiar with mathematical thinking, and gets the impression that mathematics is not a collection of tricks and recipes but a systematic science of practical importance, resting on a relatively small number of basic concepts and involving powerful unifying methods; (2) Student will see that the application of mathematics to an engineering problem consists essentially of three phases: modeling, solving and interpreting.
Syllabus : Orientation: Engineering and Mathematics; Ordinary Differential Equation of the First Order; Equation of First Order; Ordinary Linear Differential Equations; Power Series Solutions; Laplace Transform; Open Methods; Roots of Polynomials; Engineering Applications: Roots of Equations
Prerequisites : None
Text Books :
1. Kreyszigs, E., 1983. Advanced Engineering Mathematics. Fifth Edition. John Wiley & Sons, Singapore.
2. Greenberg, M. D., 1998. Advanced Engineering Mathematics. Second Edition. Prentice Hall, New Jersey.

3. Chapra, Steven C. and Canale, Raymond P., 1998. Numerical Methods for Engineers. Third Edition. McGraw-Hill International Editions, Singapore.

ENCV 8 0 0801
PHYSICAL, BIOLOGICAL AND CHEMICAL TREATMENT IN ENVIROMENTAL ENGINEERING
3 SKS
Learning Objectives : Students are able to apply the theory of unit operations and unit processes in advanced environmental engineering (advance) applied for technical calculation and design of water treatment, wastewater, solid waste and air pollution control technology
Syllabus : Unit operations and processes based on the principles of physical, chemical and biological treatment as well as based on treatment level including advanced treatment; The concept of mass balance, flow model, the reactor and its operation and process units of preliminary, primary and secondary treatment in water treatment, wastewater and waste management and air pollution; Application of the concept of mass balance in advanced biological processes in wastewater treatment by the method of suspended growth or attached growth; concept of separation of solid particles, sedimentation and flotation types; Unit operation of separation of solid particles in water treatment and water waste through the media axis (filtration - ultrafiltration), and reverse osmosis membrane; concept of dissolved gas, gas saturation and aeration process; operation of aeration and dissolved gas flotation production units; concept of the nitrogen cycle in wastewater; concept of adsorption, absorption, and precipitation; unit operations and chemical processes including the adsorption of ammonia separation, Ion Exchange: Application of bioprocess in biofilter for wastewater treatment, air pollutants treatment and combination usage; concept of recycling of wastewater; advanced chemical treatment for water recycling
Prerequisites : Environmental Chemistry and Unit Operation and Processes
Text Books :
1. Tom D. Reynolds and Paul Richards, Unit Operations and Process in Environmental Engineering Pws Series in Engineering;
2. Rich, Linvil G : " Unit Operation for Sanitary Engineering"Management, McGraw Hill

ENCV 8 0 0802
CLIMATE CHANGED AND ENVIRONMENTAL ENGINEERING
3 SKS
Learning Objectives : Students understand: (i) New prospects for engineering services; (ii) Understanding of scientific basics; (iii) Understanding of complex issues on legal frame for action; (iv) Capacity building; (v) Options for action on an engineering task
Syllabus : Climate change: scientific basics, knowledge, findings and trends, scenario for Asia and Europe; International and national regulations and agreements; Climate protection and techniques: waste, waste water, flood prevention (hydraulic engineering), transportation, energy; Adaptation technique and strategy.
Prerequisites :
Text Books :

ENCV 8 0 0803
ENVIRONMENTAL AUDIT
3 SKS
Learning Objectives : The undergraduate engineer is able to describe the basic principle, the role and function of Environmental Audit. The engineer has ability to make a realistic report of Environmental audit.
Syllabus : To equip each student with a fundamental understanding of Environmental Audit as it applies within Indonesia, including: Introduction Environmental Audit (Definition, principle, concept and environmental policies related to Environmental Audit) ; Basic Law, Policies and Regulations regarding Environmental Audit. Environmental Audit basic principles (Issues and Scopes of Environmental Audit) ; Understanding ISO 1400: Improving Environmental Management and Advancing Sustainable Development ; Assessment of Environmental Management based on Environmental Impact Assessment ; Basic Principles of Audit (Principles, Procedures, Hierarchy and Processes of Environmental Audit). Types of Audit (Compliance Audit, Waste Audit, Audit Processes). Audit Methods (Implementation Processes, Weight of Implementation, Roles of Stakeholders and Evaluation in Environmental Audit). Audit Document. Audit Case Study (Assessment of Case's Document).
Prerequisites : Environmental Science
Text Books :
"Environmental Assessment"; Ross Singleton, Pamela Castle and David Short; The Authors and thomas Telford Ltd, 1999; ISBN: 0 7277 2612 9
Referrences:
- "Audit and Reduction Manual for Industrial Emissions and Wastes"; United Nations Environment Programme, Industry and Environment Office, United Nations Industrial Development Organization. ISBN: 92-807-1303-5
- "Moving Ahead with ISO 14000", Improving Environmental Management and Advancing Sustainable Development; edited by: Philip A. Marcus & John T. Willig, Wiley Series in Environmental Quality Management John Wily & Sons, Inc, 1997, ISBN 0-471-16877-7.
- "Panduan Audit Sistem Manajemen Mutu dan/atau Lingkungan"; SNI 19-19011-2005. Badan Standarisasi Nasional.

ENCV 8 0 0501
ENGINEERING PROJECT MANAGEMENT
3 SKS
Learning Objectives : Students are encouraged to understand the concept of project management and to be able to apply the knowledge in construction projects case studies. The evaluation process of this module will be assessed through midterm test, final test, individual tasks, and group assignments.
Syllabus : Project Management overview; initiation and scope management; time management; cost management; human resource management; quality management; communication management; risk management; procurement management; project Execution & Control; project Control & Closing; Soft skills for project management.
Prerequisites : None
Text Books :

1. Kerzner, Harold, Project Management, John Wiley & Sons, Inc., 2006.
2. Project Management Institute, A Guide to Project Management Body of Knowledge, 2004 edition.

Buku-Text Books tambahan:

1. Baguley, Philip, Managing Successful Projects, Pitsman Publishing, 1995.
2. Barker, Stephen and Cole, Rob, Brilliant Project Management, Pearson Education Limited, 2007.
3. Barkley, Bruce T. and Saylor, James H., Customer-driven Project Management, McGraw-Hill, Inc., 1994.
4. Cleland, David I., Project Management – Strategic Design & Implementation, McGraw Hill, 1999.
5. Cleland, David I. ND King, William R. (ed), Project Management Handbook, Van Nostrand Reinhold, 1988.
6. Gilbreath, Robert D., Winning at Project Management, John Willey & Sons, Inc, 1986.
7. Grey, Stephen, Practical Risk Assessment for Project Management, John Willey & Sons, Inc., 1995.
8. Hollick, Malcolm, An Introduction to Project Evaluation, Longman Cheshire Pty Limited, 1993.
9. McGhee, Pamela and McAliney, Peter, Painless Project Management, John Willey & Sons, Inc., 2007.
10. Newton, Richard, Project Management Step by Step, Pearson Education Limited, 2006.
11. Nicholas, John M., Managing Business & Engineering Projects, Prentice-Hall, Inc., 1990.
12. O'Connell, Fergus, Fast Projects, Pearson Education Limited, 2007.
13. Project Management Institute, Project Management Journals.
14. Verma, Vijay K., Human Resource Skills for the Project Manager, Project Management Institute, 1996.
15. Verma Vijay K., Organizing Projects for Success, Project Management Institute, 1995.

ENCV 8 0 0502
ENGINEERING ECONOMICS AND MANAGEMENT
3 SKS
Learning Objectives : Students are expected to be able to understand the concept of engineering economics and its' application for engineering projects.
Syllabus : course overview; Introduction; Introduction To Engineering Economy; Time Value of Money; Combining Factors; Interest Rates; PW & AW Analysis; ROR Analysis & Incremental Analysis; Benefit / Cost Analysis; Depreciation; After Tax Analysis; Capital Budgeting; Effects Of Inflation & Sensitivity Analysis
Prerequisites : None
Text Books :

1. Leland Blank-Anthony Tarquin ; Engineering Economy ; 5th edition ; McGraw Hill , 2002
2. Sullivan, W., Bontadelli, J. And Wicks, E., Engineering Economy, 11th ed., Prentice Hall Inc., New Jersey, 2000
3. Stermole, F. M., Economic Evaluation and Investment Decision Methods,Golden, 1984

ENCV 8 0 0503
SYSTEMS ENGINEERING AND VALUE MANAGEMENT
3 SKS
Learning Objectives : Students are expected to be able to evaluate system design and related processes in order to create engineering products that suit the customer/client needs and values.
Syllabus : Course Overview; Introduction to Systems Definitions & Concepts; Introduction to Sustainability Development; Review Engineering Economic; Statistics & Probability in Civil Engineering Systems.; Optimization, Design & Operation, Decision Making; Issues on Human, Organizational and Technology; Value Engineering; Investment Appraisal; Reliability and Risk Analyses; New Product Development; Decision Analysis; System Dynamic and Simulation (MCS)
Prerequisites : None
Text Books :

1. Berawi, M.A. (2004), Quality Revolution: Leading the Innovation and Competitive Advantages, *International Journal of Quality & Reliability Management*, Volume: 21, Issue: 4, pp. 425-438, Emerald

2. Berawi, M.A. & Woodhead, R.M. (2008), Stimulating Innovation Using Function Models: Adding Product Value, *Value World*, Volume: 31, Number: 2, pp. 4-7, SAVE Press, USA
3. Woodhead, R.M. & Berawi, M.A. (2007), An Alternative Theory to Idea Generation, *International Journal of Management Practice*, Volume 3, No. 1, pp.1-19.
4. Kaufman, JJ & Woodhead, RM (2006), Stimulating Innovation in products and Services, John & Willey Interscience.
5. Blanchard, B S (1997*). System Engineering Management*, Wiley-Interscience
6. Buede, DM (2009), The Engineering Design of Systems: Models and Methods, Wiley-Interscience
7. Kossiakoff , A & Sweet, WN (2002), Systems Engineering Principles and Practice, Wiley-Interscience
8. Senge, Peter (1994), *The Fifth Discipline*, Doubleday Business
9. Sterman, John D. (2000). *Business Dynamics: Systems thinking and modeling for a complex world*. McGraw Hill.
10. Ulrich, Karl T. and Eppinger, Steven D (2004) *Product Design and Development*, 3rd Edition, McGraw-Hill, New York

ENCV 8 0 0601
CONSTRUCTION METHODS AND EQUIPMENT
3 SKS

Learning Objectives : Students are encouraged to understand the principles of site management, construction equipment and methods from various building and construction types.

Syllabus : General understanding of construction methods; introduction to construction equipments, site management and technology in construction projects, soil improvement through soil cement method to improve the strength of base / sub-base for road construction, road construction method with rigid pavement and flexible pavement, introduction to the technology development and application of bridge construction methods, wharf construction method(foundation, slab, beams and other structural strengthening (fender structure, etc)), ground foundation construction methods (bore pile, strauss pile, piling, and pier foundation), high rise building construction methods, dewatering

Prerequisites : None

Text Books :

1. Asiyanto, Metode Konstruksi Bangunan Teknik Sipil, Waskita Karya, 2001
2. Peurifoy, R.L., Construction Planning, Equipment, and Methods (Internal Edition), McGraw Hill, 1985

ENCV 8 0 0504
TECHNOLOGY MANAGEMENT FOR COMPETITIVE ADVANTAGE
3 SKS

Learning Objectives : Students are expected to be able to develop a strong conceptual foundation for managing technological innovation. This course introduces various concepts and frameworks for analyzing how firms can create, commercialize and capture value from technology-based products and services

Syllabus : Introduction to technology management, Competing in Technology-Intensive Industries, Types of Competitive Advantage, Intellectual Property, Creating and Managing an Innovative Organization, Technology diffusion and absorption, Human Aspects in Technology Management

Prerequisites : None

Text Books :

1. Gaynor, Handbook Of Technology Management, McGraw Hill
2. Joshua S. Gans and Scott Stern 2003. "The product market and the market for "ideas": commercialization strategies for technology entrepreneurs." *Research Policy*
3. Saloner, Garth, Andrea Shepard, and Joel Podolny. 2001. *Strategic Management*. New York: John Wiley & Sons.
4. Christian N Madu, Management Of New Technologies For Global Competitiveness, Jaico Publishing House

ENCV 8 0 0701
INFRASTRUCTURE MANAGEMENT
3 SKS

Learning Objectives : Students are expected to be able to understand the concept of infrastructure management and to evaluate various processes and policies related to development of infrastructure projects.

Syllabus : Introduction of the course, background, Economic Corridors, Domestic Connectivity, The role of Infrastructure in the Economy and objective of the course; Indonesia economic outlook, Under The Global Sky, The New Global Economy, Globalization and its consequences on infrastructure; The political economy of infrastructure, The Infrastructure Summit, The Infrastructure Policy Package; Legal & Regulation Frameworks; Policy Frameworks & Strategies; Investment Needs & Financing Gap; Road & The Land Transport; The Railway Sector; Air and Sea Transport; Telecommunication & The Knowledge Based Economy; Electricity & Energy; Water, Irrigation & Sanitation; Introduction to Public Private Partnership & Private Financing Initiatives; Fundamentals of Modern Project Financing; Institutional Settings & Capacity

Prerequisites :

Text Books :
1. Dikun, S. Infrastruktur Indonesia: Sebelum, Selama, dan Pasca Krisis. Bappenas, 2003. (SDI);
2. Course Materials (CMA) will be provided;
3. Connecting East Asia : A New Framework for Infrastructure. ADB, JBIC, and The World Bank, 2005. (CEA)

ENCV 8 0 0105
FINITE ELEMENT METHOD
3 SKS

Learning Objectives : Students should be able to comprehend and apply finite element method (FEM) for 3D elastic solid and 2D elastic solid problems (plane stress and plane strain), able to use FEM programme, able to comprehend FEM programming and able to create element strength matrices sub-routines

Syllabus : Introduction; Definition and FEM concepts, variational method, galerkin and ritz solution, shape function, mixed model and displacement model, 1D element and Euler Bernoulli beam, 2D isoparametric element (plane stress and plane strain), 3D isoparametric element, stiffness matrices and mass matrices, Gauss and Hammer numerical integration; Program application for 2D and 3D elastic problems; 2D and 3D element sub-routines dan the integration into one main program PCFEAP (Personal Computer Finite Element Analysis Program).

Prerequisites: Structural Analysis, Matrix Structural Analysis

Prerequisites : Analisa Struktur, Analisa Strukturdengan Matrik

Text Books :
1. Zienkiewicz, O.C., & R.L. Taylor, *The Finite Element Method*, voLl, 5th eds, McGraw Hill,2006
2. R.D. Cook, Malkus, M.E. P1esha, Concepts and Application of Finite Element Analysis, John Wiley and Sons, Inc., 4th eds, 2006
3. KATILI, Irwan, Metode Elemen Hingga untuk Pelat Lentur, UI Press-2003.
4. KATILI, Irwan, Metode Elemen Hingga untuk Analisis Tegangan, UI Press-2008

ENCV 8 0 0106
DESIGN OF EARTHQUAKE RESISTANCE BUILDING
3 SKS

Learning Objectives : Students should be able to comprehend the effects of earthquakes on civil engineering buildings

Syllabus : Introduction: aspects of earthquakes, causes, faults, waves, damage mechanism, seismic magnitude; earth movement characteristics and spectral response; Architectural consideration on earthquake-resistant buildings; Building dynamic response; Equivalent Static analysis: principles of equivalent static seismic forces; equivalent static procedures based on SNI; Drift design and lateral stability; seismic design of floor diaphragm; Concept of capacity design and ductility in seismic design; Seismic design and details of portal structures: beams, columns, beam-column joints; more on seismic design and details of portal structures: beams, columns, beam-column joints; Seismic design and details of shear-wall structures; more on seismic design and details of shear-wall structures; Seismic design and details of double structures: portals adn shear-walls.

Prerequisites : None

Text Books :
1. Ref 1. Farzad Naeim, *the Seismic Design Handbook*, 1989
2. Ref 2. Paulay dan Priestly, *Seismic Design of Reinforced Concrete and Masonry Buildings*, 1992.
3. Ref 3. Chopra, *Dynamic of Structures*, 1995.
4. Ref 4. BSN, *Tata Cara Perencanaan Ketahanan Gempa untuk Bangunan Gedung*, SNI 03-1726-2002
5. Ref 5. BSN, *Tata Cara Perencanaan Struktur Beton untuk Bangunan Gedung*, SNI 03-2843-2002
6. Ref 6. BSN, *Tata Cara Perencanaan Struktur Baja untuk Bangunan Gedung*, SNI 03-1729-2002

ENCV 8 0 0107
CONCRETE TECHNOLOGY AND ADV. REINFORCED CONCRETE
3 SKS

Learning Objectives : Students should be able to understand modern concrete and future concrete technologies, in particular high-performance and/or high quality concrete, mix design for specific performance to meet the regulation standards, and its application on high-rise building structures and long span bidges, able to understand the behaviours of reinforced concrete structural components as the continuation of the master program (S1) such as restrained concrete structures, ductile wall, connection detail of beam and column of concrete portals, as well as strut-and-tie model

Syllabus : Modern concrete and future concrete; Cement technology: hydration process and influencing factors: workablility, slump loss and permeability; hydration heat and volume change; creep and shrinkage of concrete. Cementious additives; silicafume; fly-ash, blast-furnace slag: the influences on the improvement of concrete strength and performance. Mix design of high-performance concrete in accordance of DOE (SNI) and ACI; Abrams-Fxs formulation; Feret and Bolomey formulation. Concrete reology: Fxs model for concrete rheology; visco-elastic behavior of concrete rheolog and the application on creep and shrinkage of concrete; Non-newtonian Fxs model. Review on reinforced concrete materials and design of flexural, axial shear and torsion loading; test standards. Restrained concrete; various related researches; comparison between SNI, ACI, NZS; Ductile wall structure; design of structural walls based on ductility concept; design of coupling beams and boundary elements; resdis-tribution of ductile wall structures. Connection panels between portal beam and column: shear strength, bonding strength, and connection panel stiffness; elastic and inelastic mechanism and behaviours. Theory of diagonal compression zone; modified compression field theory. Strut-and-tie model; definition of B-and-D region; stress dis-tribution of high beam; application for concrete structural designs.

Prerequisites : None

Text Books :

1. ACI: "ACI Manual of Concrete Practice", American Concrete Institute, 2002.
2. ACI Committee Report 363 R-92: "State of the Art Report on High Strength Concrete", 1992.
3. FIP-CEB: "High Strength Concrete; State of the Art Report", Chameleon Press, London, 1990.
4. SNI: "Rancang campuran beton normal", SK SNI-T-15-1990-03, 1990.
5. RILEM: "Recommendations for the testing and use of construction materials", International Union of Testing and Research Laboratories for Materials and Structures, E & FN Spon, 1994.
6. RILEM Workshop: "Concrete Technology; New Trends and Industrial Applications", E & FN Spon, 1994.
7. Ken W. Day: "Concrete Mix Design, Quality Control and Specification", E & FN Spon, 1995.
8. Krishna Raju: "Design of Concrete Mixes", CBS Publishers, 1985.
9. F.D. Lydon: "Concrete Mix Design", Applied Science Publishers, 1982.
10. A.M. Paillere: "Application of Admixtures in Concrete", E & FN Spon, 1995.
11. F.X. Supartono: "Teknologi beton", Pelatihan Pemeliharaan Jalan dan Jembatan HPJI, Jakarta, 12 Juni 2001.
12. T. Paulay and M.J.N. Priestley: "Seismic Design of Reinforced Concrete and Masonry Buildings", A Wiley-Interscience Publication, John Wiley & Sons, New York, 1992.
13. M.J.N. Priestley, F. Seible and G.M Calvi: " Seismic Design and Retrofit of Bridges", John Wiley & Sons, New York, 1996.
14. J.B. Mander: "Seismic Design of Bridge Piers", A Thesis submitted in partial fulfill-ment of the requirements for the Degree of Doctor of Philisophy in Civil Engineering at the University of Canterbury, University of Canterbury, Christchurch, New Zealand, 1983.
15. ACI Committee 318: "Building Code Requirements for Reinforced Concrete, ACI 318-02", American Concrete Institute, Detroit, 2002.
16. P.C. Cheung, T. Paulay and R Park: "Interior and Exterior Reinforced Concrete Beam-Column Joint of A Prototype Two-Way Frame with Floor Slab Design for Earthquake Resistance", Research Report 89-2, Department of Civil Engineering, University of Canterbury, Christchurch, New Zealand, 1989.
17. M.P. Collins and D. Mitchell: "Prestressed Concrete Structures" Prentice Hall, Englewood Cliffs, New Jersey, 1991.
18. A.S.G. Bruggelling: "Structural oncrete, Theory and Its Application", A.K. Balkema, Rotterdam, 1991.
19. J.G. MacGregor: "Reinforced Concrete, Mechanics and Design", Second Edition, Prentice Hall, Englewood Cliffs, New Jersey.
20. J. Schlaich and K. Schafer: "Konstruieren in Stahlbetonbau", Beton Kalender 2001, BK 2, Wilhelm Ernst & Sohn, Berlin – Muenchen, 2001.
21. T.T.C. Hsu: "Torsion of Reinforced Concrete", Van Nostrand Reinhold, New York, 1984.

ENCV 8 0 0108
OFFSHORE STRUCTURAL DESIGN
3 SKS

Learning Objectives : (1) To be able to understand and to implement basic fundamental of marine hydrodynamics, dynamics and advanced structural mechanics in designing of offshore structures (fixed and floating structures); (2) To be able to understand the flow and design criteria of offshore platforms both in shallow (fixed bottom founded) and deepwater environments (floating structures); (3) To be able to understand station keeping issues and mooring line design and analysis ; (4) To be able to understand and familiar with general procedures and issues in fabrication, manufacture and installation aspects ; (5) To be able to understand and to apply the Design Code & Standard of API, DNV, etc.

Syllabus : Introduction to Design of Offshore Structures (To introduce upstream sector oil and gas, offshore petroleum industry, as well as types of offshore structures related to oil and gas industry ; Fundamental design and analysis techniques; offshore platforms for shallow and deep water, pile supported, gravity based and floating platforms; new design problems faced by offshore industry) ; Loads on Offshore Structures (Wind Loads; Wave and Current Loads; Calculation based on Maximum Base Shear and Overturning Moments; Design Wave Heights and Spectral Definition; Hydrodynamic Coefficients and Marine Growth; Fatigue Load Definition and Joint Probability Distribution; Seismic Loads); Concepts of Fixed Platform Jacket and Deck (Jacket concepts, redundant framing arrangement; Launch and Lift jackets; Simple Deck configurations for Lift and float-over installations; In-service and Pre-service Loads and analysis); Steel Tubular Member Design

(Principles of WSD and LRFD; Allowable stresses and Partial Safety Factors; Tubular Members, Slenderness effects; Column Buckling, Design for Hydrostatic pressure; Design for combined axial and bending stresses (API RP 2A guidelines); Tubular Joint Design for Static and Cyclic Loads (Simple tubular joints, design using allowable loads; stress concentration factors; S-N curves and fatigue damage calculations report); Fabrication, manufacture, load-out and installation aspects (Fabrication process, stacking, lifting, load-out, transportation, launching & floating, flooding & upending and installation); Introduction to Deep-water Oil & Gas Fields Development (Concept of deepwater development systems, deepwater facilities features, floater concept and function, hydrostatic and stability of floaters, mooring line design and analysis)

Prerequisites : Advances Structural Mechanics; Marine Hydrodynamics

Text Books :

1. Applied Offshore Structural Engineering, Teng H. Hsu, Gulf Publishing Company, Houston, 1984.
2. Construction of Marine & Offshore Structures, second edition, Ben C. Gerwick, Jr.,CRC, 2000.
3. Sea Loads on Ships and Offshore Structures, O.M. Faltinsen, Ocean Technology Series, Cambridge, 1990.
4. Handbook of Ocean and Underwater Engineering, John J. Meyers, McGraw-Hill, 1969.
5. Buoy Engineering, H.O. Berteaux, John Wiley & Sons, 1976.
6. Hydrodynamics of Offshore Structures by S.K. Chakrabarti, Springer-Verlag
7. Handbook of Offshore Engineering by S.K. Chakrabarti, Elseviers, 2005.
8. Lecture notes from the Instructor.

ENCV 8 0 0204

ADV. FOUNDATION ENGINEERING AND DEEP EXCAVATION

3 SKS

Learning Objectives : Students are expected to understand the fundamental matters relating to the Work Foundation and other Geotechnical aspects, among others, relating to the behavior or characteristics of the soil, methods of deep foundation construction to field monitoring methods. This course discusses the advanced foundation engineering, engineering in the excavation, and dewatering.

Syllabus : The introduction of general matters relating to aspects of Geotechnical Engineering and Foundations, among others, an understanding of the constitutive model of soil and compressible soil characteristics; application usage Mat Foundation; construction method for large-diameter drill mast; interpretation of the results of loading test; lateral foundation capacity in; construction and analysis of wall diaphragm; method geotechnical work supervision; methods and numerical analysis for geotechnical case. Regulations and excavation in foundation design; methods of supervision. Foundation: the foundation raft and piled raft; special pile foundations; load transfer and t-z approach to the behavior of axial pile foundation; p-y approaches for lateral behavior of pile foundation; passive piles; instrumented test pile foundation and load-cell o; dynamic loading test. Digging in: the type and method of construction of the retaining wall; the basic stability of the excavation; analysis of retaining wall in the proponent; design of berms, struts, Rakers, ground anchors, waler beams, soil nailing; top-down construction method; effects of quarrying in the deformation of the surrounding area. Dewatering: dewatering analysis, systems and dewatering equipment.

Prerequisites : None

Text Books :

1. Geotechnical Engineering Portable Handbook; Robert W. Day, McGraw Hill, 2000.
2. Soil Mechanics in Engineering Practice; Terzaghi, K. & Peck, R.B.,John Wiley and Sons Ltd, New York, 1967.
3. Foundation Analysis and Design; Bowles, J.E, McGraw-Hill Book Co.,Singapore, 1988.
4. Foundation Engineering Handbook; Winterkorn, H.F. & Fang, H.Y., van Nostrand Reinhold, Ltd. 1975.
5. Analytical and Computer Methodes in Foundation Engineering; Bowles, J.E, McGraw-Hill Inc., 1977.
6. Elements of Foundation Design, Smith, G.N, Pole, E.L, Granada Publishing Ltd., 1980.

ENCV 8 0 0205

NUMERICAL METHODS IN GEOTECHNICAL ENGINEERING

3 SKS

Learning Objectives : Provide an understanding of numerical methods in geotechnical engineering with the finite element method and finite difference; with linear and nonlinear properties of materials, plastic elasto-plastic/viscous

Syllabus : Introduction to numerical methods in geotechnical engineering; geotechnical considerations; constitutive laws for geologic media; element to the linear material and non-linear; Law tension strain in elastic-plastic conditions, and elasto-visco-plastic; model with critical state soil mechanics (critical states); Settlement finite difference method and finite element in the foundation beam and the elastic plate; Analysis of consolidation on soft ground (soft soil) and seepage; Some case histories

Prerequisites : None

Text Books :

1. Bowles, J.E., Foundation Analisys and Design, McGraw-Hill Book Co., Singapore.

2. Pott, D.M. and Zaravkovic, L., Finite Element Analysis in Geotechnical Engineering, Thomas Telford Ltc., London.
3. Naylon, D.J., and Pande, G. N., Simpson, B., and Tabb, R., Finite Elements in Geotechnical Engineering, Pineridge Press, Swansea, UK.
4. Desai, C.S., and Christian, J.T., Numerical Methods in Geotechnical Engineering, Mc-Graw-Hill Inc., USA.

ENCV 8 0 0206
ENVIRONMENTAL GEOTECHNICS
3 SKS

Learning Objectives : Students are able to equip with the basic knowledge needed for the geotechnical design of waste facilities, the closure and improvement of waste facilities and construction of waste.

Syllabus : Geotechnical aspects, landfill geotechnical structure, behavior and properties of waste, geosynthetic applications for landfill, land cover, long term behavior of landfills, type of soil and groundwater contaminants, contaminated soil sampling, transfer of contaminants in groundwater, the type of contaminent, soil and groundwater remediation.

Prerequisites : None

Text Books :
1. Oweis, I.S. and Khera, R.P. 1998. *Geotechnology of Waste Management.* PWS Publishing Company, Second Edition
2. Daniel, D.E. 1993. *Geotechnical Practice for Waste Disposal.* Chapman and Hal
3. Tchobanoglous G., Theisen H., Vigil S. 1993. *Integrated Solid Waste Management: Engineering Principles and Management Issues,* McGraw-HIll, Inc., New York, International Edition

ENCV 8 0 0305
FREIGHT TRANSPORTATION
3 SKS

Learning Objectives : The students are able to analyze the performance of freight transportation system**.**

Syllabus : Introduction to logistics and distribution; Description of the physic of freight transportation; Framework of logistics planning, Freight transport demand; Freight transport demand modeling; Location of distribution facility ; Fleet Assignment; Intermodal freight transportation; Scheduling; Routeing

Prerequisites :

Text Books :
1. Bowersox, D.J., Closs, D.J. dan Cooper, M.B. (2007). *Supply chain logistics management*. New York : Mc-Graw-Hill Education.
2. Rushton, A., Croucher,P. dan Baker, P.(2006). *The Handbook of logistics and distribution management*. United Kingdom : Kogan Page Limited.
3. Taniguchi, E., Thompson, R.G., Yamada,T. dan Duin, V.R. (2001). *City logistics. Network modelling and intelligent transport systems*. Oxford,UK : Pergamon.
4. Daskin M.S. (1995). *Network and discrete location. Models, algorithms, and applications*. Canada : John Wiley & Sons,Inc.

ENCV 8 0 0306
TRANSPORT NETWORK ANALYSIS
3 SKS

Learning Objectives : The students are able to optimize the performance of transportation network system

Syllabus : Introduction to the concept of network system and transportation network; Concept of mathematical programming; Graph Theory; Network Problem Optimization: Shortest Path Problem, Maximum Flow Problem, Minimum Cost Flow Problem, Transportation Problem , Transportation Assignment with user equilibrium approach; Network Representation Technique for solving transportation problem

Prerequisites :

Text Books :
1. Glover,F., Klingman, D., dan Phillips, N.V. (1992). *Network models in optimization and their applications in practice.* John Wiley & Sons, Inc.
2. Ahuja, R.K., Magnanti, T.L dan Orlin, J.B. (1993). *Network Flows .* New Jersey : Prentice Hall .
3. Sheffi, Y. (1985). *Urban Transportation Network. Equilibrium Analysis with Mathematical Programming Methods*, Prentice-Hall, Inc. New Jersey.

ENCV 8 0 0307
ADVANCED HIGHWAY PAVEMENT ENGINEERING
3 SKS

Learning Objectives : students are able to analyze the characteristics of transport demand and transportation

Syllabus : Overview of highway pavement: function and problems, research and development of pavement; Factors influencing pavement design and criteria: road traffic and axle loading; temperature, failure criteria;,; Traffic analysis: design procedures, loading concepts, equivalent single wheel load factors; Stress and Strains in Flexible Pavement: single layer system, multi layered system; Material Characteristics: material –unbounded and bounded materials, unsaturated granular materials, Advance Testing for unsaturated granular materials, Small strain in subgrade layer, Elastic Modulus and measurements, Medium strain in sub-base and base layer, Cyclic loading Testing and models, Micro mechanic theory on granular materials, Small strain in Bituminous materials, Modulus Resilient, Advance Testing and Model on asphalt concrete; Pavement performance: Serviceability, Distresses, NDT equipment and apparatus; Stress and Deflection in Rigid Pavement: Stress due to curing, Stress and deflection due to loading, Stress due to friction

Prerequisites :

Text Books :

1. Adib K. Kanafani. Transportation Demand Analysis. Mc Graw-Hill
2. Marvin L. Manheim , Fundamentals of Transportation Systems Analysis. Vol 1 : Basic Concepts , The MIT Press
3. Moshe Ben-Akiva&Steven R. Lerman , Discrete Choice Analysis; Theory & Application to Travel Demand. The MIT Press.

ENCV 8 0 0308
TRANSPORT DEMAND ANALYSIS
3 SKS

Learning Objectives : Students should be able to analyze travel and transportation demand characteristics

Syllabus : Basics of transportation system analysis, transportation demand, theoretical aspects of trip demand, micro-economic theory of travel demand, urban transportation demand analysis characteristics, characteristics and analysis of inter-urban travel demand, analysis of air transport demand and demand analysis of transportation of goods, discreet choice analysis method

Prerequisites :

Text Books :

1. Adib K. Kanafani. Transportation Demand Analysis. Mc Graw-Hill
2. Marvin L. Manheim , Fundamentals of Transportation Systems Analysis. Vol 1 : Basic Concepts , The MIT Press
3. Moshe Ben-Akiva&Steven R. Lerman , Discrete Choice Analysis; Theory & Application to Travel Demand. The MIT Press.

ENCV 8 0 0309
TRANSPORT SAFETY
3 SKS

Learning Objectives : Students should be able to design prevention program and transportation safety measures, in particular road transportation

Syllabus : Introduction: Global and Indonesian transportation safety condition; Transportation safety management system; Definision of Transportation Accidents and Safety; Review on air transportation safety. Review on water transportation safety; Review on railway transportation safety; Road safety: Causation Factors: Human (Drivers), Vehicles and Road and environment factors; Road accident data: road safety problem in Indonesia, Eksposure, riCredit Units and consequences of traffic accidents, Identification of black spots; Preventif measures and Road Audit, Basic traffic accident model-Relationship between accidents, vehicles and populations; Economic evaluations and Transportation Safety Programs

Prerequisites :

Text Books :

1. Khisty, CJ., Lall KB., (1998), Transportation Engineering, An Introduction, Prentice Hall, New Jersey
2. Evans, Leonard, (1991), Traffic Safety and the Driver, Van Nostrand Reinhold, New York.
3. Tjahjono, T (2011). Analisis Keselamatan Lalu Lintas Jalan, Lubuk Agung, Bandung.

ENCV 8 0 0310
TRANSPORT ECONOMICS
3 SKS

Learning Objectives : Students should be able to analyze transportation system demand and analysis based on economic theory and travel behavior, able to analyze long-term and short-term economic investment of transportation projects including exteranlities cost and funding aspects

Syllabus : Introduction to Transport Economics; demand and supply concepts of transportation system; Spatial problems: movement, transport and location; transportation demand, cost and direct benefit of transportation and cost recovery; External costs of transportation: congestion, pollution, accidents; Transprotation investment: basics of pricing, understanding investment decision (BCR< IRR and NPV); and; Econometric analysis: efficiency frontier methods; demand forecasting; discrete choice models of travel behavior

Prerequisites :

Text Books :

1. Kenneth Button, 2010., Transport Economics 3rd edition, Edward Elgar Publisher.
2. Stuart Cole, 2005, Applkied Transport Economics. Policy, management & decision making 3rd edition, Kogan Page.
3. Quinet, E, Vickerman, R dan Vickerman RW, 2005. Principle of Transport Economic, Edward Elgar Publisher

ENCV 8 0 0311
RAILWAY ENGINEERING AND PLANNING
3 SKS

Learning Objectives : Students should be able to understand strategies in constructing railways and railway facilities based on Transportation engineering and construction; able to plan and design upper and lower structures of railways, abutments, piers and railway signings, able to plan railway geometrics and stations designs and safety equipment designs

Syllabus : Introduction to railway technology development and railway transport; Design criteria; speed and double gauge, classification and

clearance for railway, railway structures (upper structures and lowe structures), conditions for at-grade intersections. Geometric design of railways; gauge and gauge widening, connections, switch, curve designs and superelevations. Equipment, reinforcement, ventilation, etc in railway tunnel construction. Functions of signs, signals, telecommunications, CTC, railway operation, station design, platform design for freight and containers, classification, markings and traffic control and other supporting facilities.
Prerequisites : None
Text Books :
1. Subarkah, I (1981) : Jalan Kereta Api, Idea Dharma, Bandung
2. PJKA (1986) : Perencanaan Konstruksi Jalan Rel (Peraturan Dinas No. 10)
3. Bonet (1998) : Practical Railway Engineering
4. N. Shadrin, L. Perelman et. Al, Railway Construction

ENCV 8 0 0312
PORT PLANNING AND MANAGEMENT
3 SKS
Learning Objectives : Students should be able to design ports based on technical, operational and environmental aspects for integrated port facilities development, able to design port layouts and port facilities buildings
Syllabus : Definition of ports based on the functions, purposes and types of ports, port design concepts: major design factors in port design: types and sizes of ships, space requirement, existing and forecast traffic of ships and freight; Performance indiators of port and port facilities demand based on Berth Occupancy Ratio (BOR), service time, productivity and utilities; Instruments used in port design: Strategic Plan of Ports, Ports masterplan, Land-use plan; Port location and layout plan based on engineering, operational and environemental aspects; Port facilities demand analysis; Port facilities design: aspects of ship type and size, characteristics, forces: wind, wave, tides and current; Breakwater design; Introduction to port design (types, dimension, manouvre basin, location and approach channel), fender system (definition, types and equipment); Pier designs
Prerequisites : None
Text Books :
1. Quinn A.D, Design and Construction of Port and Marine Structure, McGraw Hill, New York, 1972
2. UNCTAD, Port Development: A Handbook for Planners in Development Countries, United Nations, New York, 1983
3. OCDI, Technical Standard for Port and Harbour Facilities, 1991
4. Direktorat Pelabuhan dan Pengerukan, DITJEN HUBLA, Pedoman Teknis Pemilihan danPenetapan Lokasi Pelabuhan, 2003

ENCV 8 0 0313
PUBLIC TRANSPORT PLANNING AND OPERATION
3 SKS
Learning Objectives : Students should be able to plan and design public transport system operation
Syllabus : Components of public transport, design and operation concepts of public transport, classification of public transport modes, technologies and operational characteristics of public transport vehicles, facilities and system, Organisation, Public transport planning in urban areas, short-term planning, system and performance evaluation, network planning, operational management and planning, public transport system and urban development, funding and tariff mechanism
Prerequisites : None
Text Books :
1. Avishai Ceder , Public Transit Planning and Operation. Theory , Modelling and Practice. Elsevier
2. G.A. Giannopoulos, Bus Planning and Operation in Urban Areas : A Practical Guide. Avebury
3. Vucan Vuchic, Urban Public Transportation Systems and Technology. Prentice Hall

ENCV 8 0 0403
WATER RESOURCES MANAGEMENT
Learning Objectives : Acknowledge the ability to work individually and/or in a group in assessing various aspects within the scope of water resources management. Acknowledge the ability to present the group-work results systematically in the form of written document and the ability to perform verbal presentation.
Understanding that water is the basis for all living ecosystems and habitats and part of an immutable hydrological cycle that must be respected if sustainable development of human activity and well-beings are to be achieved.
Syllabus : : Scope of Water Resources Management, IWRM (Integrated Water Resources Management) Concept, Water Utilization, Control of Water Destructive Force, LID (Low Impact Development)/Water Conservation, Water-related Infrastructures, Hydro-Economy, Optimization Techniques in IWRM and Analysis & Synthesis of (existing) WRM Master Plan
Prerequisites :
Text Books :
1. Undang No. 7 Tahun 2004 tentang Sumber Daya Air,Mays, Larry W., 1996. Water Resources Handbook. McGraw-Hill, Loucks, Eric D., 1998. Water Resources and the Urban Environment. ASCE.etc.

ENCV 8 0 0405
SURFACE WATER QUALITY MODELING
Learning Objectives : have the basic ability to develop water quality modelling.
Syllabus : Overview water-quality modelling, introduction to fundamental quantities and units, mathematichal models Reaction Kinetics; reaction fundamentals, Analysis of Rate Data, Stoichiometry,Temperature Effects. Mass Balance, Staedy-State Solution, and Response Time. Particular Solution, Feedforward System of Reactors. Feedback System of Reactors Computer Methods : Well-Mixed Reactors. Particular Solution.
Prerequisites : None
Text Books : Surface Water – Quality Modelling., Steven C. Chapra

ENCV 8 0 0406
GROUND WATER RESOURCES MANAGEMENT
3 SKS
Learning Objectives: Having basic ability to understand properties and characteristics of groundwater movement within regional hydrology concept also basic concept for the mathematics formulation.
Able to applicating the formulation as a tool for analyzing groundwater resources quality in regional planning and design
Syllabus : Basic principles; property, classification; Groundwater movement equation and hydrodynamical disperse, numerical model; Groundwtaer geology; Groundwater in hydrology cycle, Groundwater regional; Evaluation on groundwater resources; groundwater and geotechnics problem; Groundwater pollution; Introduction on numerical model for groundwater pollution transport
Prerequisites : Fisika Mekanika & Panas, Kalkulus, Dasar Komputer
Text Books:
1. Ground Water, R. Alaan Freeze dan John A. Cherry
2. Dynamics of Fluids in Porous Media, Jacob Bear

ENCV 8 0 0804
EMISION CONTROL ON SOLID WASTE TREATMENT UNIT
3 SKS
Learning Objectives : Students have the ability on: (i) Implementation of a framework considering building and immission control law in planning; (ii) Assessment of the impact of pollutants on the environment; (iii) Selection of appropriate emission reduction methods within the given planning context; (iv) Understanding of processes relevant to environment in the context of planning; (v) Independently work on an engineering task
Syllabus : Planning permissions according to the immission control law in Europe and Asia; World Bank standards; Environmental impacts and effects – spreading and exposure, effects on man, effects on enlivened and unenlivened environment, fate and behavior of harmful substances as well as their decomposition; Emission reduction methods for landfill; thermal and biological treatment plants; Emission control methods;Assignment: material flows and their effects with regard to residual waste treatment.
Prerequisites : None
Text Books : None

ENCV 8 0 0806
HAZARDOUS AND INDUSTRIAL WASTE MANAGEMENT
3SKS
Learning Objectives: Students are expected to understand and be able to apply process and technology in industrial and hazardous management within the framework of pollution control system.
Syllabus : Industrial process and manufacturing and economic development; Handling of excess (byproducts) of industrial activities; Rules and regulations in the environmental management of industrial activities; Principle of industrial and hazardous waste management; Toxicology and threats of industrial and hazardous waste on the environment; Concept of carrying capacity and environmental components in the management of industrial waste; Sources, types and characteristics of the industrial wastebased on raw materials, and processesas well as productsused; Impact of wastes pollution (liquid, solidandgas) in humans health and the environment;Pollution prevention and waste minimization in industry activities; Processes and waste technology for liquid, solid and gas waste; Principles of environmental remediation for contaminated sites by industrial/ hazardous wastes;and Lesson learnt from selected case studies.
Prerequisites : None
Text Books:
1. Remediation Engineering: Design Concept, Suthan S., CRC Lewis Publishers, 1999;
2. Innovations in Ground Water and Soil Cleanup: From Concept to Commercialization, National Research Council. National Academy Press. 1997:
3. Environmental Hydrogeology, Philip E. LaMoreaux [*et al*.], CRC Press. 2009:
4. Introduction to the Principles of Hazardous Waste Management,Firdaus Ali, Global Enviro. 2011.

ENCV 8 0 0505
TIME AND COST MANAGEMENT
3 SKS
Learning Objectives : Time and cost management forms the basic foundation of project management discipline. Students are expected to be able to identify and evaluate the project plan and

schedule and develop project a comprehensive project cost and budget baseline

Syllabus : Project Management Overview and Concepts; Project Time Management; Activity Definition; Activity Sequencing; Activity Resource Estimating; Schedule Development; Schedule Control; Project Cost Management; Planning for Cost Management; Cost Estimating; Cost Budgeting; Cost Control

Prerequisites : None

Text Books :

1. Project Management Institute. (2008). *A Guide to the Project Management Body of Knowledge:* (4th ed.). Project Management Institute.
2. Project Management Institute (2006) Practice Standard for Work Breakdown Structures, Second Edition, Newtown Square, PA: Project Management Institute.
3. Gray, Clifford and Larson, Erik (2008) Project Management: The Managerial Process, Fourth Edition, New York: McGraw-Hill/Irwin
4. Project Management for Engineering and Construction, Garold D. Oberlender, McGrawHill, 2nd Edition, 2000
5. Dagostino, F.R and Feigenbaum L., Estimating in Building Construction. Sixth Edition w CD ROM, Prentice Hall NJ 2003.
6. Ostwald, Phillip F, McLaren, Timothy S. Cost Analysis and Estimating for Engineering and Management. Pearson Education, Inc Prentice Hall 2004

ENCV 8 0 0506
QUALITY AND RISK MANAGEMENT
3 SKS

Learning Objectives : Students are expected to be able to understand the principles of Planning, Standard and Control and Quality and risk management in project including risk identification, risk analysis, and risk response.

Syllabus : Definition and benefit of quality and risk management, and risk impact in obtaining project quality ;Project quality including needs identification and common standard used in obtaining the expected quality; Documentation and project execution process and be able to evaluase process and project deliverable process ;Evaluation the project result and innovation regarding to quality management ;Risks contribute to the failing of quality projects; Planning and potential risk identification during project ;Methods and software to analysis the identified risk rangking ;Identification for risk response in order to minimize impact from risks ; Risk management application which has been widely used in various projects

Prerequisites : None

Text Books :

1. Project Management Institute. (2008). *A Guide to the Project Management Body of Knowledge:* (4th ed.). Project Management Institute.
2. Required: Kerzner, Harold. Project Management Best Practices: Achieving Global Excellence, 2nd Edition. Hoboken, New Jersey: John Wiley & Sons, Inc., 2010
3. Flanagan, R, George Norman. (1993). Risk Management and Construction. Oxford, Blackwell Scientific Publication.

ENCV 8 0 0507
PROCUREMENT MANAGEMENT, CONTRACT AND CLAIM ADMINISTRATION
3SKS

Learning Objectives : the course is provided a knowledge and understanding of procurement management including contract definition, market analysis, tender process, contract planning, contract administration and management, legal aspect related to contract, form of claims and problem-solving process in procurement events.

Syllabus : Identify the needs for procurement process and management **;** Identify and record the goods & services process. **;** Bidding information processing, evaluation, selecting, and negotiating contract according to the laws and regulations in administraction contract process **;** Administration contract management, project contract closure **;** Identify problems related to claims in contract process

Prerequisites : None

Text Books :

1. Project Management Institute. (2008). *A Guide to the Project Management Body of Knowledge:* (4th ed.). Project Management Institute.
2. Peter Bailey et 2008; Procurement, Principles and Management. Prentice Hall
3. Kenneth Lysons et al 2008; Excellence in Procurement: How to optimise costs and add value.
4. Project Procurement Management: Contracting, Subcontracting, Teaming" by Quentin W. Fleming, (Tustin, CA: FMC Press).

ENCV 8 0 0602
HUMAN RESOURCE AND PROJECT COMMUNICATION MANAGEMENT
3 SKS

Learning Objectives : This course will covers the role of the human resource function, social and legal environment, human resource strategy, resource planning, recruiting, performance management, employee relations, and organizational policies. As Communications management being one of the essential functions that can affect the outcome of a project, the students will learn how to identify the appropriate audiences, develop appropriate communications media, establish a communications schedule, and manage the flow of information in and out of the project team. Learn

the tools and techniques that project teams can use to build an effective communications plan.
Syllabus : Upon completion of this course, students will be able to: explain the importance of leadership, human resources management and communication generally and their application in the project environment specifically ; identify leadership qualities and traits for successful project management ; establish organizational policies and standards for project teams ; explain the principles of communication management and their application in projects ; explain the impact of personal communications and related issues in the project environment ; Perform human resource planning functions ; Conduct an effective identification and analysis of project stakeholders ; Develop an effective project information management approach ; Apply communication methods and tools for an effective communication plan ; Lead project teams through more effective communications
Prerequisites : None
Text Books :
1. Project Management Institute. (2008). *A Guide to the Project Management Body of Knowledge:* (4th ed.). Project Management Institute
2. Bratton, J. and Gold J., 2007. Human Resource Management: Theory and Practice. Basingstoke, UK: Palgrave Macmillan. (Hereafter referred to as Bratton and Gold.)

ENCV 8 0 0702
PUBLIC PROJECT INVESTMENT AND FINANCE
3 SKS
Learning Objectives : Students are expected to be able to understand and to evaluate the financing system and public policies related to varous infrastructure projects development.
Syllabus : definition and concept of infrastructure investment; concept and process of infrastructure development; principle of politic policy and public policy analysis for infrastructure development; concept and institutional system of infrastructure; feasibility analisis of public and private partnership; concept and scheme of public and private partnership; concept and principle of public and private partnership; concept and implementatioin of infrastructure project; concept and principle of public fund based investment financing; concept and principle of alternative financing for infrastructure investment; concept and principle of value for money for infrastructure development; concept and principle of social engineering for infrasturcure project development
Prerequisites : None
Text Books :
1. Sullivan, W., Bontadelli, J. And Wicks, E., Engineering Economy, 11th ed., Prentice Hall Inc., New Jersey, 2000
2. Stermole, F. M., Economic Evaluation and Investment Decision Methods, Golden, 1984
3. Project Finance
4. Infrastructure Financial analysis
5. Undang-undang dan Peraturan Pemerintah terkait pembangunan infrastruktur
6. Connecting East Asia : A New Framework for Infrastructure. ADB, JBIC, and The World Bank, 2005. (CEA)

ENCV 8 0 0703
FUNDAMENTALS OF PUBLIC PRIVATE PARTNERSHIP
3 SKS
Learning Objectives : Students are expected to be able to understand and to evaluate the sytem, process, and policies related to public private partnership for infrastructure projects development
Syllabus : definition and concept of public private partnership; defintion and concept of public private partnership (PPP) and PPP project financing; policy process and strategy related to the public private partnership; economic analysis related to PPP based investment;PPP based project feasibility; technical and economical analysis for public private partnership; concept and principle of resource planning in public private partnership projects; documentation and administration process for public private partnership; concept and principle for procurement, mediation and litigation in public private partnership project; concept and principle of cost analysis and mitigation in public private partnership; concept and principle of performance assesment for public private partnership
Prerequisites : None
Text Books :
1. Dikun, S. Infrastruktur Indonesia: Sebelum, Selama, dan Pasca Krisis. Bappenas, 2003. (SDI);
2. Course Materials (CMA) will be provided;
3. Connecting East Asia : A New Framework for Infrastructure. ADB, JBIC, and The World Bank, 2005. (CEA)

ENCV 8 0 0704
INFRASTRUCTURE INVESTMENT
3 SKS
Learning Objectives : Students are expected to be able to understand and to evaluate the financing system and policy related to various infrastructure projects
Syllabus : Definition and concept of infastructure investment; Indonesia's global economic condition and the relation to infrastructure investment climate; principle of political policy and economic analysis to infrastructure development; financing system for infrastructure development; definition and concept of public private partnership (PPP) and PPP-based project financing; concept and

basic principle for project financing; economical analysis related to investment feasibility and investment availability; concept and principle of decision making for infrastructure development; concept and principle of public fund-based investment financing; concept and principle of banking fund infrastructure investment financing; concept and principle of infrastructure investment financing by market; concept and principle of alternative financing for infrastructure investment; concept and principle of value for money for infrastructure development; concept and investment process for infrastructure investment.

Prerequisites : None

Text Books :

2. Leland Blank-Anthony Tarquin ; Engineering Economy ; 5th edition ; McGraw Hill . 2002
3. Sullivan, W., Bontadelli, J. And Wicks, E., Engineering Economy, 11th ed., Prentice Hall Inc., New Jersey, 2000
4. Stermole, F. M., Economic Evaluation and Investment Decision Methods, Golden, 1984
5. Project Finance
6. Infrastructure Financial analysis

ENCV 8 0 0705
LEGAL AND BUSINESS ETHICS IN INFRASTRUCTURE
3 SKS

Learning Objectives :

1. To provide broad understanding to students on the philosophy of Article 33 Constitution 1945, and the position of Constitutional Court on private sector participation in infrastructure provision in Indonesia;
2. To provide a brief overview of laws and regulations related with infrastructure sectors with respect to private sector participation;
3. To explain the students on the principle of contract laws;
4. To provide the students with real case study of various cooperation agreement of certain sectors;

Syllabus : Fundamentals of PPP; Nature of Concession Agreement in Developed and Developing Countries; Review of Laws and regulations Related to infrastructure sectors; Overview of Perpres 67/2005; What is a Private Operator Concession Agreement; Obligations of Private Operator; Cooperation Agreement in the Concession of Hotel Property, (*A Real Case Study*); Cooperation Agreement in the Concession of Seaport, (*A Real Case Study*); Cooperation Agreement in Toll Road Sector (*A Real Case Study*); Review of Contracts Related to PPP (*A Real Case Study*)

Prerequisites : None

Text Books :

1. Constitution 1945 & Its Amendments;
2. Law 15/1985 on Power along with its government regulations;
3. Law 22/2001 on Oil and Gas along with its government regulations;
4. Law 34/2004 on Road along with its government regulations;
5. Law 36/1999 on Telecommunication along with its government regulations;
6. Law 7/2004 on Water Resource along with its government regulations;
7. Law 32/2004 as amended by Perpu 2/2005 on Regional Autonomy;
8. Perpres 67/2005 on Cooperation Between Government and Legal entities in providing Infrastructure
9. Various Decisions of Constitutional Court relating to Laws on infrastructure sectors.
10. Various Decisions of Supreme Court relating to regulation on infrastructure sectors.
11. Book with the title : Privatisasi versus Neo-Sosialisme Indonesia prepared by A. Effendy Choirie;
12. Any other books related with the topic;
13. Various [Draft] concession agreement between government and business entities in infrastructure provision

ENCV 8 0 0109
BRIDGE STRUCTURAL DESIGN
3 SKS

Learning Objectives: Students should be able to comprehend the development of bridges structures, able to determine bridge locations and layouts, identify types of bridge structural system and types of steel and concrete bridges and able to analyze and design upper structure and lower structure of bridges and understand various methods of bridge constructions.

Syllabus: Development and history of bridges; location and layout of bridges; regulations on road and railway loading; bridge structure system: upper and lower structures and foundations and bearings, geometric and types of bridges; wood bridges, steel bridges: rolled and plate girders, composites, orthotropic decks, truss arch, cable-stayed bridges; concrete bridges: plate bridge, deck girder, prestressed segmental bridges, truss reinforced concrete bridges, frame bridges, arch bridges, cable-stayed bridges and prestressed bridges; substructures, pier and abutment; bridge analysis and design: bridge loading, load distribution on stringer, longitudinal beam, and floor beam, prestessing effect, structural analysis and design; loading on substructures, soil pressure, seismic design; Bearing design

Prerequisites: Structural Design

Text Books:

1. MS Troisky, Planning and Design of Bridges, John Wiley & Sons, Inc, New York, 1994
2. ________, Pedoman Perencanaan Pembebanan Jembatan Jalan Raya – SNI No. 1725-1989-F, Departemen Pekerjaan Umum
3. ________, Peraturan Perencanaan Teknik

Jembatan – Bridge Management Systems, 1992, Departemen Pekerjaan Umum
4. RM Barker, JA Puckett, Design of Highway Bridges, based on AASHTO LRFD Bridge Design Specifications, John Wiley & Sons, New York, 1997
5. PP Xanthakos, Theory and Design of Bridges, John Wiley & Sons, New York, 1994
6. N Taly, Design of Modern Highway Bridges, The McGraw-Hill Company, Inc., New York, 1998
7. Mathivat, J., The Cantilever Construction of Prestressed Concrete Bridges, John Wiley & Sons, 1983
8. Prichard, B., Bridge Design for Economy and Durability, Concept for New, Strengthened and Replacement Bridges, Thomas Telford, London, 1992

ENCV 8 0 0110
STRUCTURAL DESIGN OF HIGHRISE BUILDINGS
3 SKS

Learning Objectives: Students should be able to understand design procedures and prestressed concrete technology in accordance with the standard, as well as the application for building structures and long-span bridges, to adopt the design method based on Load and Resistance Factored Design (LRFD), and serviceability of strengths, stability and bending aspects, asn presetress anchorage zone, to understand high-rise building structural designs procedures, from conceptual design to final design, both for gravitational loading and lateral loading

Syllabus: Definition, history, basic concept of presetressed concrete, pre- and post-tensining technology. Properties of concrete material and reinforcing bar and prestresssing steel. Prestress losses. Analysis on bending due to work loading (crossection of crack not elastic liniear). Ultimate strength of prestressed concrete crosssections. Design of prestressed concrete crosssection. Design of flexural crosssection. Camber dan deflection. Analysis of continuous beam, Shear strength on prestressed beam. Bond and anchorage of prestressed steel. Application of continuous prestressed concrete for slab, Application of prestressed concrte for bridges. Design criteria of high-rise buildings, Loading: gravitation, wind -and earthquake. Structural system: gravity retaining and lateral retaining. Modelling and Analysis. Frame designs (concrete and steel), shear walls and double-sided shear walls

Prerequisites: None

Text Books:

1. SNI 03-2874-2002:"*Tatacara Perencanaan Struktur Beton untuk Bangunan Gedung*", Badan Standarisasi Nasional, 2002
2. _____________, *Building Code Requirements for Structural Concrete (ACI 318-05)*, Reported by ACI Committee 318
3. Lin, T.Y. & Burn, *Design of Prestressed Concrete Structures*, Third Edition, John Wiley & Sons, 1982
4. Nilson, A., *Design of Prestressed Concrete*, 2nd Edition, John Wiley & Sons, 1987
5. Edward G. Nawy, *Prestressed Concrete, A Fundamental Approach*, 2nd edition, Prentice Hall, 1996
6. Podolny, W. and Muller, JM., *Construction and Design of Prestressed Concrete Segmental Bridges*, John Wiley & Sons, 1982
7. _________________, *Tata Cara Perencanaan Struktur Baja untuk Bangunan Gedung*, SNI 03-1729-2002, BSN, 2002
8. __________________, *Specification for Structural Steel Buildings*, ANSI/AISC 360-05
9. _________________, *Seismic Provision for Structural Steel Buildings*, ANSI/AISC 341-05
10. __________, *Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications*, ANSI/AISC 385-05

ENCV 8 0 0111
PLATE AND SHELL
3 SKS

Learning Objectives: Students should be able to understand and apply finite element method for the analysis of plate and shell structural designs

Syllabus: Plates: Plate formulation; Plate element and shear deformation; Kirchoff element; Validation and performance test of plate element; Shell: Geometric description, virtual working principles adn variational shapes, Isoparametric elements, facet-plan type element; Structural design and analysis of shells; plate and shell structural concepts, types and shapes of shell structures, Several aspects of FEA for shell structures, Design and analysis: roof structures; cylindrical shell, gable HP, Folded Plate, Dome, tanks structures with circular prestressing; silos and bunkers

Prerequisites: None

Text Books:

1. I. Katili, Metode Elemen Hingga untuk Pelat Lentur, Penerbit Universitas; 2003
2. David P. Billington, Thin Shell Concrete Structures, Second Edition, McGraw Hill Book Company, New York, 1982

ENCV 8 0 0207
DYNAMICS AND EARTHQUAKE IN GEOTECHNIC
3 SKS

Learning Objectives: Able to calculate and analyze the dynamic characteristics of the soil foundation response to dynamic forces

Syllabus: Dynamic loads on the ground; fundamental vibrations; waves in elastic media: dynamic properties of soil; vibrations of the foundation; effect of earthquakes on the ground, ground seismic lateral pressures; liquefaction; foundation of the machine above the pole. Vibration theory; waves in elastic media: dynamic properties of soil; foundation and vibration. Introduction to the analysis of probabilistic earthquake hazard; amplication analysis of earthquake ground; the phenomenon of liquefaction; slope stability analysis of the earthquake; analysis of lateral earth pressure due to earthquake. The introduction of improved methods to lower the ground vibration and earthquake effects on the ground

Prerequisites: None

Text Books:

1. S.L. Cramer, Geotechnical Earthquake Engineering, Prentice Hall, 1996.
2. Braja M. Das, Principles of Soil Dynamics, PWS-KENT Publishing Co., 1993
3. Chopra A.K., Dynamics of Structures, Printice Hall, 1995

ENCV 8 0 0208
SELECTED TOPICS IN GEOTECHNICS
3 SKS

Learning Objectives: Students are expected to understand basic things related to the Physics of Geological and Geophysical Applications in Geotechnical investigation; introduction of Soil and Rock as well as insight into the understanding of geology; Applications Geo-hydrology; as well as matters related to Rock Mechanics and Rock Engineering

Syllabus: Engineering geology of Indonesia: Geological processes, the theory of plate, Indonesia Regional tectonics, climate and weathering processes of rocks, soil surface; Introduction to basic principles of geophysics and geophysical applications in geotechnical investigations: estimating geo-electric, seismic refraction, geo-sounding, geo-sonar: Application Geohydrology; Rock Engineering: Types and behavior of rocks; testing and correlation of intact rocks, the behavior of rock discontinuities, description and parameters of rock mass; rock slopes, the basic use of stereonets, Kinematic analysis and stability; rock foundations: shallow foundation and deep foundation. Reinforced soil wall: the type of reinforced soil wall system, extensible and inextensible reinforcement elements, reinforcement testing, analysis and design of reinforced soil walls

Prerequisites: None

Text Books:

1. Klasifikasi Massa Batuan; Made AstawaRai, PedomanajaranMekanikaBatuan ITB, Bandung, 1997
2. Decision-making for Ordinary Foundations on Rock; Miller R.P, Proceeding of Conference on Rock Engineering for Foundations and Slopes, ASCE, New York, 1976.
3. PengantarAnalisisKemantapanLereng; Soe dartoNotosiswoyo&PartantoProjosumarto, JurusanTeknikPertambangan, ITB, 1984.
4. Soil Mechanics in Engineering Practice; Terzaghi, K. & Peck, R.B.,John Wiley and Sons Ltd, New York, 1967.

ENCV 8 0 0315
ADVANCED HIGHWAY MAINTENANCE
3 SKS

Learning Objectives: Student is able to analyze pavement maintenance system with preservation approach in the scale of network and regional

Syllabus: Pavement management system: pavement maintenance operation cost effective approach, project level and network level approach with model and element, life cycle cost analysis, data capture and analysis; Pavement distress analysis: type and level of severity defined by roughness, skid resistance and pavement index; Structural pavement evaluation: AASHTO model, Bina Marga model, back calculation, pavement condition evaluation, tools and equipment, distress observation with destructive and non-destructive testing method; Rehabilitation and maintenance techniques with local, globalized and major maintenance; preventive or preservation approach; Asset management: framework, tools, program, sustainability system, application of asset management; recent technology on pavement maintenance and materials.

Prerequisites: None

Text Books:

Optimal Timing of Pavement Preventive Maintenance Treatment Applications, NCHRP Report 523

ENCV 8 0 0316
URBAN TRANSPORT PLANNING
3 SKS

Learning Objectives: Students should be able to describe basic theories and to understand transportation planning in general and urban transportation in particular, understand macro urban transportation planning, to apply macro urban transportation planning academically and pragmatically.

Syllabus: Introduction of urban system and the relationship with urban transportation system incuding policy making and evaluation process, types of urban transport and technologies, processing of data and other information, transportation system interaction and land use, software used in urban transportation planning, interaction of transportation system and land-use; introduction to software in the design of urban transportation system.

Prerequisites: None

Text Books:

1. Meyer, MD & Miller EJ, Urban Transportation Planning, McGraw Hill, 1984
2. Bruton MJ, Introduction to Transport Planning, Hutchinson & Co, 1985
3. Papacostas CS & Preveduoros PD, Trans-

portation Engineering and Planning, 1993
4. Sigurd Grava (Eds), Urban Transport System, Choices for Communities, McGraw Hill, 2003
5. Suyono Dikun (Eds), Infrastruktur Indonesia, Bappenas, 2003

ENCV 8 0 0317
TRANSPORT ENVIRONMENTAL IMPACT
3 SKS
Learning Objectives: Students should be able to analyze various impacts of transportation on environment and should be able to conduct traffic safety studies, identify high-accident locations, and propose crash countermeasure and potential engineering solutions
Syllabus: Introduction to environmental impact analysis, TIA documentations procedures and related regulations, Transportation impacts: air pollution, noise, vibration, land taking and severance, delay, TIA, traffic accident data analysis, blackspot analysis
Prerequisites: None
Text Books:
1. Peraturan Pemerintah No. 27 Tahun 1999 Tentang : Analisis Mengenai Dampak Lingkungan Hidup
2. Cohn, LF, McVoy, GR, Environmental Analysis of Transportation System, John Wiley & Sons, 1982
3. Departement of Transportation and IHTE, Road and Traffic in Urban Areas, 1988
4. Departemen of Transportation Welsh Office, HMSO, Calculation of Road Traffic Noise, 1988.

ENCV 8 0 0318
INTERMODAL TRANSPORTATION SYSTEMS
3 SKS
Learning Objectives: Students should be able to analyze the performance of inter-modal system of goods transportation
Syllabus: Strategic design of inter-modal transportation system (infrastructures and rolling-stock); logistic system; operations, designs and policies of inter-modal goods transportation; inter-modal technology; inter-modal terminal
Prerequisites: None
Text Books:
1. Bowersox, D.J., Closs, D.J. dan Cooper, M.B. (2007). *Supply chain logistics management*. New York : Mc-Graw-Hill Education.
2. Rushton, A., Croucher,P. dan Baker, P.(2006). *The Handbook of logistics and distribution management*. United Kingdom : Kogan Page Limited.
3. Lowe, D. (2005) Intermodal Freight Transport. Elsevier.

ENCV 8 0 0319
ADVANCED HIGHWAY MATERIALS
3 SKS
Learning Objectives: Students should be able to analyze the properties and characteristic of materials subjected to stress and strain, and the rheology of highway materials
Syllabus: Identification of material responsed based on tensions, compressions, bending, torsion, direct stress, multi axial and hardness concepts; Basic concepts of materials behaviours due to yielding and fractures; Rheology of liquids and solids; characterization of stiffness of asphaltic pavement materials, rutting modeling using shear method, flexible pavement deformation analysis using mechanistic method, modeling for fatigue cracks, dan damage due to water. Polymers materials and modification of pavement materials (polymers, and other additives); concrete asphalt materials tests using cyclic loading and temepraturs, asphalt characteristics tests dan material rheology (indirect tesile stress, contrabro, rheometer, wheel-tracking machine)
Prerequisites: None
Text Books:
1. Huang, Yang H. (2004). *Pavement Analysis and Design*, Pearson- Prentice Hall.
2. Young, J.F, Mindress, S., Gray, R.J., Bentur, A. (1998) *The Science and Technology of Civil Engineering Materials*, Prentice Hall
3. Correia, A.G. (1996) *Flexible Pavements*, Balkema.

ENCV 8 0 0320
TRANSPORTATION SYSTEMS OPERATIONS AND CONTROL
3 SKS
Learning Objectives: Students should be able to calculate strategic design of the operational control of transportation system covering traffic control of network system, mass transport, goods transport and air transport.
Syllabus: General: Scheduling, system, terminal operational system, traffic light system, traffic control, network control, traffic simulation principles and equipment, and intelligent transportation system. **Special Topic on Rail transport:** introduction to railway control system, signs/block system for railway operations, railway and station capacity. **Special Topic on Air Transport:** Navigational control/delay of aircraft movements, slot time management, and run-way, taxiway and apron capacity aspects in the airport operations
Prerequisites: None
Text Books:
1. Roger P. Roess, et al., Traffic Engineering (4th Edition). 4th Edition, Prentice Hall, 2010
2. Kazda, A dan Caves, RE, 2007. Airport Design and Operation, 2nd ed. Elsevier.

3. Pachl, J, 2002. Railway operation and control, Vtd Rail Pub

ENCV 8 0 0322
AIRPORT PLANNING AND MANAGEMENT
3 SKS
Learning Objectives: The students are able to design the air side and ground side of airport system
Syllabus: Introduction, Characteristics of the aircraft; Airport Master Plan, Airport capacity analysis, Airport Configuration ,Geometric Design of Landing Area, Apron and Terminal Gate System, Planning and design of terminal building and supporting building, Design of airport access road, Design of airport drainage, Environment and noise analysis
Prerequisites: None
Text Books:
1. Horonjef. R, Airport Planning,Macgrawhill
2. ICAO, Annex 14
3. FAA Circulair
4. Ashford, N., Terminal Building

ENCV 8 0 0809
CONTAMINATION AND SOIL REMEDIATION
3 SKS
Learning Objectives: Students can understand the problems of land contamination by industrial activity or accident and are able to design a remediation program as required by law
Syllabus: Some of the activities that potentially lead to contamination of the environment B3 material (soil and groundwater); Some of the types and forms of pollutants are the focus of B3; patterns and trip characteristics and the spread of contaminants in soil; Some of the impacts and risks that can be generated pollutants the environment; Several methods of elimination spread of contaminants in soil; contaminated land restoration method B3; recovery in Physical, Chemical, and Biochemistry; Some form of technical design of soil and groundwater remediation; economic and financial aspects for remediation projects, and some examples of case studies in the field.
Prerequisites: Environmental laboratory, Environmental Microbiology, Unit OperationsandProcess, Industrial and hazardous Waste Management, and Wastewater Treatment Design.
Text Books:
1. Remediation Engineering: Design Concept, Suthan S., CRC Lewis Publishers, 1999;
2. Innovations in Ground Water and Soil Cleanup: From Concept to Commercialization, National Research Council. National Academy Press. 1997:
3. Environmental Hydrogeology, Philip E. LaMoreaux [*et al*.], CRC Press. 2009:
4. Introduction to the Principles of Hazardous Waste Management,Firdaus Ali, Global Enviro. 2011.

ENCV 8 0 0603
PROJECT INVESTMENT AND FINANCING
3 SKS
Learning Objectives: Students are expected to be able to understand the concept of *valuation, organization*, and *funding* of projects and be able to evaluate the risk-return character of projects from multiple perspectives. Students will learn the fundamentals of project valuation as applied to construction projects, review the pros and cons of non-recourse financing and identify the major providers of such funds and the correlation between project structure and financial performance in project investment and finance.
Syllabus: Project Financing; Evaluating Project Cash Flow; Key Project Finance Risk; Types of Investments and disinvestments; Strategic Analysis of selected investment decisions; Valuation and Infrastructure Financing; Private Participation in Infrastructure Sectors; Financing Decisions; Contracts and Risk Management
Prerequisites: None
Text Books:
1. Brealey, Richard A., Ian A. Cooper, and Michel A Habib (1996), *Using Project Finance to Fund Infrastructure Investments, Journal of Applied Corporate Finance*, 9:3, 25-38
2. John D Finnerty (2007)., *Project Financing: Asset-Based Financial Engineering*, 2nd edition, John Wiley & Sons
3. E. R. Yescombe (2002), *Principles of Project Finance*, Academic Press.
4. Weber, Barbara and Alfen, Hans Wilhelm (2010), *Infrastructure as an Asset Class: Investment Strategy, Project Finance and PPP*, Wiley Finance.
5. Bodie, Zvi, Alex Kane and Alan Marcus (2008), *Essentials of Investments*, 7th edition, McGraw-Hill Irwin.

ENCV 8 0 0706
INFRASTRUCTURE AND REGIONAL DEVELOPMENT
3 SKS
Learning Objectives: Students are expected to be able to prepare strategic planning for settlement infrastructure, to carry out an analysis of settlement infrastructure considering the dynamics of urban development, and be able to integrate the provision of settlement infrastructure and urban development.
Syllabus: Overview of major infrastructure systems; Strategic planning for settlement infrastructure; dynamics of urban development; the needs of urban environmental infrastructure, Transportation Engineering, Town Planning and Urban Development, Design of Water and Wastewater Treatment Systems
Prerequisites: None
Text Books:

1. Peavy, H.S. Rowe, D.R. and Tchobanoglous, G. (1995), *Environmental Engineering*. McGraw Hill. NY.
2. Stein, Jay M. ed. (1998), *Public infrastructure planning and management*. Newbury Park, Calif.: Sage Publications.
3. Anderson, L. (2000), *Planning the Built Environment*. APA Press: Chicago, IL.

ENCV 8 0 0604
MANAGEMENT INFORMATION SYSTEM AND INFORMATION TECHNOLOGY
3 SKS
Learning Objectives: This course will examine the various levels and types of information systems required by an organization to integrate their information system needs and to design and implement information systems in order to support for a variety of tasks. Students are expected to be able to identify appropriate information system and technologies and its implementation in projects.
Syllabus: Introduction to Information Systems; Computer Based Information Systems; Software; Electronic Commerce; Strategic Information Systems Planning; Value Creation with Information Systems; Information Systems Governance & Auditing; Appropriating IT-Enabled Value Over Time; Information System Trends and Security, Privacy, and Ethics.
Prerequisites: None
Text Books:
1. R. Kelly Rainer, Efraim Turban and Richard Potter (2007), *Introduction to Information Systems - Supporting and Transforming Business* , John Wilay and Sons, Inc.
2. Laudon and Laudon (2011), *Essentials of Management Information Systems*, 9th edition, Prentice Hall.
3. Piccoli, G. (2011) Information Systems for Managers - Text and Cases, 2nd Edition Wiley.
4. Fuller, M., Valacich, J., and George, J. (2008), Information Systems Project Management, Pearson Education.

ENCV 8 0 0508
MANAGEMENT OF HEALTH, SAFETY AND ENVIRONMENT
3 SKS
Learning Objectives: Students are expected to be able to understand the basic principles of health and safety in construction projects and to evaluate the projects in terms of environmental friendly and safety culture.
Syllabus: Basic principles of HSE Management; Relevance of Work Productivity with HSE Management; Model Structure of HSE Process, Legal aspect and regulation related to HSE Management; Analysis and Evaluation of Risk in Construction Projects; Sources of Risk and Potential dangers; HSE Management in Construction Project; Environmental Management and Environmental Pollution Control in Project Implementation; Methods and Strategies for Disease control and Handling Accidents; Internal Audit for Construction HSE Program .
Prerequisites: None
Text Books:
1. Charles A. Wentz. *Safety, Health and Environment Protection*. McGraw-Hill Education (Int'l Ed.). 1999. ISBN-13: 978-0071168618.
2. Kumpulan Regulasi (UU, PP, Perpres, Permen, Kepmen, Perda, Pergub, dll), OHSAS 8001-2007, ISO 9001-2008, dan ISO 14001-2004.
3. On line referensi (Digital Journal dan Clipping Mass Media), Handout Kuliah, dan bahan bacaan lain yang relevan dengan materi kuliah.

ENCV 8 0 0707
INFRASTRUCTURE AND PROPERTY DEVELOPMENT
3 SKS
Learning Objectives: Students will be provided with a general understanding of infrastructure development with an emphasis on property development generally and sustainable housing in particular. The course will provide students with knowledge regarding to infrastructure supply such as principles of water and power supply, communication systems, standards at various levels of the settlements for health, education, & public facilities.
Syllabus: Course overview; Housing supply; transit oriented development; housing delivery system; land availability and cost; existence of property rights and registry; Zoning, community planning and density issues; Principles of water and power supply.
Prerequisites: None
Text Books:
1. Lee, Y.-C., Ridley, T. and Juma, C (2006), *Infrastructure, Innovation and Development*, International Journal of Technology and Globalisation, Vol. 2, Nos. 3/4, pp. 268-278.
2. Jeffrey D. Fisher and Robert S. Martin (2009), *Income Property Valuation* 3rd Edition, Dearborn Financial Publishing, Inc.

ENCV 8 0 0708
INFRASTRUCTURE AND CAPITAL MARKET
3 SKS
Learning Objectives: Students are expected to be able to examine the available securities that can be used to finance infrastructure project investment. The focus of this course will be on the design of these securities, the issuing process for these securities, the pricing of these securities, the securities covered include corporate and junk bonds, bank loans, common and preferred equity, commercial paper, securitization, as well as some recent innovations.

Syllabus: financial institutions; investment banking; bank risk management; Treasury market; equity investment; exchange offers; sales and trading; bond rating agencies; prepackaged bankruptcies; debtor-in-possession financing; pricing credit risk; hedge funds; innovation in capital markets;
Prerequisites: None
Text Books:
1. Frank J. Fabozzi and Franco Modigliani, *Capital Markets: Institutions, and Instruments*, 4th ed., Pearson FM
2. Donald E Fisher and Ronald J. Jordon (2009), *Security Analysis and Portfolio Management*, Prentice Hall, 6th Edition,
3. Mark Hirschey and John Nogsinger (2008), Investments Analysis and Behaviour, McGraw Hill

ENCV 8 0 0002
RESEARCH METHODOLOGY
3 SKS
Learning Objectives: Students are expected to be able to understand the concept of research methodology and apply the knowledge to develop research proposal. The evaluation process of this module will be assessed through midterm test, final test, individual tasks, and group assignments.
Syllabus: This course provides essential knowledge to develop thesis proposal and research framework.
Prerequisites: None
Text Books:
1. Nazir,Moh, Metode Penelitian, Ghalia Indonesia,2003
2. Keputusan Rektor UI No 628, Pedoman Teknis Penulisan Tugas Akhir Mahasiswa Universitas Indonesia, 2008
3. FTUI, Pedoman Penulisan Tesis, 2006
4. Direktorat P3M, Dirjen Dikti Depdikbud, Panduan Metode Penelitian,1992
5. Riduwan, Metode dan Teknik Menyusun Tesis, Alfabeta, 2006
6. Sukandarrumidi, Metodologi Penelitian, Gajah Mada University Press, 2006
7. Yin.Robert k, Studi Kasus Desain dan Metode, Rajagrafindo Persada, 2008
8. Sugiyono, Statistika untuk Penelitian, Alfabeta, 2006
9. Sugiarto,Teknik Sampling, Gramedia Pustaka Utama, 2001
10. Riduwan, Skala pengukuran variable-variabel penelitian,Alfabeta, 2002
11. Azwar. Saifudin, Reliabilitas dan Validitas, Pustaka Pelajar,1997
12. Marimin, Teknik dan Aplikasi Pengambilan Keputusan Kriteria Majemuk, Grasindo, 2004
13. Sugiyono, Statistik Nonparametrik untuk Penelitian, Alfabeta, 2003
14. Ritonga. A.R, Korelasi Dalam Statistik Nonparametrik, Lembaga Penerbit FEUI, 1992

ENCV 8 0 0003
SEMINAR
1 SKS
A Seminar/pre-thesis activity to provide students with skills to generate, analysis and organize ideas by means of problem solving techniques to make a proposal of their thesis.

ENCV 8 0 0810
WASTE TO ENERGY
3 SKS
Learning Objectives: Students are able to explain the characteristics and quality requirements of waste material that could potentially be recovered as energy, perform thermo-chemical conversion calculation on the energy content, and familiar with the alternative technologies available for waste treatment along with its application
Syllabus: Characteristic of WTE Feedstock & Thermo-chemical conversion, Technology in Waste To Energy, Thermal Technology - Municipal waste Combustion, MSW Handling, Quality Requirements, MSW Process to Energy with High-Value Products & Specialty By-Products, Ash Handling & Material Recovery, Emission Control from WTE Facilities, Application of WTE especially RDF in industry, Practical experiences in using RDF – Problems and solutions
Prerequisites: None
Text Books:
1. Young, G.C. 2010. Municipal Solid Waste to Energy Conversion Processes. A John Wiley & Sons, Inc., Publication. New Jersey.
2. Tchobanoglous, G., Theisen, H., Vigil, S.A. 1993. Integrated Solid Waste Management. McGraw-Hill International. New York.
3. Tchobanoglous, G., Kreith, F. 2002. Handbook of Solid Waste Management. 2nd Edition. McGraw-Hill. New York.
4. UNEP. 2005. Solid Waste Management. Vol. I and II. Cal Recovery Incorporated. California.
5. Kumpulan Regulasi (UU, PP, Perpres, Permen, Kepmen, Perda, Pergub, dll), Norma, Standar, Pedoman, Manual, dan lainnya terkait dengan pengelolaan persampahan
6. On line referensi (Digital Journal dan Clipping Media), *Handout* Kuliah, dan bahan bacaan lain yang relevan dengan materi ajar ini

ENCV 8 0 0004
THESIS
6 SKS
Thesis is a final project of Master Program. Thesis may include Theoretical Analysis and Literature Study of Topic Interest; Design, Analysis, Development & Simulation Works and Laboratory or a Combination of them.

ENCV 8 0 0314
SELECTED TOPICS IN TRANSPORTATION
3 SKS
Learning Objectives:
Syllabus:
Prerequisites
Text books:

6.2. MASTER PROGRAM IN MECHANICAL ENGINEERING

Program Specification

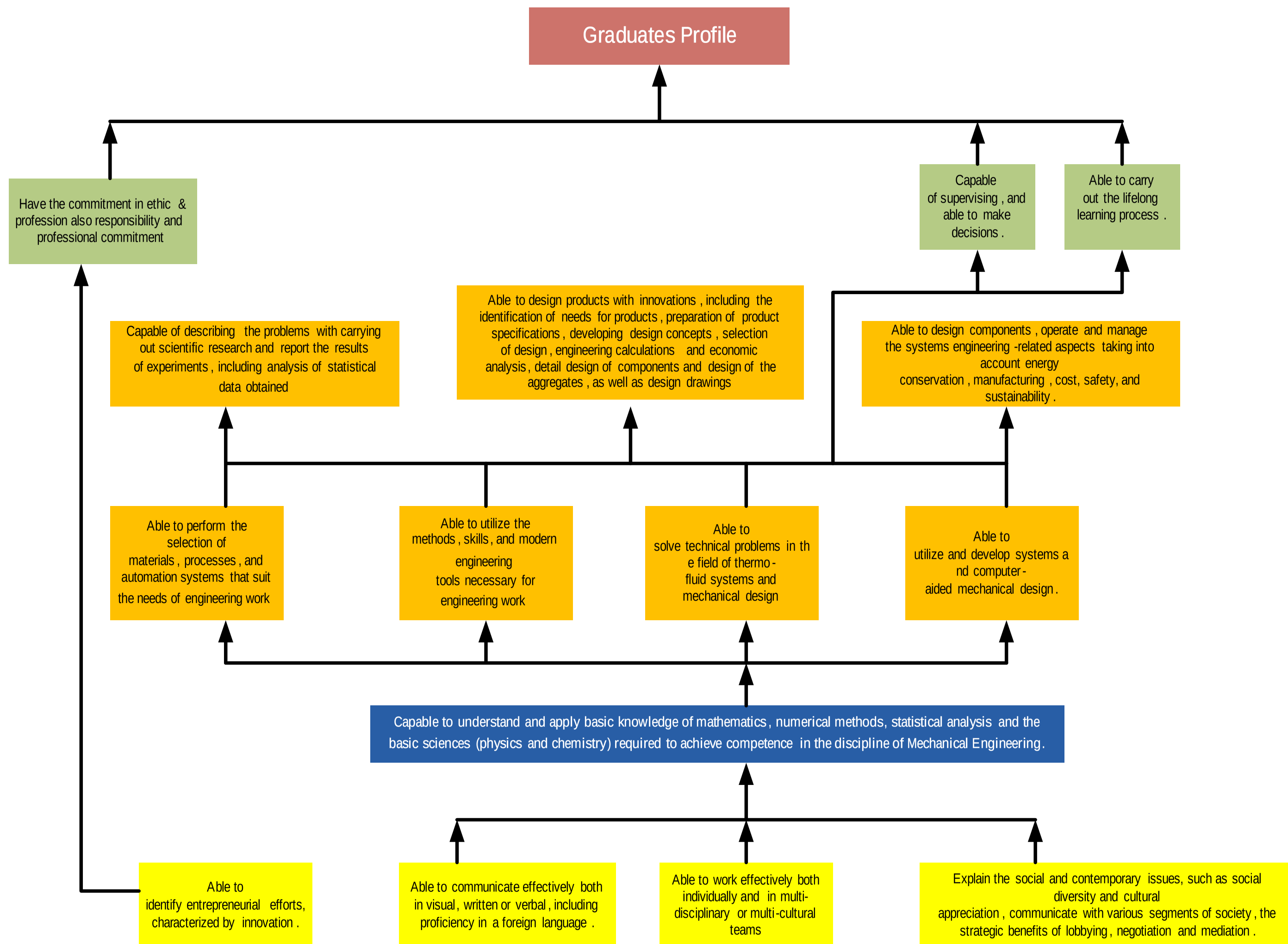
1	**Awarding Institution**		Universitas Indonesia
2	**Teaching Institution**		Universitas Indonesia
3	**Programme Title**		Master Program in Mechanical Engineering
4	**Class**		Regular
5	**Final Award**		Magister Teknik (M.T.)
6	**Accreditation / Recognition**		BAN-PT: A – accredited
7	**Language(s) of Instruction**		Bahasa Indonesia and English
8	**Study Scheme (Full Time / Part Time)**		Full Time
9	**Entry Requirements**		Bachelor Degree in Mechanical Engineering, Math and Physics; pass the entrance exam.
10	**Study Duration**		Designed for 2 years
	Type of Semester	Number of semester	Number of weeks /semester
	Regular	8	17
	Short (optional)	3	8
11	**Graduate Profiles:** Graduates who have the character of leadership and excellence in scholarship, research, expertise and professionalism in the field of Mechanical Engineering		
12	**List of Graduates Competences:** 1. Able to understand and apply knowledge of advanced mathematics, numerical methods, statistical analysis and the basic sciences (physics and chemistry) needed to resolve problems in Mechanical Engineering disciplines (Main Competence) 2. Able to describe and solve scientific problems by designing and conducting research, and report the results of research, including statistical analysis of data obtained (Main Competence) 3. Able to identify, formulate, and solve engineering problems in accordance with Technical Expertise area of Specialisation Mekanikalnya. (Main Competence) 4. Able to carry out product design innovations, including the identification of needs for products, preparation of product specifications, developing design concepts, selection of design, engineering calculations and economic analysis, detail design and design aggregate components, and design drawings by considering aspects of energy conservation, manufacturing, cost, safety, and sustainability. (Main Competence) 5. Able to utilize and develop the methods, materials selection, process, and automation systems, and modern engineering equipment, including computer-aided systems required for engineering work (Main Competence) 6. Able to communicate the results of scientific study and research effectively, both visual, written or verbal, including proficiency in a foreign language (preferably English) (Main Competence) 7. Capable of supervising, monitoring, evaluation, and decision making (Main Competence). 8. Professional responsibility and commitment. 9. Able to carry out the lifelong learning process. 10. Able to identify entrepreneurial efforts, characterized by innovation 11. Able to work effectively both individually and in multi-disciplinary or multi-cultural teams. 12. Explain the social and contemporary issues, such as social diversity and cultural appreciation, communicate with various segments of society, the strategic benefits of lobbying, negotiation and mediation.		

12	The 2012 Mechanical Engineering Graduate Program curriculum, there are 6 Specialization Program that can be chose by the students according to their academic ability dan interest, which are: 1. Energy Conversion (KE) 2. Bulding Utilities and Fire Safety (SUBAK) 3. Design and Product Manufacture (PEMAP) 4. Automation and Manufacture System (SMO) 5. Vehicle Engineering and Heavy Equipment 6. Marine Resoruces and Technology (TSDM) Specificly, beside the 12 points of Graduates Competences, the students of The Graduates Program will have the competences accordance to their specialization. **1. Competence in the field of Energy Conversion (KE):** Able to analyse, apply and design a mechanical system by utilizing the law and phenomenon from the cutting-edge technology related to the field of energy conversion and conservation. **2. Competence in the field of Building Utility System and Fire Safety (SUBAK)** Able to analyse, apply and design the building utility efficiently and the fire safety system based on performance for the office and industrial buildings. **3. Competence in the field of Product Design and Manufacturing (PEMAP)** Able to analyse, apply and desing a product, manfacture and assembly process by integrating the latest technology in the field of desing and manufacturing. **4. Competence in the field of Automation and Manufacturing System (SMO)** Able to analyse, apply and desing a manufacturing system and automation that will be used for a development and product manufacturing process by utilizing the cutting-edge technology in the field of manufacturing and automation. **5. Competence in the field of Vehicle Engineering and Heavy Equipment (TEKAB)** Able to abalysa and desing a vehicle system and heavy equipment for several fields, such as: industrial, construction, minerals and energy. **6. Competence in the field of Maritime Resources and Technology (TSDM)** Able to analyse and design a system and apply the maritime technology related to the utilization of sustainable maritime resources.		
13	**Classification of Subjects**		
No	Classification	Credit Hours (SKS)	Percentage
i	Department Courses	10	25 %
ii	Majoring Courses	20	50 %
iii	Seminar & Thesis	10	25 %
	Total		100 %
14	**Total Credit Hours to Graduate**		40 SKS

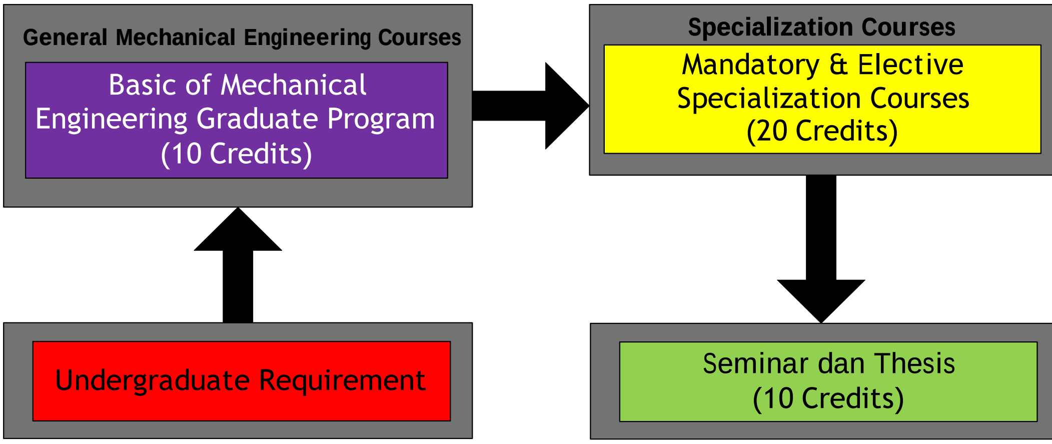
Career Prospects

Graduates of Mechanical Engineering has devoted itself in various fields, including automotive industry, oil and gas, heavy machinery, educational institutions, research institutions and other industries

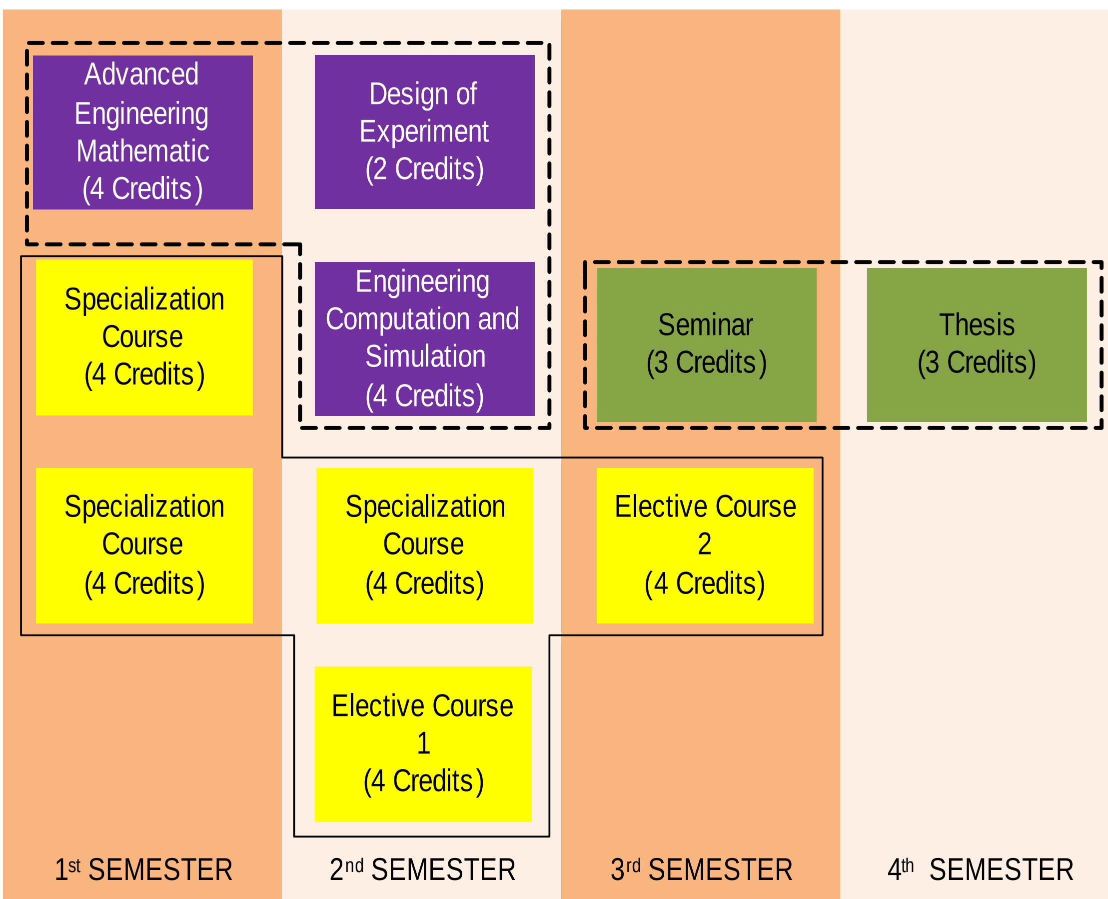
Learning Outcomes Flow Diagram



Flow Diagram of Subjects



Curriculum Structure for Mechanical Engineering Graduate Program



The framework of The 2012 Mechanical Engineering Gradute Program Curriculum can be seen in figure above which shows the relation of the courses. The Master Engineering program will be completed if the student passed 40 credits during their study. The 40 credits consist of: 10 credits of general mechanical engineering courses, 20 credits of specialization courses and 10 credits of seminar and thesis.

MASTER PROGRAM

Course Structure of Master Program in Mechanical Engineering

1. Major in Energy Conversion

KODE	MATA AJARAN	SUBJECT	SKS
	Semester 1	1 st Semester	
ENME 8 0 0001	Matematika Teknik Lanjut	Advanced Matematics	4
ENME 8 0 0103	Dinamika Fluida dan Perpindahan Kalor Lanjut	Advanced Fluid Dynamics and Heat Transfer	4
ENME 8 0 0101	Termodinamika Lanjut	Advanced Thermodynamics	4
	Subtotal		12
	Semester 2	2 nd Semester	
ENME 8 0 0003	Desain Penelitian	Design of Experiment	2
ENME 8 0 0102	Optimasi Sistem Energi	Energy Optimization System	4
ENME 8 0 0002	Komputasi Teknik dan Simulasi	Engineering Computation and Simulation	4
	Pilihan Peminatan 1	Elective 1	4
	Subtotal		14
	Semester 3	3 rd Semester	
ENME 8 0 0004	Seminar	Seminar	3
	Pilihan Peminatan 2	Elective 2	4
	Subtotal		7
	Semester 4	4 th Semester	
ENME 8 0 0005	Tesis	Thesis	7
	Subtotal		7
	Total		40

List of Elective Courses in Energy Conversion Study Program (Elective 1 and Elective 2)

Code	Semester 2	2nd Semester	SKS
	Mata Ajaran	Subject	
ENME 8 0 0111	Rekayasa Penukar Kalor dan Massa	Heat and Mass Transfer Engineering	4
ENME 8 0 0112	Teknik Aerodinamika	Aerodynamics Engineering	4
ENME 8 0 0113	Pembangkitan Daya	Power Generation	4
	Semester 3	3rd Semester	SKS
	Mata Ajaran	Subject	
ENME 8 0 0114	Teknik Pembakaran	Combustion Engineering	4
ENME 8 0 0115	Motor Pembakaran Dalam	Internal Combustion Engine	4
ENME 8 0 0116	Pengukuran dan Visualisasi AliranTera-pan	Applied Flow Measurement and Visualization	4
ENME 8 0 0117	Aplikasi CFD	CFD Application	4

2. Major in Building Utilities and Fire Safety

KODE	MATA AJARAN	SUBJECT	SKS
	Semester 1	1 st Semester	
ENME 8 0 0001	Matematika Teknik Lanjut	Advanced Matematics	4
ENME 8 0 0203	Dinamika Api dan Pemodelan	Fire Dynamics and Modeling	4
ENME 8 0 0201	Energi dan Keselamatan dalam Bangunan	Energy and Safety in Building	4
	Subtotal		12

	Semester 2	2 nd Semester	
ENME 8 0 0003	Desain Penelitian	Design of Experiment	2
ENME 8 0 0202	Sistem Mekanikal dan Elektrikal Gedung	Building Mechanical and Electrical System	4
ENME 8 0 0002	Komputasi Teknik dan Simulasi	Engineering Computation and Simulation	4
	Pilihan 1	Elective 1	4
Subtotal			14
	Semester 3	3 rd Semester	
ENME 8 0 0004	Seminar	Seminar	3
	Pilihan Peminatan 2	Elective 2	4
Subtotal			7
	Semester 4	4 th Semester	
ENME 8 0 0005	Tesis	Thesis	7
Subtotal			7
Total			40

List of Elective Courses in Building Utilities and Fire Safety Study Program (Elective 1 and Elective 2)

Kode	Semester 2 Mata Ajaran	2nd Semester Subject	Sks
ENME 8 0 0211	Sistem Ventilasi dan Tata Udara	Air Conditioning and Ventilation System	4
ENME 8 0 0212	Perancangan Sistem Utilitas Bangunan	Building Utility System Design	4
ENME 8 0 0213	Audit Energi	Energy Audit	4
	Semester 3 Mata Ajaran	3rd Semester Subject	Sks
ENME 8 0 0214	Teknik Refrijerasi	Refrigeration Engineering	4
ENME 8 0 0215	Teknik Keselamatan dan Proteksi Kebakaran	Fire Safety and Protection Engineering	4

3. Major in Design and Manufacturing

KODE	MATA AJARAN Semester 1	SUBJECT 1 st Semester	SKS
ENME 8 0 0001	Matematika Teknik Lanjut	Advanced Matematics	4
ENME 8 0 0302	Material dan Proses Manufaktur	Materials and Manufacturing Processes	4
ENME 8 0 0301	Metodologi Perancangan dan Pengembangan Produk	Product Design and Development Methodology	4
Subtotal			12
	Semester 2	2 nd Semester	
ENME 8 0 0003	Desain Penelitian	Design of Experiment	2
ENME 8 0 0002	Komputasi Teknik dan Simulasi	Engineering Computation and Simulation	4
ENME 8 0 0303	Integrasi Teknologi Perancangan dan Manufaktur	Designing and Manufacturing Technology Integration	4
	Pilihan Peminatan 1	Elective 1	4
Subtotal			14

	Semester 3	3 rd Semester	
ENME 8 0 0004	Seminar Pilihan Peminatan 2	Semianr Elective 2	3 4
Subtotal			**7**
	Semester 4	**4 th Semester**	
ENME 8 0 0005	Tesis	Thesis	7
Subtotal			**7**
Total			40

List of Elective Courses in Design and Manufacturing Study Program (Elective 1 and Elective 2)

Kode	Semester 2	2nd Semester	Sks
ENME 8 0 0311	Perancangan untuk Manufaktur dan Perakitan	Design For Manufacture and Assembly	4
ENME 8 0 0312	Kegagalan Mekanikal	Mechanical Failure	4
ENME 8 0 0313	Kebisingan dan Getaran	Noise and Vibration	4
	Semester 3	**3rd Semester**	
	Mata Ajaran	**Subject**	**Sks**
ENME 8 0 0314	Fabrikasi Mikro dan Manufaktur Presisi	Microfabrication and precision manufacturing	4
ENME 8 0 0315	Dinamika Sistem Mekanikal	Dynamics of Mechanical System	4
ENME 8 0 0316	Pengembangan Produk Komposit	Composite Product Development	4
ENME 8 0 0317	Finite Element dan Multiphysics	Finite Element and Multiphysics	4

4. **Major in Automation and Manufacturing System**

KODE	MATA AJARAN	SUBJECT	SKS
	Semester 1	1 st Semester	
ENME 8 0 0001	Matematika Teknik Lanjut	Advanced Matematics	4
ENME 8 0 0403	Manajemen Sistem Informasi Manufaktur	Management of Manufacturing Information System	4
ENME 8 0 0401	Proses dan Sistem Manufaktur	Manufacturing System and Processes	4
Subtotal			12
	Semester 2	**2 nd Semester**	
ENME 8 0 0003	Desain Penelitian	Design of Experiment	2
ENME 8 0 0002	Komputasi Teknik dan Simulasi	Engineering Computation and Simulation	4
ENME 8 0 0402	Otomasi dan Robotika	Automation and Robotics	4
	Pilihan Peminatan 1	Elective 1	4
Subtotal			14
	Semester 3	**3 rd Semester**	
ENME 8 0 0004	Seminar Pilihan Peminatan 2	 Elective 2	3 4

Subtotal			7
	Semester 4	**4 th Semester**	
ENME 8 0 0005	Tesis	Thesis	7
Subtotal			7
Total			40

Daftar mata kuliah pilihan peminatan Manufaktur dan Otomasi (M.A. Pilihan #1, M.A. Pilihan # 2)

KODE	Semester 2	2nd Semester	Sks
ENME 8 0 0411	CAD/CAM	CAD/CAM	4
ENME 8 0 0412	Penilaian Kinerja Manufaktur	Manufacturing Performance Assesment	4
	Semester 3	3rd Semester	
	Mata Ajaran	Subject	Sks
ENME 8 0 0413	Sistem Machine Vision	Machine Vision System	4
ENME 8 0 0414	Sistem Manajemen Produksi dan Mutu	Quality and Production Management System	4

5. **Major in Vehicle Engineering and Heavy Equipment**

KODE	MATA AJARAN	SUBJECT	SKS
	Semester 1	**1 st Semester**	
ENME 8 0 0001	Matematika Teknik Lanjut	Advanced Matematics	4
ENME 8 0 0501	Rekayasa Kendaraan dan Alat Berat	Vehicle Engineering and Heavy Duty Equipment	4
ENME 8 0 0502	Rekayasan Rangka dan Badan Kendaraan	Vehicle Frame and Body Engineering	4
Subtotal			12
	Semester 2	**2 nd Semester**	
ENME 8 0 0003	Desain Penelitian	Design of Experiment	2
ENME 8 0 0002	Komputasi Teknik dan Simulasi	Engineering Computation and Simulation	4
ENME 8 0 0503	Sistem Pengendalian Kendaraan	Vehicle Control System	4
	Pilihan Peminatan 1	Elective 1	4
Subtotal			14
	Semester 3	**3 rd Semester**	
ENME 8 0 0004	Seminar	Seminar	3
	Pilihan Peminatan 2	Elective 2	4
Subtotal			7
	Semester 4	**4 th Semester**	
ENME 8 0 0005	Tesis	Thesis	7
Subtotal			7
Total			40

List of Elective Courses in Vehicle Engineering and Heavy Equipment Study Program (Elective 1 and Elective 2)

	Semester 2	2nd Semester	SKS
ENME 8 0 0511	Teknik Kendaraan Rel		4
ENME 8 0 0512	Mesin dan Peralatan Pengangkat	Handling and Construction Equipment	4
	Semester 3	3rd Semester	
Kode	Mata Ajaran	Subject	Sks
ENME 8 0 0513	Teknologi Muktahir Kendaraan	Modern Vehicle Technology	4
ENME 8 0 0514	Peralatan Pengeboran Minyak dan Gas	Oil and Gas Drilling Equipment	4

6. Marine Resources and Technology

KODE	MATA AJARAN	SUBJECT	SKS
	Semester 1	**1 st Semester**	
ENME 8 0 0001	Matematika Teknik Lanjut	Advanced Engineering Matematics	4
ENME 8 0 0602	Termofluida Lanjut	Advances Thermofluid	4
ENME 8 0 0601	Sumber Daya Maritim	Maritime Resources and Technologies	4
Subtotal			12
	Semester 2	**2 nd Semester**	
ENME 8 0 0003	Desain Penelitian	Design of Experiment	2
ENME800002	Komputasi Teknik dan Simulasi	Engineering Computation and Simulation	4
ENME800601	Teknologi Maritim	Maritime Technology	4
	Pilihan Peminatan 1	Elective 1	4
Subtotal			10
	Semester 3	**3 rd Semester**	
ENME 8 0 0004	Seminar	Seminar	3
	Pilihan Peminatan 2	Elective 2	4
Subtotal			7
	Semester 4	**4 th Semester**	
ENME 8 0 0005	Tesis	Thesis	7
Subtotal			7
Total			40

List of elective courses in Marine Resources and Technology Study Program (Elective 1 and Elective 2)

	Semester 2	**2nd Semester**	
ENME 8 0 0611	Manajemen Produksi Kapal*	Ship Production Management	4
ENME 8 0 0612	Kapal Khusus	Special Ship	4
ENME 8 0 0613	Teknik Las*	Welding Engineering	4
ENME 8 0 0102	Optimasi Sistem Energi	Energy Optimization System	4

	Semester 3	3rd Semester	
Kode	Mata Ajaran	Subject	Sks
ENME 8 0 0615	Bangunan Lepas Pantai*	Marine and Offshore Structure	4
ENME 8 0 F616	Manajemen Transportasi Laut dan Kepelabuhanan *	Sea Transport and Port Management	4
ENME 8 0 F617	Hukum dan Peraturan Kemaritiman*	Maritime Law and Regulation	4

For students who are willing and capable to continue the education program to pursue Masters in Engineering through the Fast track program, credit transfer can be performed as many as 20 credits. The numbers of credits that can be transferred consist of: 8 credits from 2 Mandatory Core Courses and 8 credits from 2 Elective Core Courses.

Course Description

ENME800001
ADVANCED ENGINEERING MATHEMATICS (4 SKS)
Course Objective:
Complete student's anylitical ability. Students understand and able to use the advances mathematical concepts in order to solve the engineering problems
Syllabus:
Introduction to differential equation, 1st order differential equation, 2nd order differential equation, higher order differential equation, vector analysis, vector differential, grad operation, divergence and culr, vector integration, laplace transform, laplace transform to solve the differential equation, fourrier transform, convulsion, numerical method, root of equation, numerical differentiation, numerical integral.
Requirement: -
References:

1. Purcell, E.J., *Calculus and Analytic Geometry*, Addison-Wesley, 1996.
2. Anton, Howard, *Elementary Linear Algebra*, John Wiley & Sons, 1996.
3. Kreyszig, E., *Advance Engineering Mathematics*, John Wiley & Sons, 2004.

ENME800002
ENGINEERING COMPUTATION AND SIMULATION (4 SKS)
Course Objective:
The purpose of this course is that students know well and are able to apply the processes and methods (algorithms) calculations (numerical and analytic) of engineering in the real world of computing and computer-based parameters that affect the speed and accuracy of the calculation.
Syllabus :
Introduction of Computer Applications: Matlab, Algorithms and Algorithm Analysis;Computational Complexity; Algorithm Types: Optimization and Representation of Numbers; Overflow and underflow; Formula Error and Error in Numeric; FiniteDifference in Computing Applications: Numerical Integration in the Computing Applications; ODE In Applications computing; PDE in computing Applications;Monte Carlo in computing Applications
Requirement: -
References:

1. Sedgewick R., Phillippe F, *An Introduction to the Analysis of Algorithms*, Addison Wesley.
2. Cheney W., Kincaid D., *Numerical Mathematics and Computing*, Cole Publishing

ENME800003
DESIGN OF EXPERIMENT (2 SKS)
Course Objective:
This course provides knowledge on methods of planning, execution and reporting of the research in the field of engineering so that students are able to apply scientific principles in the preparation of the thesis in particular, as well as in a scientific publication from the research. Students should be able to manage an investigation that began from the planning stages, applying the correct procedure and constructs apparatus design, and apply instrumentation and measurement systems, to execute and perform the analysis and interpretation of data by the rules of statistics properly.
Syllabus:
Introduction: Introduction to Research Design, Problem Solving Approaches, Research Project Planning, Design and Application Measurement Systems: Elements of Functional Measurement Systems, Performance Measurement System Characteristics, Analysis of Accuracy (Uncertainty) Systems, Design and Construction of Apparatus Research, Planning Experiments, execution experiments: Construction of the apparatus, the apparatus Debugging, Datasheet and logbooks; Analysis and Interpretation of data; Communication Engineering: Principles of Communication Engineering, Report, Paper, and Research Articles.
Requirement : -
References:

1. Montgomery, D.C., *Design and Analysis of Experiments,* (5th ed.), John Wiley and Sons, Inc., New York, 2001
2. Coleman, H.W., Steele, G.W.Jr., *Experimentation and Uncertainty Analysis for Engineers*, (2nd ed.), John Wiley and Sons, Inc., New York, 1999
3. Doebelin, E.O., *Engineering Experimentation: Planning, Execution, Reporting*, McGraw-Hill, Inc., New York, 1995
4. Kirkup, Les., *Experimental Method: An Introduction to the Analysis and Presentation of Data*, John Wiley and Sons

Australia, Ltd., Queensland, 1994
5. Lipson, C, Sheth, N.J., *Statistical Design and Analysis of Engineering Experiments*, Mc-Graw Hill Kogakusha, Ltd., Tokyo, 1973

ENME800101
ADVANCED THERMODYNAMICS (4 SKS)
Course Objective:
Provide further understanding of the science of thermodynamics and its applications so that students are able to design and conduct a basic research mapun able to complete the analysis involves the calculation of the thermodynamic system correctly and systematically in order to find the best solution gentang effectiveness of the use of substances and energy, especially in the 'engineering design' by motto: 'Low entropy production', 'high thermal efficiency' and 'low pollution effect'.
Syllabus :
Basic Thermodynamics and Gas Dynamics, Equilibrium of Thermodynamics System, Thermodynamics properties of System, Thermodyamics of ideal gas mixture, review of chemical thermodynamics, review of chemical kinetics, conservation equation for multicomponent reaction system, pre-mixed laminar flames, method of measuring flame velocity (bunsen burner), flame quenching, flamability limit of premixed laminar flame, gaseous diffusion flame and combustion of single liquid droplet, combustion in compression ignition engine, combustion in spark ignition engine, combustion research in hydrocarbon oxygen mixture, engine research, combustion-generated emission, experimental method : preseure measurement and recording; temperature measurement and recording; combustion photography and flame speed detection; spectrographic method; chemical analysis technique (NDIR, FID, Gaschromatography).
Requirement: -
References:
1. Holmann, J.P., Thermodynamics, Intl. Student Edition, McGraw Hill, 2005.
2. Kenneth Wark Jr. Thermodynamics, McGraw Hill, 2003.
3. Francis F. Huang, Engineering Thermodynamics, MaxWell Macmillan Intl. Edition, 2000.
4. H.D. Baehr, *Termodynamik* , Springer Verlag
5. K. Stephan, *Termodynamik*, Grundlagen und technishe Anwendung-en, Band 1, Band 2, Springer Verlag.
6. Bejan, Adrian, *Advanced Engineering Thermodynamics*, Wiley – interscience, 2nd Edition, 1997

ENME800103
ADVANCED FLUID DYNAMICS AND HEAT TRANSFER (4 SKS)
Course Objective:
Enhance the ability of students in the study of fluid mechanics in more detail so as to conduct research or the application of science in industrial applications. Studying the mechanism of heat transfer in a control volume due to the existence of the temperature difference and concentration as well as the involvement of one, two or three phases at the time simultaneously.
Syllabus:
Viscous flow of Newtonian fluid, membrane boundary flow, Non-Newtonian Fluid Flow, Two-Multi Phase Flow, Particle Displacement Flow, Porous Media and Fluidized Beds, Turbulent Flow and Mixing, Jet, Chimney, Energy and Momentum Equatio, one-two-three dimension conduction heat transfer, heat transfer on extended surface.
Requirement:-
References:
1. Frank P Incropere, David P De Witt, Fundamental heat and mass transfer, 5th Ed., John Wiley & Sons, 1996, New York
2. Holman JP, Heat Transfer, 9th, Mc Graw Hill, 2003.
3. Koestoer, RA, Perpindahan Kalor untuk Mahasiswa Teknik, Salemba Teknika, 2003.
4. Welty R James, Wicks Charless, Wilson Robert, Fundamentals of Momentum, Heat, and Mass Transfer, 3rd Ed. John Wiley & Sons, 1996, New York
5. Cengel, Yunus, Heat Transfer a Practical Approach, 2nd Ed. Mc Graw Hill, 2003, Singapore.
6. Kreith Frank, Bohn Mark, Principles of Heat Transfer, 6th Ed. Brooks/cole, 2001, USA
7. Abbott I R, Theory of Wing Section, Dover Publications.
8. Bird R B, Transport Phenomena, John Wiley & Sons.

ENME800111
HEAT AND MASS TRANSFER ENGINEERING (4 SKS)
Course Objective:
The course objective is to provide understanding of the heat exchangers used in many industrial processes and power plants as the application of heat transfer. This course provides a basic competency to know main heat exchanger types and to understand and able to select suitable

heat exchanger type for current applications. Student is also expected to understand basic factors in designing heat exchangers, to estimate size and price and know and choose the type of heat exchanger. Provide basic understanding and various parameters on the drying process so that students can perform calculations and analysis of various drying techniques and their applications. This course also provides the expertise so that students are able to do drying modeling, to design and analyze the system for various materials (solid and solvent) so that the drying process can be suitably selected for particular product.

Syllabus:

Heat Transfer Review; Type and Application of Heat Exchangers; Practgical Design of Shell and Tube Heat Exchanger (Thermal and Mechanical); Manufacturing Cost Estimation; Heat Exchangers; Operation and Monitoring of Heat Exchangers (Fouling And Vibration); Maintenance of Heat Exchangers; Corrossion on Heat Eschangers; Heat Exchanger Design Software; Presentation and Laboratory Practice of Heat Exchangers. Review Transfer Phenomena (Momentum, Heat and Mass); Drying Principles and Basics; Mathematical Modeling of Drying System; Classification and Selection of Dryer, Post-Harvest Drying and Storage of Grain; Rotary Drying; Vacuum Drying; Fluidized Bed and Spouted Bed Drying; Drum Dryer; Spray Drying, Freeze Drying; Conveyor Drying; Solar Drying; Enrgy Optimization in Drying System; Drying System Design.

Requirements: Heat and Mass Transfer, Fluid Mechanics

References:

1. Frank P Incropere, David P De Witt, Fundamental heat and mass transfer, 5th Ed.,John Wiley & Sons, 2002, New York
2. Holman JP, Heat Transfer, 9th, Mc Graw Hill,2003.
3. Smith Eric, Thermal Design of Heat Exchanger, John Wiley & Sons, 1996, New York
4. Welty R James, Wicks Charless, Wilson Robert, Fundamentals of Momentum, Heat, and Mass Transfer, 3rd Ed. John Wiley & Sons, 1996, New York.
5. Cengel, Yunus, Heat Transfer a Practical Approach, 2nd Ed. Mc Graw Hill, 2003,Singapore.
6. Kreith Frank, Bohn Mark, Principles of Heat Transfer, 6th Ed. Brooks/cole, 2001, USA
7. Mujumdar, A.S., Drying : Principles and Practice, in Albright's Chemical Engineer's Handbook, Editor, Lyle Albright, Taylor & Francis, NY, USA, 2002
8. Mujumdar, Arun, S., Drying technology in agriculture and food sciences, 2001
9. Chakraverty, A,. Mujumdar AS and Vijaya Raghavan, Handbook of Postharvest Technology, Marcel Dekker, Inc, New York, 2003
10. Related Journals : Drying Technology Journals.
11. Rohsenow Warren, Hartnett James, Cho Young, Handbooks of Heat Transfer, 3rd Ed., Mc Graw Hill, 1998, New York.

ENME800112
AERODYNAMICS ENGINEERING (4 SKS)

Course Objective:

Aerodynamic Engineering is an advanced course of Fluid Mechanics which focusing on aeronautics applications. Through the course students is expected to be able to understand the fundamental principles and basic equations of aerodynamics and to apply them in the process of airfoil design and to understand performance characteristics of the airfoil. Student is able to understand the phenomenon of incompressible flow through the airfoil and finite wings. Student is expected to be able to have an understanding of subsonic and supersonic compressible flow phenomena through aerofoil and other compressible flow phenomena.

Syllabus:

Introduction on Aerodynamics; Basic and Principle Equations; Incompressible flow; Airfoil Aerodynamics Characteristics; Finite Wings; Incompressible Flow through Airfoil; Incompressible Flow through Finite Wings; Airfoil in Compressible Flow; Wings and Wings-Body Combination in Compressible Flow; Airfoil Design; Double Surface; Vortex Lift; Secondary Flow and Viscous Effect; Other Phenomena in Compressible Flow; Normal Shock Wave; Oblique Shock Wave; Expansion Wave; Supersonic Wave.

Requirement: -

References:

1. A.M. Kuethe and C.Y. Chow, Foundations of Aerodynamics, John Wiley & Sons, Inc., 1997.
2. B.W. McCormick, Aerodynamics, Aeronautics, and Flight Mechanics, John Wiley & Sons,Inc., 1995.
3. J Anderson, Fundamentals of Aerodynamics, McGraw Hill, 2001.

ENME800113
POWER GENERATION (4 SKS)

Course Objective:

The course objective is to provide an understanding of the basic principles of power generation, and basic competency in the design and development of power generation

systems.
Syllabus:
Industrial Power Plant and Steam System: Boiler, Steam Turbine, Gas Turbine; Cogeneration Engineering, Instrumentation and Main Tools; Performance and Reliability Factors; Economical Aspects, Environmental Aspects: Settings and Prevention.
Requirement: -
References:

1. Tyler G. Hicks, Power Plant Evaluation and Design Reference Guide, McGraw Hill, 1986.
2. Sill and Zoner, Steam Turbine Generator Process Controll and Diagnostics, Wiley Higher Ed., 1996.
3. Saranavamuttoo et.al, Gas Turbine Theory, 5th Edition, Prentice Hall, 2001

ENME800114
COMBUSTION ENGINEERING (4 SKS)
Course Objective:
Combustion Engineering provide basic competency to investigate, analyze and learn about the process of combustion of fuel, and the nature and behavior of flame. The course provides basic understanding to apply the laws of basic aerothermochemistry in the engineering calculation of practical combustion engineering. The student is expected to be able to analyze the combustion behavior of a flame and to develop knowledge in the field of combustion engineering.
Syllabus:
Important Meaning of Combustion Study; Basic Reaction and Stoikhiometry of Combustion; Gas Fuel (BBG); Liquid Fuel, Solid Fuel; Basic Thermochemistry and Fluid Dynamics of Combustion; Principles of Conservation of Mass and Continuity; Turbulence Premixed Flame Structure; Detonation; Combustion Technology; Fixed-Bed Combustion, Suspension, Fluidized-Bed; Study on Flame and Combustion Technology; Minimum Temperature Self-ignition (Auto/Self-Ignition); Flammability Limit; Fire spread, Fire Suppression Material, Combustion and the environment.
Requirement: -
References:

1. Turn, S.R., An Introduction to Combustion, 2nd Edition, McGraw-Hill, Inc. 2000
2. Borman, G.L., and Ragland, K.W., Combustion Engineering, McGraw-Hill, Inc. 1998.
3. Griffi ths, J.F., and Barnard, J.A., Flame and Combustion, 3rd Edition, Blackie Academic and Professional, 1995.
4. Glassman, I., Combustion, 3rd Edition, Academic Press, 1996.
5. Warnatz, J., Maas, U., and Dibble R.W., Combustion, 2nd Edition, Springer-Verlag, 1998.

ENME800115
INTERNAL COMBUSTION ENGINE (4 SKS)
Course Objective:
Student is expected to have competency and expertise in the field of his interest of internal combustion engine working principle and theory and is able to design and do construction calculation.
Syllabus:
Actual Cycle of Internal Combustion Engine; Fuel System; Ignition and Combustion in Spark Ignition Engine and Compressed Ignition Engine; Some Basic Characteristics and Calculations; Basic Engine Design; Determination of Engine's Main Components; Kinematics and Dynamics Analysis of the Motion; Calculation and Planning of Lubrication and Cooling System.
Requirement: -
References:

1. Guzela L, Onder, C., Introduction to Modelling and Control of Internal Combustion Engines, Springer, 2004
2. Heywood, J., Internal Combustion Engines Fundamental, McGraw Hill, 1989
3. Taylor, C.F., Internal Combustion Engines, in Theory and Practice, M.I.T Press, England, 1985.
4. Khovakh, M., Motor Vehicle Engines, MIR Publisher, Moscow, 1971.

ENME800116
APPLIED FLOW MEASUREMENT AND VISUALIZATION (4 SKS)
Course Objective:
Applied flow diagnostic study measurement and visualization techniques which have wide application both in industry and laboratory. The course give basic competency for the student to be bale to understand various measurement and visualization methods and to design appropriate flow diagnostic system in process installation in industry or experimental set up in a scientific research activities which related to fluid flow.
Syllabus :
Statistics Diagnostic Flow, Calibration in Flow Measurement; Momentum Sensing Meter (orifice plate, venturi, nozzle meters); Positive Displacement Flow Meter (Nutating Disc, Sliding Vane, Gear meters, etc.); Electromagnetic and Ultrasonic Flow Meters; Compressible Flow Meter (Wet Gas and Wind Anemometer); Principles Local Velocity Measurement in Liquid and Gases; Hot Wire Anemometry; Based

Laser Velocimetry (LDV, PIV); Principles of Flow Visualization, Flow Visualization conventional; Shadowgraphs and Schliern Technique; Interferometry Technique; Light Sheet Based Technique ; Image Processing and Computer-Assisted Method

Requirement: -

References:

1. Yang ,W.J, Handbook of Flow Visualization, Taylor and Francis. 2001
2. Baker, R.C., Flow Measurement Handbook: Industrial Designs, Operating Principles, Performance and Applications, Cambridge University Press, 2000

ENME800102
ENERGY OPTIMIZATION SYSTEM (4 SKS)

Course Objective:

This course provides an understanding of mathematical modeling, simulation and optimization of energy systems through technical and economical approach. The course is intended to equip student with the ability to understand mathematical model, simulation and optimization of thermal systems.

Syllabus:

Workable System Design; Economical Evaluation; Determination of Mathematical Equations; Thermal Equipment Modeling; System Simulation; System Optimization: Objective Function, Constraints; Lagrange Multipliers: Lagrange multiplier to complete the optimization process; Dynamics, Geometric and Linear Programming; Mathematical Model of Thermodynamics Properties; Big System Simulation under Steady Condition; Big Thermal System Simulation; Calculation of Variables in Optimum Conditions.

Requirement: -

References:

1. Stoecker, W.F., *Design of Thermal System*, Mc.Graw Hill Book Co, 1989.
2. Boehm,R.F., *Design of Analysis of Thermal System,* John Wiley&Sons,1987.
3. Yogesh Jaluria, *Design and Optimization of Thermal Systems*, Mc.Graw Hill Book Co, 1998.

ENME800203
FIRE DYNAMICS AND MODELLING (4 SKS)

Course Objective:

Sudents understand the various stages of fires in buildings, and provide basic knowledge mengenaiberbagai methods and techniques applied in the analysis of fire development, and develop students' ability to critically analyze the methods of practical application. This course also aims to improve the ability to understand and analyze the model. Broadly speaking, after completing this course students will be able to:

- Explain the effects on the growth of the fire compartment.
- Explain the various applications of the model and its limitations in fire safety engineering calculations.
- Able to explain the growth stage yangapi by various variables.
- Students will have the skills and kemanpuan in:
- Applying a two-zone models in the calculation of the various cases of fire,
- Calculating the value of various physical variables related to fire growth,
- Analyze and interpret the results of fire safety engineering experiments.
- Assessing the reasonableness of the calculation results obtained from a variety of computational models
- Estimate the value of the data for input into the computational model
- Designing a fire plan so that it can be used in the design of protection systems and smoke and gas handling combustion products.
- Evaluate the effect of the fire on the people in the building
- For the fire in the building, students can calculate the critical conditions waktusebelum achieved
- Maintain, in lisandan written, and presented a selection of models and assumptions in the analysis of a given case of fire.

Syllabus:

Introduction to the process of combustion, premixed flame and diffusion flame, ignition and spread of fire, classification of fires and the influence of the geometry of the room. Calorimetry fire: heat release rate, mass loss rate and the relationship between time and heat release rate, the growth of fire in the room, as well as testing methods. The dynamics of the flame: fire plume and flame (flame), a high flame, the flame height correlation, Froude Numbers, and the flame jet and a review of related models; the flow of gas in the room during the fire, Bernoulli equations, profiles of temperature and pressure, air mass flow of combustion product gases through the openings; energy balance, heat transfer, heat flux, the correlation to temperature. Products of combustion: the formation of smoke, the visibility factor, filling model of smoke in a compartment, the formation of CO, CO2. Fire modeling: Two-zone models, CFD models. Analysis of flammable materials effect, the geometry of the room and opening to the growth of flame, smoke and combustion products. Proposed efforts to suppress the growth and spread of flame and smoke.

References:

1. Dougal Dysdale, An Introduction to Fire Dynamics 2nd Ed., John Wiley and Sons, 2003.
2. Society of Fire Protection Engineers, The SFPE Handbook of Fire Protection Engineering, 3rd Edition, 2003.
3. A.H. Buchanan, Fire Engineering Design Guide, New Zealand, 2001.
4. Journal dan standard terkait.

ENME800211
VENTILATION AND AIR CONDITIONING SYSTEM (4 SKS)

Course Objective :
This course provide the understanding and basic competence in design the air conditioning system regarding a better air condition. The student will provided with knowledge about the environmentally friendly regrigerant.

Syllabus :
Basic of Air Conditioning: Air Cooled dan Water Cooled Chiller, Packaged Unit, Direct Expansion and Split Unit; Basic VAC Calculation : Design Condition, Load Estimating, Cooling Load; Sistem Ventilasi : Air Changes, Outdoor Air Requirement, Indoor Air Quality. Clean Space and Air Filter System in industry and hospotal; distribution system: Equal Friction Method and Static Regain, Duct and Piping Sizing; Air Conditioning System Components : Chiller, Cooling Tower, Fan, S and AHU; Control System in Building.

Requirement: Teknik Pendingin

References :

1. Ronald Howell, Harry J.Sauer, Jr and William J.Coad : Principles of HVAC, ASHRAE 1998.
2. Carrier : Handbook of HVAC
3. ASHRAE Standard
4. Overseas Vocational Training Association Employment Promotion Corporation : Fundamentals of refrigeration and Air Conditioning.

ENME800201
ENERGY AND SAFETY IN BUILDING (4 SKS)

Course Objective:
The aims and outcomes of this course is to develop an understanding of the environmental and energy elements applying to buildings. It deals with the energy implications of the selection and control of thermal, lighting, acoustics, and transportation, and safety in buildings. In details it also discuss the heating and cooling systems in buildings, the role of condensing boilers, heat pumps, combined heat and power (CHP) and absorption chilling, as well as conventional heating ventilation air conditioning (HVAC) plant, in the consumption of energy in buildings. It combines theoretical knowledge of the components in building utility system that make up energy systems (demand and supply) in buildings with whole system appraisal.

Syllabus:
1. Identify the environmental elements applying to buildings
2. Recognize our human needs relating to buildings
3. Building design: propose ways to control the building's response to the outside environment, select the adequate design and materials for a given building configuration
4. Building materials
5. Thermal aspects of a building
6. Lighting aspects of a building
7. Acoustic aspects of a building
8. Transportation in building
9. Life safety in building
10. Introduction to building utility system and appraisal.

ENME800202
BUILDING MECHANICAL AND ELECTRICAL SYSTEM (4 SKS)

Course Objective:
The course's objective is to deliver knowledge, skills and understanding of the mechanical and electrical systems in a modern building that has been increasing in its requirements in terms of sophistication, efficiency, and low energy use.

Syllabus:
General Building Mechanical System, Plumbing System: SNI, Calculation, Waste Water Management, Building Energy System; Building Automation System; Lift and Escalator: Types, Round Trip Time, Handling Capacity, Waiting Time, Installation and Control System; Escalator Types, Application and Installation, Building Automation System,

Requirement:-

References:

1. Mechanical System for Building.
2. Handbook of HVAC.
3. ASHRAE Journal
4. NFPA
5. Mechanical Installation in Building.
6. SNI Plambing
7. SNI Hydrant, Sprinkler dan APAR.

ENME800212
BUILDING UTILITY SYSTEM DESIGN (4 SKS)
Course Objective:
Students have the ability to design and calculate the utility of building integrated systems, using knowledge, design criteria, standards and related regulations.
Syllabus:
Integrated design include building envelope, lighting systems, mechanical and electrical construction, HVAC systems, and automation systems, taking into account the environmental and economic constraints.
Requirement:-
References:
1. Anil Ahuja, Integrated M/E Design: Building systems engineering, Chapman Hall - International Thomson Publishing, 2000.
2. Richard R. Janis and William K. Y. Tao, Mechanical & Electrical Systems in Buildings (4th Edition), 2008.
3. SFPE Handbook of Fire Protection Engineering, 2008
4. ASHRAE Handbook – HVAC Application, 2012
5. American Society of Plumbing Engineers, Plumbing Engineering Design Handbook, A Plumbing Engineer's Guide to System Design and Specifications, 2004.
6. Related standard and journals.

ENME800213
ENERGY AUDIT (4 SKS)
Course Objective:
This course focuses on the theory, techniques and practices of analyzing energy aspects of building operations and correlating a building envelope's interaction with the mechanical systems. Students will perform a detailed energy audit of a state-of-the-art commercial building design using energy modeling simulation software and develop energy conservation strategies, such as thermal storage, that can be applied to heating, cooling, and ventilating equipment to reduce utility bills. Students will apply supporting analytical data to develop operations and maintenance changes designed to improve energy efficiency and reduce operating cost.
Syllabus
Energy Auditing Basics, Energy Accounting and Analysis, Understanding the Utility Bill, Energy Economics, Survey Instrumentation, The Building Envelope Audit, The Electrical System Audit, The Heating, Ventilating and Air-Conditioning Audit, Upgrading HVAC Systems for Energy Efficiency Verification of System Performance, Maintenance and Energy Audits, Self-Evaluation Checklists, World-class Energy Assessmeents, and Water Conservation
Requirement:-
References:
1. Albert Thumann, William J. Younger, Terry Niehus, Handbook of Energy Audits, Eighth Edition, The Fairmont Press, 2010.
2. Moncef Krarti, Energy Audit of Building Systems: An Engineering Approach, Second Edition, CRC Press, Taylor & Francis Group, 2010.

ENME800214
REFRIGERATION ENGINEERING (4 SKS)
Course Objective:
Refrigeration engineering course provides basic competency for the student to be able to do the simulation software to design a cooling system and equipments involved with a very close relationship with the Industrial and engineering users. Hence student will have understanding in design and development of cooling system and ability to evaluate and analyze its performance, especially on clod storage.
Syllabus:
Principles of Refrigeration and Heat Pump, Terminology and Units; Mechanical Vapor Compression Refrigeration Engine; Heat Trasnfer in Refrigeration System; ph Diagram Calculation in Refrigeration Cycle; Refrigeran, Lubricant, Salt and the Environment; Compressors; Condenser and Evaporator; Refrigeration Piping System and Equipments; Automatic Control System and Safety Equipments; Air Properties; Psychrometric and its process; Absorption Refrigeration; Alternative refrigeration Cycles (adsorption, gas compression, and ejector); Display Case, Prefabricated Cold Storage and Cold Storage, Cold Room Calculations.
Prerequisite: Basic Thermodynamics
References:
1. *ASHRAE Handbook of Fundamental*, ASHRAE Atlanta, 1995.
2. Kuehn, Ramsey and Therkeld, *Thermal Environmental Engineering, 3rd Edition*, Prentice Hall, 1998.
3. Threkeld,JL., *Thermal Environmental Engineering*, Prentice Hall.
4. *ASHRAE Handbook of Fundamental*, ASHRAE Atlanta, 2001
5. *ASHRAE Handbook of Refrigeration*, ASHRAE, Atlanta, 2002.

ENME800215
FIRE SAFETY AND PROTECTION ENGINEERING (4 SKS)
Course Objective:
Students understand the basic and important parameters in the process of fire and fire hazards. Students have the competency on the regulations and standards on the testing of material of the fire and the design of fire protection systems. Students have the expertise in specialized skills in fire modeling, designing and analyzing the protection system against fire. Students know the role of safety management on the fire hazard in ensuring the industry and high rise building operations.
Syllabus:
Introduction of Fire Process; Fire Dynamics; dangerous Elements Release in Fire; Fire Modeling Theory; Fire Modeling with Computer Program; Material Testing Method for Fire Hazard; Fire Detection Systems; Standard Rules on Fire Hazard; Fire Protection System Design Fire, Fire Fighting Systems: Hydrant and Sprinkler System; Analysis of Fire Risk in Buildings.
Prerequisite: None
References:
1. Dougal Dysdale, *An Introduction to Fire Dynamics 2nd Ed.*, John Wiley and Sons, 2003.
2. Society of Fire Protection Engineers, *The SFPE Handbook of Fire Protection Engineering*, 3rd Edition, 2003.
3. Rasbach, D.J., et al., *Evaluation of Fire Safety*, John Wiley and Sons, 2004.
4. A.H. Buchanan, *Fire Engineering Design Guide*, New Zealand, 2001.
5. SNI, ASTM, NFPA, rules and standards

ENME800302
MATERIAL AND MANUFACTURING PROCESSES (4 SKS)
Course Objective:
The course provides understanding and basic competence of theory, application method and product manufacturing processes that covers: working principle, process characteristics, process limitations, work and force due to the process, parameters that affects to the process and the relation of material with the process that needed for certain process.
Syllabi:
Manufacturing Process and Production Systems; Materials in Manufacturing; Theory and Method of Casting Processes; Theory and Method of Bulk Deformation Processes; Theory and Method of Metal Forming Processes; Theory and Method of Powder Metalurgy Processes; Theory and Method of Material Machining/ Cutting Processes; Theory and Method for Enhancing Manufactured Surface Quality; Theory and Method of Joining Processes; Theory and Method of Prototyping; Engineering Material Characteristics; The Relation between Process Characteristics and Material Characteristics; The Parameter Control of Process for Material; Assignment in Manufacturing Process and Material Selection for Market Needs.
Prerequisite: Engineering Materials
References:
1. Ashby, *Material selection in Mechanical Design*, Butterworrth Heinneman, 2005
2. Ashby, *Material selection in Mechanical Engineering*, Pergamon Press, 2004
3. Degarmo, E. Paul, *Materials and Processes in Manufacturing*, Prentice Hall Int. Inc, 8th edition, 2005
4. Kalpakjian, S, *Manufacturing Engineering and Technology*, McGraw Hill 4th edition, 2001.

ENME800301

PRODUCT DESIGN AND DEVELOPMENT METHODOLOGY (4 SKS)

Course Objective:
Provide an understanding and mastery of the theory and methodology of design and product development include: planning, concept development, system design, detailed design, testing and screening, production ramp-up, in a series of factors to consider overall product development.
Syllabus:
Product Planning: Needs Identification Methods; Product Selection Method (Feasibility Study); Business Specifications: Concept Development and Selection; Aspects of Engineering in Product Development and Manufacturing (Process, Material, Thermal, Durability) Non-Technical Aspects in Product Development and Manufacturing; basic Design for Manufacturing and Assembly; Calculation of Economics of Product Development.
Requirement: -
References:
1. Karl T.Ulrich. *Product Design and Development* , 3rd edition, Mc.Graw Hill 2004.
2. Dieter, G.E., *Engineering Design*, 3rd edition, Mc.Graw Hill 2000

ENME800401

MANUFACTURING SYSTEM AND PROCESSES (4 SKS)

Course Objective:
College process and manufacturing systems are given in order for students to know and be able to apply the conventional manufacturing process technology and non-conventional for the manufacture of a product and the parameters which influence it are devoted to the metal forming processes, machining, rapid-prototyping process. In addition, knowing, and understanding the existing production systems in the industry.
Syllabus:
Materials in Manufacturing: Theory and Method of Casting Process (Metal Casting); Theory and Method of Bulk Formation Processes: Theory and Method of Formation Process Material Sheet (Sheet Metal Forming): Theory and Methods of Powder Metallurgy Process (Powder Metalurgy); Theory and Methods for Machining Processes / Cutting Materials: Theory and Methods of Product Surface Quality Improvement process: Concepts and methods of manufacturing systems.
Requirement: -
References :

1. Wagoner R., Chenot J.-L, *Fundamentals of Metal Forming*, John Wiley & Sons, Inc, 2003
2. Degarmo P., *Materials and Process in Manufacturing*, Prentice Hall, 2004
3. Schey J., *Introduction to Manufacturing Process*, McGraw-Hill, 2004
4. Thomas E Vollman, *Manufacturing Planning and Control*, McGraw Hill 1997
5. Stanley B. Gershwin, *Manufacturing System Engineering*, Prentice Hall, 1993
6. John M. Nicholas, *Competitive Manufacturing Management*, 1997

ENME800403
MANUFACTURING INFORMANTION SYSTEM MANANGEMENT (4 SKS)
Course Objective:
Provide understanding of the theory, method and application of information technology systems, management, and development of the concept of knowledge-based information systems (Knowledge Management System) and capable to apply in the manufacturing industry.
Syllabus:
Introduction to Information Systems; State of The Art Utilization Information System; Theory and System Methodology; Database Management Systems; System Design I: Overview functionality, enabling Technology (Automated Solution Assessments Quality, Multi Data Representation, Database Technology and XML); Design System II: (Database Design, Information Input, Output Information); Case Study: Documentation automation and Reporting System for Manufacturing; Introduction Knowledge Base Engineering, Concepts and Methodology in the KBE (System Specialists, Neural Network); KBE application.
Prerequisites: None
References:

1. Raymond McLeod Jr., *Strategic Information Management: Challenges and Strategies in Managing Information System*, 3rd ed, Butterworth-Heinneman, 2003
2. Cortada, James. *Total Quality Management*, Mc Graw Hill Book Co
3. Ake, Kevin et. al, *Information Technology for Manufacturing: Reducing Costs and Expanding Capabilites*, CRC Press 2003
4. Cecelja, Franco, *Manufacturing Information and Data System: Analysis Design and Practice*, Butterworth-Heinemann 2001

ENME800311
DESIGN FOR MANUFACTURE AND ASSEMBLY (4 SKS)
Course Objective:
Provide knowledge, understanding and competence in the product design process which is considering, including factor and oriented on: material, manufacturing capability and assembling process. Therefore the product is expected to have made ease of manufacture and assembly.
Sillaby:
Review of the materials selection and processes, product design for manual assembly, design for automated assembly, PCB design for manufacture and assembly, machining process design, injection molding, sheet metal forming processes, die-casting.
Prerequisite: None
References:

Boothroyd, *Product Design for Manufacture and Assembly*, Marcel Dekker Inc, 2002

ENME800312
MECHANICAL FAILURE (4 SKS)
Course Objective:

This course provides an understanding and competence about principles and modes of mechanical failure may occur and should be avoided so that should be considered in the design of mechanical, including buckling, Corrosion, fatigue, creep, melting, fracture, thermal, and wear.

Sillaby:

Theory and Buckling Mode (Torsional-lateral, Plastic, Dynamic), Theory and Corrosion mode (Metal, Non-Metal, Glass); Corrosion Prevention; Theory and Fatigue Failure Mode; Theory and creep mode; Theory and Melting Mode; Theory and Type of Fracture mode, Theory and the thermal failure mode; Theory and Wear mode; Failure Analysis and Prevention to: Buckling, Corrosion, Fatigue, creep, Melting, Fracture, Thermal, and Wear.

Prerequisites: Engineering Material, Basic Mechanical Design, Mechanical Design

References:

1. Jack A Collins, *Materials Failure in Mechanical Design*, Wiley - Interscience, 1993
2. S. Suresh, *Fatigue of Materials*, Cambridge University Press, 1998
3. M Jansenn, J. Zuidema, *Fracture Mechanics*, VSSD, 2006
4. Arthur J. McEvily, *Metal Failures : Mechanisms, Analysis and Prevention*, 2001

ENMEB00313

NOISE AND VIBRATION (4 SKS)

Course Objective :

This course provides competency to students to complete the issue of application of vibration on the mechanical structure of the construction, and plate or vessel (vessel), perform the calculation of vibration reducer system design, system and engine holder enhancing of production equipment. Finally students have to make a basic vibration measurements, forecasts predicted the damage engine, the vibration analysis of the data signal and the vibration spectrum and carry out machine performance diagnosis based on data analysis of vibration data and other data related

Syllabus :

Mechanical vibration with Many Degrees Freedom; Vibration on the Structure Construction; Vibration on plate and body shell (Vibration Plate and Shell); Vibration Isolation; Designing Vibration Absorber; Engineering Vibration Measurement; Vibration spectrum analysis; Performance Diagnostic Machine.

Prerequisites: Numerical Computation, Mechanical Vibration, Maintenance and Machine Cond. Minitoring

References:

1. Jerry H.G., *"Mechanical and Structural Vibrations"*, John Wiley, 2004
2. Demeter G.F., "*Mechanical and Structural Vibrations*", John Wiley, 1995
3. Kenneth G.M., "*Vibration Testing-Theory and practice*", John Wiley, 1995
4. Werner Soedel, "*Vibrations of Shells and Plates*", 3rd edition – revised and expanded, Marcel Dekker, INC., 2004
5. Randall R.B., "*Frequency Analysis*", Brüel & Kjær, 1987
6. Jens T.B., "*Mechanical Vibration and Shock Measurement*", Brüel & Kjær, 1980

ENME800314

MICROFABRICATION AND PRECISION MANUFACTURING (4 SKS)

Course Objective:

This course provides expertise of micro manufacturing process widely used in the making of MEMS (micro Electro mechanical system) at this time that has wide application of the biomedic system, sensors and micro-electronic devices (electronic devices). This course giving understanding of manufacturing techniques and basic structure mechanics in a product and also the micro-characterization of the process fabrication conducted in the laboratory. This course provides a basic competency of the principles in the design techniques which control the movement of the size or dimensions in a very small if compared with the size of the object that is designed and produced the correct design and the development machine and a precision mechanism. Lectures focus on the practical concepts that can be directly applied to the design process. Laboratory sessions will be provided in the form of a group where there tried to apply the principles learned in an activity..

Syllabus:

Introduction to Engineering Micro Fabrication; Lithography: The design aspect, ma**SKS** making, etching technique (And Wet Etching Dry Etching); Deposisi Engineering: Chemistry and Chemicals; Electroplating, Micromolding, Beam Processing; Microscaling consideration); Transport Processes and Metrology in the micro-scope; Lab Practice and Applications. Philosophy Precision Manufacturing; kinematic concept; Pro and contra Flexures Design; Materials for Precision Components; Self Calibration Concept; Manufacturing Process which is Important in Precision Manufacturing, Precision Instruments; Basic Concept of Tolerance on Dimensions and geometric.

Requirement: -

References:

1. Madou, M.J. Fundamentals of

microfabrication: the science of miniaturization, CRC Press, 2002.
2. McGeough, J (Ed.), Micromachining of Engineering Materials, Marcel Dekker, 2002, ISBN 0-8247-0644-7
3. Mainsah, E., Greenwood J.A. and Chetwynd D.G. Metrology and properties of engineering surfaces, Kluwer Academic Publ., 2001
4. Gardner J.W. and Hingle H.T. (Ed.) From Instrumentation to Nanotechnology, Gordon and Breach Science Publishers, 1991, ISBN 2-88124-794-.
5. Korvink J.G. and Greiner A. Semiconductors for Micro- and Nanotechnology – An Introduction for Engineers, WILEY-VCH Verlag GmbH, 2002, ISBN 3-527-30257-3.
6. Mark J. Jackson, Microfabrication and nanomanufacturing. Taylor and Francis, 2006.
7. Dornfeld, D., Lee Dae-Eun, *Precision Manufacturing*, Springer, 2008, ISBN 978-0-387-32467-8
8. Smith, S. T., Chetwynd, D. G., *Foundations of Ultraprecision Mechanism Design*, Taylor & Francis, 1992, ISBN 288-449-0019.
9. Evans, C. E., *Precision Engineering: An Evolutionary View*, Cranfield Press, Bedford, UK, 1989. (TJ15 .E9 1989, RBR)

ENME800315
DYNAMICS OF MECHANICAL SYSTEM (4 SKS)
Course Objective:
Provide an understanding and competence in the principles and methods of dynamic analysis of mechanical systems as an important input in the design process to produce a mechanical system that has a better dynamic resistance and also know the effects they impose on other systems that interact.
Syllabus:
Kinematic Systems: Theory and Principles of Dynamic Systems: Dynamic Modeling Method: Block Diagrams and State-Variable Model: Analysis on Time-Domain System: Analysis of the Frequency-Domain System; Vibration; Stability: Dynamic Balance: Dynamic Analysis of Mechanical Components; Modeling and Analysis control system.
Requirement: -
References:
1. Palm, *Modelling, Analysis, and Control of Dynamic Systems*, Wiley, 2006
2. Harold Joseph dan Ronald Huston, *Dynamic of Mechanical System*, CRC, 2002
3. Palm, *System Dynamics*, McGraw-Hill, 2007
4. Chapman, Stephen J., *Essentials of Matlab Programming*, Thomson Nelson, 2006

ENME800316
COMPOSITE PRODUCT DEVELOPMENT (4 SKS)
Course Objective:
Provide expertise and competence to students in the field of designing and manufacturing of parts / mechanical construction using composite materials. This course provides an understanding of composite materials, including the characteristics, testing, manufacturing process, and special applications in the engineering field.
Syllabus:
Composite Type, Material, Properties, Mechanics; Knowledge and Characteristics of Fiber Composite, Strength, Hardness, and the composite thermal expansion; Theory of Combination Fiber and Matrix; Matrix Composite Characterization; Laminar Theory On Axis and Off Axis; Composite Product Design, Composite Fabrication Technique ; Testing Method; Future Applications.
Requirement: -
References:
1. A. Brent Strong, *Fundamentals Of Composites Manufacturing: Materials, Methods and Applications* - Technology & Engineering – 2007
2. By Daniel Gay, Suong V . Hoa, Stephen W. TsaiTranslated by Stephen W Tsai Contributor Suong V. Hoa, Stephen W. Tsai, *Composite materials: Design and application* : CRC Press 2003
3. Soemardi,T.P. *Diktat Mekanika komposit, Fabrikasi dan Testing*. FTUI.2003.
4. Composites ASM handbook No 21

ENME800317
FINITE ELEMENT AND MULTIPHYSICS (4 SKS)
Course Objective:
Provide a basic understanding and skills regarding the principles of modeling, solution techniques such as 'finite element method' and its application in cases of design and engineering analysis. The models studied included physical aspects of the problem in Thermal, elasticity (plates and shells), acoustic, and electromagnetic.
Syllabus:
The introduction of FEA (Finite Element Analysis); Fundamental FEA I (basic concepts and formulations FEA FEA) FEA Fundamentals II (failure modes, Dynamic Analysis, FEA Capabilities and limitations); Basic Finite Element Modeling: Modeling CAD for FEA; Building a Finite Element Model: Model simulation and

interpretation of results; Thermal-Structural; Pressure-Structural; Electromagnetic-Thermal-Structural; Analysis of Thermal Actuator; Coating process: Key elements of Successful Implementation of Technology multiphysics; Introduction to CFD and Its Application.

Requirement : Matematika Teknik, Fisika Mekanika dan Panas, Fisika Listrik, Magnit, Gelombang dan Optik

References:

1. William B J Zimmerman, Multiphysics Modeling with Finite Element Methods, World Scientific Publishing, 2006
2. Barry H.V Topping, A Bittnar, Engineering computational technology, Civil-Comp press Edinburgh, UK, 2002
3. Indra Siswantara, Catatan Kuliah Teknologi Multiphysiscs, 2008

ENME800411
CAD/CAM (4 SKS)

Course Objective:

This lecture will discussed about technology of CAD, CAM, Integration of CAD / CAM application in the industry and the emphasis on: the principles modeling and surface curve geometry (Geometric modeling), design of 2D and 3D models with computer assisted. The principle of data exchange between CAD/CAM systems also tool path design using computer for prismatic and sculptured model. Lectures CAD / CAM are provided with the aim that students have the understanding and applying technology of CAD / CAM: starting the process from design to production process with the computers assistance.

Syllabus:

Overview of CAD / CAM System; Hardware & Software System of CAD / CAM; Interactive Tools and Computer Graphics Concepts, Geometric Modeling: Type & Representation of mathematical model Curve, Surface & Solid ; Data Exchange in CAD / CAM system; Manufacturing Processes: Manufacturing Process Review Type and Parameter Calculation machining, Lab. practice of CAD; CNC Technology; Tool Path Generation Method in the CAM system; Control 'quality of machinery' in the CAM system; Computer Aided Process Planning-CAPP; Postprocessing; Lab. practice of CAM

Requirement: -

References:

1. Kiswanto G., Handout CAD/CAM, Diktat kuliah, 2004.
2. Choi B. K., Jerard R. B., Sculptured Surface Machining,
3. Zeid, I., CAD/CAM Theory and Practice, McGraw-Hill, 1991.
4. Chang, T. -C., Computer Aided Manufacturing, Prentice-Hall, 1998.
5. Korem, Y., Computer Control of Manufacturing Systems, McGraw-Hill

ENME800412
MANUFACTURING PERFORMANCE ASSESMENT (4 SKS)

Course Objective:

Syllabus:

Requirement: -

References:

ENME800413
MACHINE VISION SYSTEM (4 SKS)

Course Objective:

Machine Vision System provides the understanding and competency of the principles, methods and applications monitoring the production process by using visual-based camera technology, image processing, for the purpose of introducing the feature: product identification, selection and product screening, and quality control. With the completion of this course, students have the ability to apply and develop the visual method of monitoring the production process in the industry for the purpose.

Syllabus:

Basic Machine Vision Method: Binary Image, Binary Morphology and Gray-Scale, Texture analysis; Identification Method feature; image Processing Method Smart / Intelligent, Image Processing System; Control Equipment / Instruments Interface (Instruments, Signal, Protocol, Microcontroller) ; Method Introduction Color image; Machine Vision Applications.

Requirement: -

References:

1. J.R. Parker, Algorithms for Image Processing and Computer Vision, Wiley, 2003
2. Butchelor B. G., Whelan P. F.,Intelligent Vision System for Industry, Springer, 2002
3. E.R. Davies, Machine Vision : Theory, Algorithm, Practicalities, Morgan Kauffman, 2004
4. Micheul S, Lawrence O'Gorman, Michael J S Practical Algorithms for Image Analysis : Description, Examples and Code, , Cambride Univ. Press, 2000
5. Rafael Gonzales, et.al, Digital Image Processing using Matlab, Prentice Hall, 2003

ENME800414
QUALITY AND PRODUCTION MANAGEMENT SYSTEM (4 SKS)

Course Objective:

Provide knowledge, understanding and ability to perform management, analysis and improvement of production systems in the manufacturing industry with the principles of efficiency and effectiveness, and able to understand and implement and develop policies and procedures are needed to improve and control the various processes to improve the performance of the industry.

Syllabus :

Introduction to Manufacturing Systems, Manufacturing Principles, Resources, Production Process and Production Organization, Production Lay-Out, Design, Scheduling and Production Process Control; Productive Maintenance, Logistics and Inventory; Engineering Quality, Quality Control, Quality Function Deployment (QFD) , Total Quality Management; Quality Management System (8 Quality Management Principles, International Standard Quality Management System: ISO 9001, ISO 9004, ISO TS 16949, the International Management System Standard: ISO 14001, OHSAS 18001); System And Process Improvement: Cause - Effect Analysis, FMEA (Failure Mode and Effect Analysis), Lean Six Sigma.

Requirement:-

References:

1. Hitomi, Katsundo. Manufacturing System Engineering. Taylor & Francis. 2001
2. TQM : A Cross Functional Prespective, Rao, CARR, Dambolena, Kopp, Martin, Rafii, Schlesinger, John Willey, 1996
3. TQM, Text, Cases and Readings, Joel E. Ross, St. Lucie Press 100 E. Linton Blvd Suite 403 B Delray Beach, FL 33483

ENME800511

RAILWAY VEHICLE ENGINEERING (4 SKS)

Course Objective:

Provide the students with the knowledge and ability in analyzing and designing railway vehicle.

Syllabus :

Engineering and economic analysis of rail vehicle; structures and frame of rail vehicle; structural analysis of flat car; coupler analysis; electrical and pressurized air; analysis and modeling of bogie; axle; wheel; brake and pivot; suspension system and riding quality; dynamic load analysis; fatigue and fracture in rail vehicle; rail vehicle model and track geometry; modeling of rolling stock components; rail vehicle response on tangent track; rail vehicle lateral stability on tangent track; rail vehicle response on curved track; wheel wear; dynamics of rail vehicle train.

Requirement : -

References:

1. Simon Iwnicki, handbook of railway vehicle dynamics, CRC Press, Taylor & Francis Group, 2006.

ENME800512

HANDLING AND CONSTRUCTION EQUIPMENT (4 SKS)

Course Objective:

Provide expertise and competence to students in the field of design and development of lifting equipment and construction equipment

Syllabus:

Introduction and Scope of Construction Equipment; Tractor, Bulldozer, Dump Truck and shovel; Construction Equipment Mechanical Concept;

Heavy equipment system: Pneumatic and Hydraulic; Basic Machine-lifting machinery and materials transporter; Cranes, hoist and conveyor; forklift: Moving Walks, Escalators, and Elevators

Requirement: -

References:

1. ASME. Handbook of Materials Handling.
2. Mc.Guiness. Mechanical and Electrical Equiment for Building.

ENME800501

VEHICLE ENGINEERING & HEAVY DUTY EQUIPMENT (4 SKS)

Course Objective

This course provides the latest technology from the four-wheeled passenger vehicle, especially with covering all aspects of engineering in a vehicle. Lectures given vehicle engineering with the aim that students have basic competence to do the engineering on the four-wheeled passenger vehicle in particular.

Syllabus :

Vehicle Kinematics & Dynamics; mover and transmission system; Breaking Systems, Wheel and Suspension; Security System: Active and passive at the time experiencing issues.

Requirement : -

References:

1. Bosch Automotive Handbook, Sixth Editions, 2006
2. Gillespie, Thomas D., Fundamentals of Vehicle Dynamics, 2004
3. Heisler, Heinz. Advanced Vehicle Technology, 2004
4. Hermann, Hans. SAE Handbook of Automotive Engineering, 2004
5. Miliken, William F., Douglas L. Milliken, Maurice Olley, Chassis Design : Principles and Analysis, 2004
6. Pacejka, Hans B. Tire & Vehicle Dynamics, SAE, 2006

ENME800502
VEHICLE FRAME AND BODY ENGINEERING (4 SKS)
Course Objective
Provide the understanding of several concepts related to design and analysis of vehicle frame such as:
- A brief understanding in the history of vehicle design development
- Understanding the different possible scenarios for vehicle design and interactivity of the process in the design and manufacture of vehicles, as well as various types of vehicle structure and its use.
- Understand how the load can be analyzed simply and with the use of computers as well as a simple structural analysis that highlights the processes involved in vehicle structures.
- Understanding the basic concepts related to the aerodynamic vehicle body and the basic calculations required in the form of an aerodynamic vehicle design

Syllabus :
Introduction to Innovation and breakthrough discoveries in the field of automotive and industrial development of the automotive world today. Understanding the concept of loading on the vehicle structure, various types of chassis, structural analysis with a simple method of surface structure (Simple Structural Surface method) and method of computing the skeletal structure. aerodynamic force, reducing the lift force (drag force reduction), stability and concept of calculation of the vehicle body dynamics computation.

Requirement : -
References:
1. Heinz Heisler, "Advance Vehicle Technology", Society of Automotive Engineers, Inc. ISBN 0 7680 10713.
2. Brian Cantor, Patrick Grant and Colin Johnston, "Automotive Engineering Lightweight, Functional, and Novel Materials", Taylor & Francis Group, 6000 Broken Sound Parkway NW, Suite 300, ISBN 978-0-7503-1001-7.
3. Giancarlo Genta, Lorenzo Morello, "The Automotive Chassis Vol. 1: Components Design", Springer Science+Business Media B.V., ISBN: 978-1-4020-8674-8 e-ISBN: 978-1-4020-8676-2.
4. Giancarlo Genta, Lorenzo Morello, "The Automotive Chassis Vol. 1: System Design", Springer Science+Business Media B.V., ISBN: 978-1-4020-8673-1 e-ISBN: 978-1-4020-8675-5.
5. David A. Crolla, "Automotive Engineering Powertrain, Chassis System and Vehicle Body", Butterworth-Heinemann is an imprint of Elsevier, Linacre House, Jordan Hill, Oxford OX2 8DP, UK ISBN: 978-1-85617-577-7.
6. Nick Tucker and Kevin Lindsey, "An Introduction to Automotive Composite", Rapra Technology Limited, ISBN: 1-85957-279-0.
7. Jason C. Brown, A. John Robertson, and Stan T. Serpento, "Motor Vehicle Structures: Concepts and Fundamentals", Butterworth-Heinemann Linacre House, Jordan Hill, Oxford OX2 8DP, ISBN 0750651342
8. Liang Yun · Alan Bliault · Johnny Doo, WIG Craft and Ekranoplan, "Ground Effect Craft Technology", ISBN 978-1-4419-0041-8 e-ISBN 978-1-4419-0042-5, DOI 10.1007/978-1-4419-0042-5, Springer New York Dordrecht Heidelberg London.
9. Matthew Huang, "Vehicle Crash Mechanics", CRC Press LLC, International Standard Book Number 0-8493-0104-1.
10. Ahmed A. Shabana, Khaled E. Zaazaa and Hiroyuki Sugiyama, "Railroad Vehicle Dynamics a Computational Approach", CRC Press is an imprint of the Taylor & Francis Group, ISBN 978-1-4200-4581-9.

ENME800601
MARITIME RESOURCES AND TECHNOLOGIES (4 SKS)
Course Objective:
Provide the understanding about the potential of maritime resources: fisheries and non-fisheries in Indonesia.
Syllabus :
Fisheries potential in Indonesia, fishing zone classification, fishing, aquaculture, fish processing industry, marine-based industries, utilization of coral reefs, utilization of algae.

Requirement :-
References:
1. Talahatu, Marine Resources Dictate Lecture. 2008
2. Departemen kelautan dan Perikanan. Potensi Perikanan di Indonesia. 2008

ENME800513
MODERN VEHICLE TECHNOLOGY (4 SKS)
Course Objective:
Students understand the concept of manufacturing technology and control systems on the vehicle so as to:
- Analyze the condition of current technological advances to make fundamental changes in vehicle

design a sustainable future.
- Design process to create an automatic control system that helps in controlling the vehicle.
- Designing vehicles with electronic control systems that can improve vehicle performance.
- Describes the integration of vehicle control systems and mechanical-electrical interaction possibilities for the design of future vehicles.

Syllabus :

Knock control, Linear solenoid idle speed control, Sequential fuel injection, Distributorless ignition, Self-diagnosis for fail-safe operation, Crankshaft angular position measurement for ignition timing, Direct mass air flow sensor, Variable valve phasing, teknologi kendaraan *Hybrid Electric Vehicles and Electric Vehicle*.

Requirement

References:

1. Julian Happian-Smith, " An Introduction to Modern Vehicle Design", Butterworth-Heinemann Linacre House, Jordan Hill, Oxford OX2 8DP, ISBN 07506 5044 3.
2. Heinz Heisler, "Advance Vehicle Technology", Society of Automotive Engineers, Inc. ISBN 07680 1071 3.
3. Fuhs, Allen E., "Hybrid vehicles and the future of personal transportation", CRC Press, Taylor & Francis Group, ISBN-13: 978-1-4200-7534-2, ISBN-10: 1-4200-7534-9.
4. Lino Guzzella and Christopher H. Onder, "Introduction to Modeling and Control of Internal Combustion Engine Systems", Springer-Verlag Berlin Heidelberg, ISBN 978-3-642-10774-0 e-ISBN 978-3-642-10775-7, DOI 10.1007/978-3-642-10775-7, Library of Congress Control Number: 2009940323.
5. Iqbal Husain, "ELECTRIC and HYBRID VEHICLES Design Fundamentals", CRC PRESS Boca Raton London New York Washington, D.C., ISBN 0-203-00939-8 Master e-book ISBN, International Standard Book Number 0-8493-1466-6 (Print Edition), Library of Congress Card Number 2002041120.
6. Ali Emadi, "Handbook of Automotive Power Electronics and Motor Drives", Taylor & Francis Group, CRC Press is an imprint of Taylor & Francis Group, ISBN 0-8247-2361-9.
7. Nicolas Navet and Françoise Simonot-Lion, "Automotive Embedded Systems Handbook", CRC Press Taylor & Francis Group, 6000 Broken Sound Parkway NW, Suite 300, ISBN-13: 978-0-8493-8026-6, ISBN-10: 0-8493-8026-X
8. Paul Nieuwenhuis and Peter Wells, "The automotive industry and the environment A technical, business and social future", Woodhead Publishing ISBN 1 85573 713 2, CRC Press ISBN 0-8493-2072-0, CRC Press order number: WP2072.
9. Simon Tung, Bernard Kinker, and Mathias Woydt," Automotive Lubricant Testing and Advanced Additive Development", ASTM 100 Barr Harbor Drive PO Box C700, West Conshohocken, PA 19428-2959, ISBN: 978-0-8031-4505-4.
10. James Larminie, John Lowry, "Electric Vehicle Technology Explained", *Oxford Brookes University, Oxford, UK, Acenti Designs Ltd., UK.* ISBN 0-470-85163-5.

ENME800514

OIL AND GAS DRILLING EQUIPMENT (4 SKS)

Course Objective:

Provide additional insights regarding the implementation of basic knowledge of engineering competence that is at the core of oil and gas drilling techniques. Competencies expected of graduates capable of developing the engine with value added technical knowledge of oil and gas drilling equipment that is ready to be trained and shaped to be easily and immediately adapt to work without the awkwardness of the world's E / P oil and gas fields in general and in particular oil and gas drilling. Thus it has the advantages of graduates and a wider choice in the real world of work later. Objectives and learning outcomes to be achieved:

1 Enabled students to know the basic tools and their functions and how each is needed in an oil and gas drilling operations.

2 Students capable of explaining the technique of oil and gas drilling operations and its other related aspects such as equipment used, safety issues, safety equipment, emergency and environmental issues.

3 Students have a pretty good understanding of the knowledge of drilling equipment and its operation so as to participate in an oil and gas drilling operations with confidence and readiness to increase knowledge and skills later on after graduation.

Syllabus :

Intro to oil / gas well, oil / gas Exploration, exploitation and production, drilling rig, the terminology, the problem of drilling, drilling fluid, drilling oil and gas in the system, hoisting system equipments, equipments rotating system, circulating system equipments, power system equipments, blowout prevention system equipments, well design, equipments and operations for safety and efficiency, process and equipments for cementing, drilling preparation, drilling operations, drilling and process problems (drill string vibration and whirling, collar failure, etc.) artificial lift methods and equipments, visit to the field of oil and gas drilling.

Requirement

References:

1. Don A. Gorman, Jerry W. Meyer, "Drilling Equipment and Operations", Action Systems Inc., Dallas, Texas – USA.
2. Adam T. Bourgoyne, Martin E. Chenevert, et. al., "Applied Drilling Engineering", Society of Petroleum Engineers, Richarson, Texas – USA.
3. Nguyen J.P., "Drilling-Oil and Gas Field Development Techniques", Institut Français du Pétrole Publication, 1996
4. Kermit E. Brown, "The Technology of Artificial Lift Methods", Volume 2a, Petroleum publishing Co., 1980
5. Amanat U.C., "Oil Well Testing handbook", Elsevier, 2004
6. Amanat U.C., "Gas Well Testing handbook", Elsevier, 2004

ENME800602
ADVANCED THERMOFLUIDS (4 SKS)

Course Objective:

Students are expected to understand the concepts of mass, momentum, heat, work, energy and entropy at termofluida mechanics. Memahmi basic principles of hydrostatics, flow measurement, identifying termofluid system or control volume and the flow of time, momentum, heat and work associated with a given problem. Understand the concept of lift and drag force. Applying the first and second law of thermodynamics withing thermofluids sytem.

Syllabus :

Introduction to thermofluids, hydrostatic, control volume approach, Bernoulli equation, streamlined curves, the basic concepts of thermodynamics, the relationship properties and ideal gases, application of the first and second law of thermodynamics, temperature, entropy, entropy of use, fuel , control volume analysis, steady flow, gas turbines and jet engines.

Requirement : -

References:

1. Cengel, Y.A. & Boles, M.A. Thermodynamics: An Engineering Approach
2. Homsy, G.M.(Ed.) Mechanics Of Fluids
3. Moran, M.J. & Shapiro, H.N. Fundamentals Of Engineering Thermodynamics
4. Nakayama, Y.; & Boucher, R.F. Introduction To Fluid Mechanics
5. Rogers, G.F.C. & Mayhew, Y.R. Engineering Thermodynamics
6. Samimy, M., Et Al. A Gallery Of Fluid Motion
7. Sonntag, R.E., Borgnakke, C., & Van Wylen, G.J. Fundamentals Of Thermodynamics
8. Van Dyke, M. An Album Of Fluid Motion

ENME800303
DESIGNING AND MANUFACTURING TECHNOLOGY INTEGRATION (4 SKS)

Course Objective:

Provide an understanding of competence and capability in designing and manufacturing process by utilizing peracangan / includes latest design and manufacturing system CAD / CAM and reverse engineering and prototype development to improve efficiency and accelerate the production process, reduce errors, improve quality and reduce production costs.

Syllabus :

System Overview of CAD / CAM; Hardware & Software Systems CAD / CAM: Geometric Modelling: Type a mathematical representation of the model curve, surface and solid 3D modeling methods and manipulation of 3D models; exchange of data within and between sistem-CAD/CAM; CAD Laboratory Activity; Technology CNC; Tool Path Generation Method-CAM systems; Control 'quality of machining' (machined surface quality) in the system-CAM: Computer-Aided Process Planning CAPP; postprocessing; Practice CAM: 3D geometry measurements, principles and measurement based Coordinate Measuring Machine (CMM), the method of filtration data, the identification of boundary features, modeling and manipulation of point-based 3D models, 3D models for the modularization of the prototype, prototype and rapidprototyping method, discretization model, principles and application of SLS and SLM.

Requirement : -

References:

1. Kunwoo Lee, *Principles of CAD/CAM/CAE*, Prentice Hall, 2003
2. Gandjar K, *Hand out CAD/CAM*, DTMUI, 2007
3. Connie L. Dotson, *Fundamentals of Dimensional Metrology*, Delmar Learning, 2006
4. Ali K. Kamrani, Emad A Nasr, *Rapid Prototyping*: *Theory And Practice*, Birkhauser, 2006
5. Patri K. Venivinod, Weyin Ma, *Rapid Prototyping: Laser based and Other*

Technologies, 2003

ENME800402
AUTOMATION AND ROBOTICS (4 SKS)
Course Objective:
Automation and Robotics course discusses technology and application in the automation industry and the design and control the robot emphasizes: understanding the types of automation systems, particularly in the manufacturing industry and the mechanism, the design and development of automation system that emphasizes the 3 things: reliability, quality and cost and the understanding robot control system. Automation and Robotics Lectures given with the aim that students have an understanding in the implementation of technology Automation and Robotics, especially in the manufacturing industry.
Syllabus :
Automation System; Classification Type Manufacturing Automation machinery; Actuator; Sensor System; PLC Control System in the Manufacturing Automation machinery; Robotics: Definitions and Principles of Robot; Spatial Descriptions: Definitions and Principles, Methods and Applications Spatial descriptions; Forward Kinematics: Definition, Principles and The Forward Kinematics; Jacobians: Speed, explicit shape, definition and principle of inverse Kinematics; Dynamic: The form of explicit, Acceleration and inertia; Control system ronbotic: PID control, the Joint Space Control, Operational Control and Space Force Control; Robot Design Assignment.
Requirement :-
References:
1. Craig J., *Introduction to Robotics,* Addison Wesley Publishing Inc., 1989.
2. Heath L., *Fundamentals of Robotics,* Theory and Applications, Prentice Hall, 1979.
3. Koren Y., *Robotics for Engineer*, McGraw Hill, Intl Edition, 1985.
4. Lentz K. W. Jr., *Design of Automatic Machinery*, Van Nostrand Reinhold, 1985.
5. Schilling R. J., Mikell P., *Fundamentals of Robotics, Analysis and Control*, Prentice Hall, 2000.
6. Kiswanto G., *Otomasi dan Robotika*, Diktat Kuliah Departemen Teknik Mesin, 2004.

ENME800503
VEHICLE CONTROL SYSTEM (4 SKS)
Course Objective:
Students understand the basic features of the vehicle control system that has the ability to;

- Describes a simple method for the analysis of vehicle suspension systems and components;
- Describes the vehicle suspension system design requirements and how to achieve it;
- Analyze the various factors and issues that affect the design of suspension of driving
- Understand the mechanics of the vehicle wheel
- Describes recent developments in control of the braking system and braking system design and material needs an efficient,
- Analyze the influence of the steering system characteristics to the vehicle motion

Syllabus :
Introduction of the role of vehicle suspension systems, factors that affect the design, definitions and terminology in vehicle suspension systems, suspension mobility mechanisms, different types of suspension, kinematics analysis, the analysis center of rotation (roll center analysis), geometric style as well as lateral, suspension components. The basis of the braking system. Regulation, function and terms of use brake system, brake system components and configurations as well as the kinematics of the braking system. Consideration of adhesion force proportional to the brake system and braking efficiency. Deformation, lateral force and slip angle on the tire when the vehicle is running. Penikungan characteristics (cornering characteristics) according to Fiala theoretical approach to the mathematical model and the effect is due to air pressure in tires.
Requirement :-
References:
1. Heinz Heisler, “Advance Vehicle Technology”, Society of Automotive Engineers Inc. ISBN 0 7680 1071 3
2. Giancarlo Genta, Lorenzo Morello, “The Automotive Chassis Vol. 1: Components Design”, Springer Science+Business Media B.V., ISBN: 978-1-4020-8674-8 e-ISBN: 978-1-4020-8676-2.
3. Giancarlo Genta, Lorenzo Morello, “The Automotive Chassis Vol. 1: System Design”, Springer Science+Business Media B.V., ISBN: 978-1-4020-8673-1 e-ISBN: 978-1-4020-8675-5.
4. David A. Crolla, “Automotive Engineering Powertrain, Chassis System and Vehicle Body”, Butterworth-Heinemann is an imprint of Elsevier, Linacre House, Jordan

Hill, Oxford OX2 8DP, UK ISBN: 978-1-85617-577-7.
5. Masato Abe, "Vehicle Handling Dynamics, Theory and Applications", Butterworth-Heinemann is an imprint of Elsevier Linacre House, Jordan Hill, Oxford OX2 8DP, UK, ISBN–13: 978-1-8561-7749-8.
6. Fred Puhn, " Brake Handbook", Published by HPBooks A Division of HPBooks, Inc., ISBN 0-89586-232-8 Library of Congress Catalog Number 84-62610.
7. John C. Dixon, "The Shock Absorber Handbook Second Edition", John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, ISBN 978-0-470-51020-9.
8. Reza N. Jazar, "Vehicle Dynamics: Theory and Applications," Springer Science+Business Media, LLC, ISBN: 978-0-387-74243-4 e-ISBN: 978-0-387-74244-1.
9. Liang Yun · Alan Bliault · Johnny Doo, WIG Craft and Ekranoplan, "Ground Effect Craft Technology", ISBN 978-1-4419-0041-8 e-ISBN 978-1-4419-0042-5, DOI 10.1007/978-1-4419-0042-5, Springer New York Dordrecht Heidelberg London.
10. T.K. GARRETT , K. NEWTON, W. STEEDS, "The Motor Vehicle", Butterworth-Heinemann Linacre House, Jordan Hill, Oxford OX2 8DP, ISBN 07506 4449 4.

ENME800603
MARITIME TECHNOLOGY (4 SKS)
Course Objective:
Understanding about maritime technology and the use of sea transport of marine-based energy sources. This course is also intended to make students understand the maritime opportunities that can be developed by utilizing the technology.
Syllabus :
Ships clasification based on their function, aspects to be considered in designing the ship, the historical development of offshore construction, marine environment, types of building offshore: fixed and floating design design, mooring and anchor systems, Perhitunga style and strength calculations of offshore construction , FPSO, Marine energy resources: wave, wake, OTEC, salinity, hydrogen
Requirement :-
References:
1. International Energy Authority Renewable Energy Technology Deployment (IEA-RETD), Offshore Renewable Energy: Accelerating the Deployment of Offshore Wind, Tidal, and Wave Technologies., IEA-RETD 2012.
2. Chakrabarti, Handbook of Offshore Engineering, Elsevier. 2007

ENME800611
SHIP PRODUCTION MANAGEMENT (4 SKS)
COURSE OBJECTIVE :
Provide knowledge and understanding of the various shipyard management and technique.
Syllabus :
Shipyard Layout; Ship Process Production; Steel Stock Yard Planning; Crane Calculation: Jamorang Calculation At Each Stage Production: Make Work Schedule: Work Break Down Structure; Integrated Hull Outfitting and Painting; Advanced Outfiting; Group Technology Methods for Ship Production; Ship launching; Ship trials.
Prasayarat :
References:
1. D.J. Eyres, Ship Construction, Butterworth-Heinemann, 2007
2. R.Shenoi, Ship Production Technology, Univ. Of Southampton.
3. National Research Council, Shipbuilding Technology and Education, National Academy Press, 1996

ENME800614
ENERGY SYSTEM OPTIMIZATION (4 SKS)
Course Objective:
This course provides an understanding of mathematical modeling, simulation and optimization of energy systems through technical and economical approach. The course is intended to equip student with the ability to understand mathematical model, simulation and optimization of thermal systems.
Syllabus:
Workable System Design; Economical Evaluation; Determination of Mathematical Equations; Thermal Equipment Modeling; System Simulation; System Optimization: Objective Function, Constraints; Lagrange Multipliers: Lagrange multiplier to complete the optimization process; Dynamics, Geometric and Linear Programming; Mathematical Model of Thermodynamics Properties; Big System Simulation under Steady Condition; Big Thermal System Simulation; Calculation of Variables in Optimum Conditions.
Requirement: Engineering Mathematics, Basic Thermodynamics, Fluid Mechanics
References:
1. Stoecker, W.F. " Design of Thermal System", Mc.Graw Hill Book Co, 1989.
2. Boehm,R.F."Design of Analysis of Thermal System"John Wiley&Sons,1987.
3. Yogesh Jaluria, "Design and Optimization of Thermal Systems " Mc.Graw Hill Book Co, 1998.

ENME800615
MARINE AND OFFSHORE STRUCTURE (4 SKS)
Course Objective :
Provide the knowledge, understanding of the theory and principles of building offshore include the type, function, and offshore construction technology and techniques in performing design structure.
Syllabus :
Types of Offshore; Construction and Offshore Structures; Calculation of Style and Power Offshore: Safety Requirements; Construction

Semi-submersible; Single Buoy Mooring; FPSO; Offshore Maintenance and Repair.
Requirement :
References :
1. Cliff Gerwick, Construction of Marine and Off-shore Structures, CRC Press 1999
2. Subrata Chakrabarti, Handbook of Offshore Engineering, Elsevier Science, 2005
3. Yong Bai, Marine Structural Design, Elsevier Science, 2003

ENME800617
MARITIME LAW AND REGULATION (4 SKS)
Course Objective :
Provide knowledge and understanding of the laws and regulations on maritime activities both nationally and internationally.
Syllabus :
Introduction of maritime law; Regulation of Marine Pollution Prevention and Control; SOLAS; Prevention of Collisions Regulations; ISM Code; Statutory Rules; Passenger Ship Regulations; Tanker Regulations; Offshore Regulations: Accident Rescue Regulations; Other IMO rules. Accident prevention regulations; Risk assessment and analysis.
Requirement : -
References :
1. International Convention for the Prevention of Pollution From Ships (MARPOL), International Maritime Organisation Publications
2. International Regulations for Preventing Collisions at Sea (COLREG), International Maritime Organisation Publications
3. International Convention for the *Safety of Life at Sea* (SOLAS), International Maritime Organisation Publications
4. International Safety Management Code (ISM Code) Guide Book, International Maritime Organisation Publications
5. Churchil R.R. dan Lowe A.V, The Law of the Sea, MUP 1999

ENME800612
SPECIAL SHIP PROJECT (4 SKS)
Course Objective :
Provide the knowledge, understanding of ship design for special purposes
Syllabus :
Typology and special ship purposes; Material to special Ship, Design Considerations; Calculation of loading; Calculation of Ship Quantities; Computation Structures: Propulsion Systems; Motion System; Safety and Navigation System; Stability Calculation.
Requirement : -
References :
1. Lars Larsson dan Rolf Eliasson, Principles of Yacht Design, International Marine/Ragged Mountain Press, 2007
2. Dave Gerr, The Elements of Boats Strength, International Marine/Ragged Mountain Press, 1999
3. Norman L. Skene, dan Marnard Bray, Elements of Yacht Design, Sheridan house, 2001
4. Steve Killing dan Doug Hunter, Yacht Design Explained : A Sailors Guide to the Principles and Practices of Design, W.W Norton and Company, 1998
5. S. Sleight, Modern Boat Building, Conway Maritime Press.

ENME800613
WELDING ENGINEERING (4 SKS)
Course Objective :
Provide the knowledge, understanding of the theories, principles, design and assessment of the welding quality and applications.
Syllabus :
Introduction: welding inspector qualifications; Destructive test; Non-destructive test; welding inspector responsibilities; welding procedures and welder qualifications; welding design applications; residual stress and deformation; welding symbols
Requirement :
References :
Technical Manual TM 5-805-7. Welding Design, Procedures and Inspection Headquarters, Department of the Army.1985
Lioyds Register. Welding Procedures, Inspections and Qualifications.

ENME800616
SEA TRANSPORT AND PORT MANAGEMENT (4 SKS)
Course Objective :
Provide knowledge and understanding of various management approaches, maritime transport and port activities which also include risk factors, safety, and economy.
Syllabus :
Sea Transport Demand Trend: Marine Transportation Market Research; Inter Mode Transport System; System loading and unloading, Types of Sea Transport, Warehousing and Storage Cargo Systems, Systems Agency, Survey Charge, Corporate Sailing economic calculation, Customs.
Requirement : -
References :
1. P. Lorange, Shipping Management, Institution for shipping Research.
2. Patrick Alderton, Reeds Sea Transport : Operation and Management, Adlard Coles, 2008
3. Patrick Alderton, Port Management and Operations,Informa Business Publishing, 2005
4. Svein Kristiansen, Maritime Transportation : Safety management and Risk analysis, Butterworth-Heinemann, 2004
5. M. Stopford, Maritime Economics, Routledge, 1997
6. House, D.J, Cargo Work for Maritime Operation, Butterworth Heinemann, 2005

6.3. MASTER PROGRAM IN ELECTRICAL ENGINEERING

Program Specification

1	**Awarding Institution**		Universitas Indonesia
2	**Teaching Institution**		Universitas Indonesia
3	**Programme Title**		Master Program in Electrical Engineering
4	**Class**		Regular
5	**Final Award**		Magister Teknik (M.T.)
6	**Accreditation / Recognition**		BAN-PT: A – accredited
7	**Language(s) of Instruction**		Bahasa Indonesia
8	**Study Scheme (Full Time / Part Time)**		Full Time
9	**Entry Requirements**		S1 in Electrical Engineering, Math and Physics; and pass the entrance exam.
10	**Study Duration**		Designed for 2 years
	Type of Semester	Number of semester	Number of weeks /semester
	Regular	4	17
	Short (optional)	-	-
11	**Graduate Profiles:** Master of Engineering who is able to design and independently conduct research in the field of electrical engineering based on technological advancement in accordance with professional ethics		

12 **Expected Learning Outcomes:**

General outcomes:
- Able to independently conduct research based on innovative methods in electrical engineering fields in accordance with scientific and preofessional ethics.
- Able to disseminate research results to society both written and oral in scientific forum.
- Able to design / develop system in electrical engineering field through inter and multidisciplinary approach
- Able to manage teamwork or research team to solve electrical engineering problems
- Able to contribute in human resources improvement aiming at electrical engineering research development
- Able to broaden and maintain collaboration network with colleagues and electrical engineering research communities both nationally and internationally

Specific outcomes in photonic and electronic major:
- Able to characterize and integrate circuits and electronic devices and photonics
- Able to design a variety of electronic circuits and devices, photonics and micro-electro
- Able to analyze in depth various circuit design, electronic devices, photonics and micro-electro mechanical systems
- Able to contribute to current developments in the field of electronics and photonics

Specific outcomes to telecommunication major:
- Able to analyze in depth and improve the performance of telecommunication access system and networks
- Able to model and design the communication system
- Able to model and design the radar system

Specific outcomes in control major:
- Able to accurately model the control system according to the actual system
- Able to analyze the stability of comprehensive control system
- Able to develop and implement alternative control algorithms in real-time as a solution
- Able to contribute to the development of new control techniques and it's applications

Specific outcomes in electrical power and energy major:
- Able to master the phenomenon of electric power
- Identify the needs of Electric Power System Components and Power Electronics
- Able to apply conventional and renewable energy conversion
- Able to plan, analyze, design and engineering combine energy and electricity
- Able to implement technology advancement in energy and electricity engineering

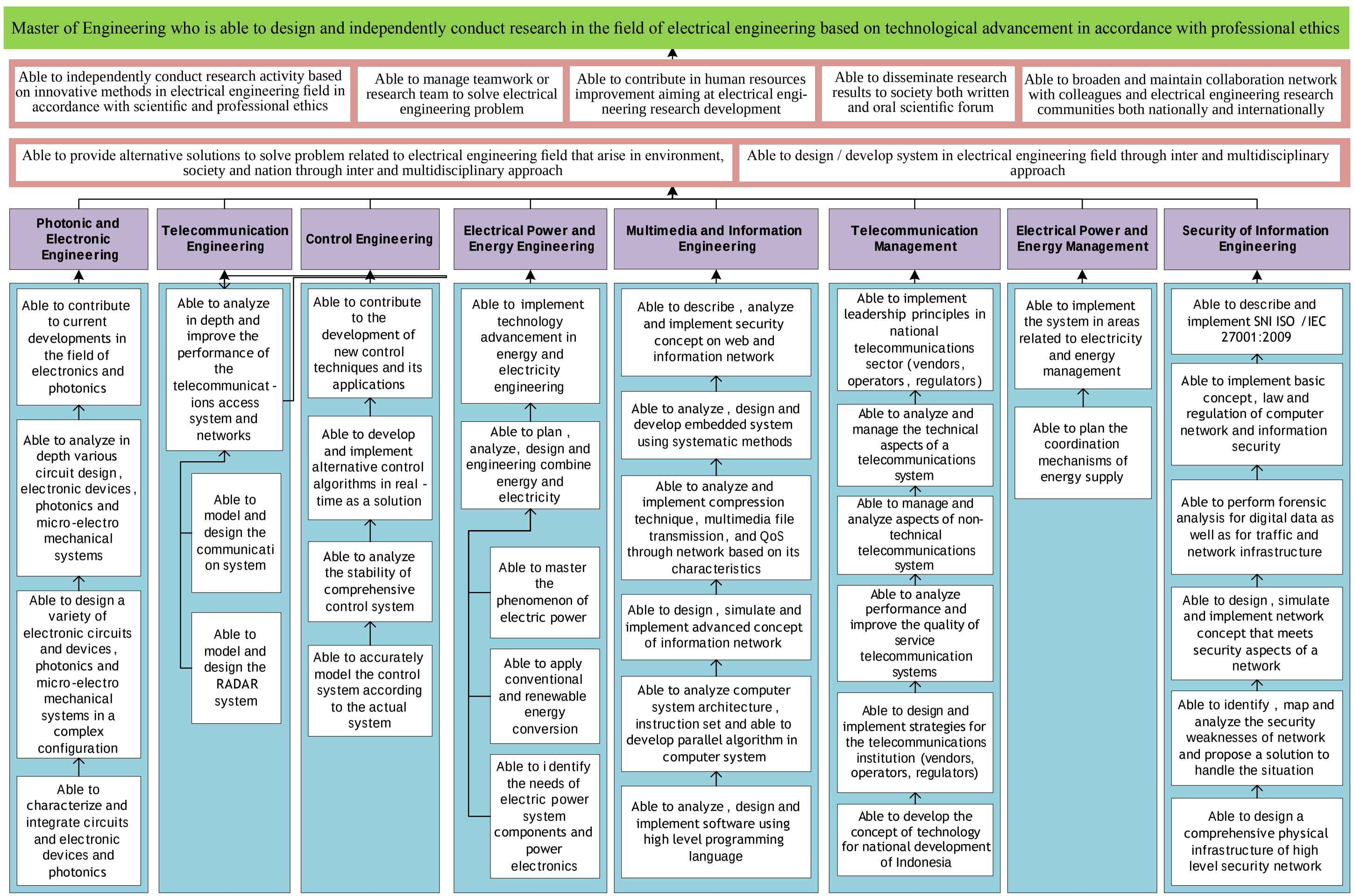
12	Specific outcomes in multimedia and information major: • Able to analyze, design and implement software using high level programming language • Able to analyze computer system architecture, instruction set and able to develop parallel algorithm in computer system • Able to design, simulate, and implement advanced concept of information network • Able to analyze and implement compression technique, multimedia file transmission, and QoS through network based on it's characteristics • Able to analyze, design and develop embedded system using systematic methods • Able to describe, analyze and implement security concept on web and information network Specific outcomes in telecommunication managament major: • Able to develop the concept of technology for national development of Indonesia • Able to design and implement strategies for telecommunications institution (vendors, operators, regulators) • Able to analyze performance and improve the quality of service telecommunication systems • Able to manage and analyze aspects of non-technical telecommunications system • Able to analyze and manage the technical aspects of a telecommunications system • Able to implement leadership principles in national telecommunications sector (vendors, operators, regulators) Specific outcomes in electrical power and energy management major: • Able to plan the coordination mechanisms of energy supply • Able to implement the system in areas related to electricity and energy management Specific outcomes in security of information network major: • Able to describe and implement SNI ISO/IEC 27001:2009 • Able to implement basic concept, law and regulation of computer network and information security • Able to perform forensic analysis for digital data as well as for traffic and network infrastructure • Able to design, simulate and implement network concept that meets security aspects of a network • Able to identify, map and analyze the security weaknesses of network and propose a solution to handle the situation • Able to design a comprehensive physical infrastructure of high level security network

13	**Classification of Subjects**		
No	Classification	Credit Hours (SKS)	Percentage
i	Department Courses	17	41.46%
ii	Majoring Courses	24	58.54%
	Total		100 %
14	**Total Credit Hours to Graduate**		41 SKS

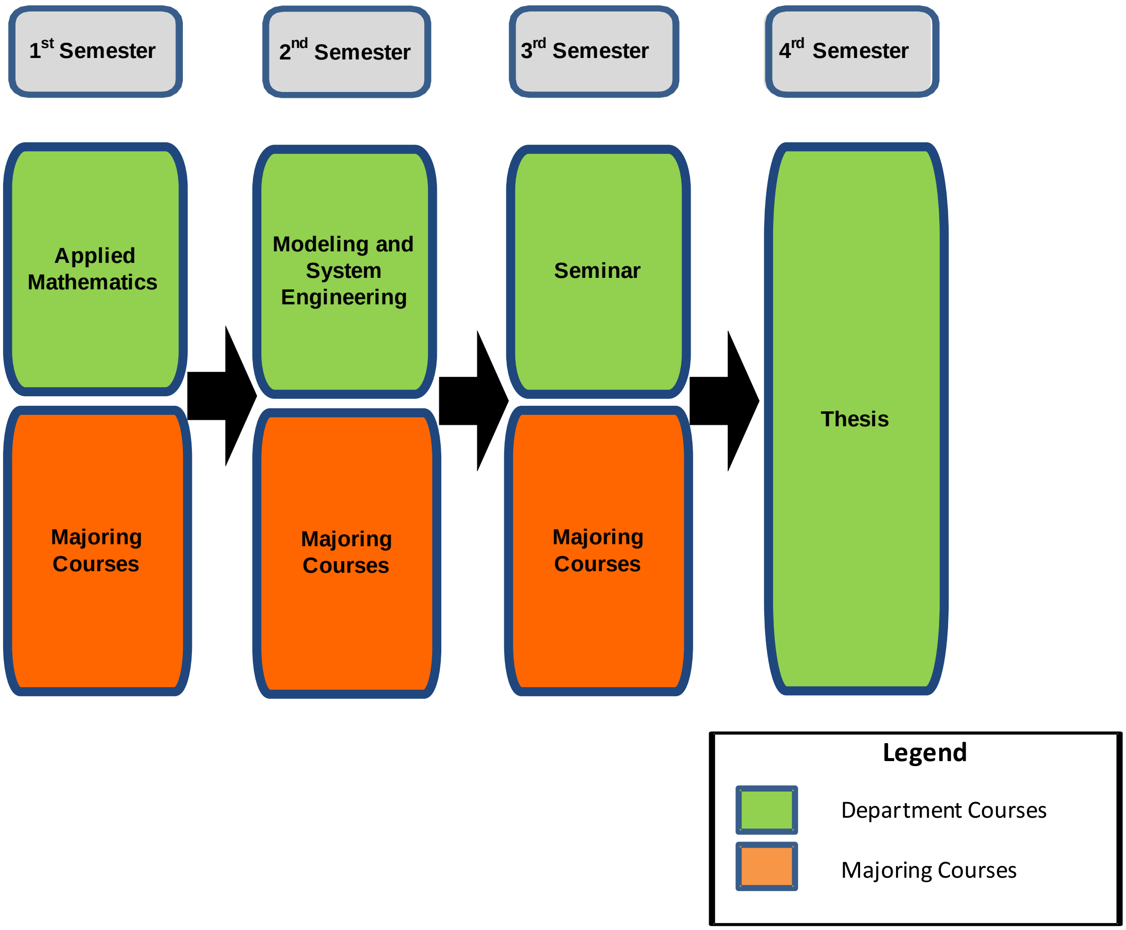
Career Prospects

The graduates of this program have been employed in various industrial companies such as power engineering, IT, electronic, oil & gas, telecommunication and other related inductries. Some of graduates were even employed before the graduation.
Some occupation or job titles that are suitable for this program are electrical engineer, process engineer, control engineer, instrumentation engineer, program manager, project manager, technical manager and professional lecturers.

Learning Outcomes Flow Diagram



Flow Diagram of Subjects



CURRICULUM 0F MASTER PROGRAM IN ELECTRICAL ENGINEERING

MAJOR IN TELECOMMUNICATION ENGINEERING

KODE	MATA KULIAH	SUBJECT	SKS
	Semester 1	**1st Semester**	
ENEE800001	Matematika Terapan	Applied Mathematics	3
ENEE800101	Sistem Broadband Bergerak Lanjut	Advanced Mobile Broadband System	3
ENEE800102	Sistem Radar	Radar Systems	3
ENEE800103	Pengolahan Sinyal Dijital	Digital Signal Processing	3
Subtotal			**12**
	Semester 2	**2nd Semester**	
ENEE800002	Pemodelan dan Rekayasa Sistem	Modeling and System Engineering	3
ENEE800104	Sistem Komunikasi Lanjut	Advanced Communication Systems	3
ENEE800105	Jaringan Komunikasi Optik	Optical Communication Networks	3
ENEE800106	Antena Lanjut	Advanced Antenna	3
Subtotal			**12**
	Semester 3	**3rd Semester**	
ENEE800107	Teknik Sistem Medis Nirkabel	Wireless Medical System Engineering	3
ENEE800108	Teknik RF Lanjut	Advanced RF Engineering	3
ENEE800003	Seminar/Pra-Tesis	Seminar/Pre – Thesis	3
Subtotal			**9**
	Semester 4	**4rd Semester**	
ENEE800004	Tesis	Thesis	**8**
Subtotal			**8**
TOTAL			**41**

MAJOR IN ELECTRICAL POWER AND ENERGY ENGINEERING

KODE	MATA KULIAH	SUBJECT	SKS
	Semester 1	**1st Semester**	
ENEE800001	Matematika Terapan	Applied Mathematics	3
ENEE800201	Operasi dan Kendali Pembang-kitan Tenaga Listrik	Power Generation Operation and Control	3
ENEE800202	Mutu Sistem Tenaga Listrik	Electrical Power System Quality	3
ENEE800203	Energi Baru dan Terbarukan	New and Renewable Energy	3
Subtotal			**12**

	Semester 2	**2nd Semester**	
ENEE800002	Pemodelan dan Rekayasa Sistem	Modeling and System Engineering	3
ENEE800204	Manajemen dan Ekonomi Energi	Economics Energy and Management	3
ENEE800205	Elektronika Daya Industri	Industrial Power Electronics	3
	Pilihan1	Elective1	3
	Subtotal		**12**
	Semester 3	**3rd Semester**	
ENEE800206	Perencanaan Sistem Tenaga Listrik	Electrical Power System Planning	3
ENEE800003	Seminar/Pra-Tesis	Seminar/Pre - Thesis	3
ENEE800701	Energi dan Lingkungan	Energy and Environment	3
	Subtotal		**9**
	Semester 4	**4rd Semester**	
ENEE800004	Tesis	Thesis	**8**
	Subtotal		**8**
	TOTAL		**41**

MAJOR IN PHOTONIC AND ELECTRONIC ENGINEERING

KODE	MATA KULIAH	SUBJECT	SKS
	Semester 1	**1st Semester**	
ENEE800001	Matematika Terapan	Applied Mathematics	3
ENEE800301	Teori Rangkaian Terpadu	Integrated Circuit Theory	3
ENEE800302	Fisika Elektronika	Electronics Physics	3
ENEE800303	Divais Fotonik	Photonic Devices	3
	Subtotal		**12**
	Semester 2	**2nd Semester**	
ENEE800002	Pemodelan dan Rekayasa Sistem	Modeling and System Engineering	3
ENEE800304	Divais Solid State	Solid State Device	3
ENEE800305	Divais Hetero-struktur	Hetero-structure Devices	3
	Pilihan1	Elective1	3
	Subtotal		**12**
	Semester 3	**3rd Semester**	
ENEE800306	Microelectromechanical System	Microelectromechanical System	3
ENEE800003	Seminar/Pra-Tesis	Seminar/Pre - Thesis	3
	Pilihan2	Elective2	3
	Subtotal		**9**

	Semester 4	4rd Semester	
ENEE800004	Tesis	Thesis	**8**
Subtotal			**8**
TOTAL			**41**

MAJOR IN CONTROL ENGINEERING

KODE	MATA KULIAH	SUBJECT	SKS
	Semester 1	**1st Semester**	
ENEE800001	Matematika Terapan	Applied Mathematics	3
ENEE800401	Kendali Analog dan Dijital	Analog and Digital Control	3
ENEE800402	Pengukuran dan Kendali Proses	Measurement and Process Control	3
ENEE800403	Sistem Kendali Multivariabel	Multivariable Control Systems	3
Subtotal			**12**
	Semester 2	**2nd Semester**	
ENEE800002	Pemodelan dan Rekayasa Sistem	Modeling and System Engineering	3
ENEE800404	Robotika Cerdas	Intelligent Robotics	3
ENEE800405	Kendali Adaptif dan Optimal	Adaptive and Optimal Control	3
	Pilihan1	Elective1	3
Subtotal			**12**
	Semester 3	**3rd Semester**	
ENEE800406	Kendali dan Sistem Cerdas	Intelligent System and Control	3
ENEE800003	Seminar/Pra-Tesis	Seminar/Pre – Thesis	3
	Pilihan2	Elective2	3
Subtotal			**9**
	Semester 4	**4rd Semester**	
ENEE800004	Tesis	Thesis	**8**
Subtotal			**8**
TOTAL			**41**

MAJOR IN MULTIMEDIA AND INFORMATION ENGINEERING

KODE	MATA AJARAN	SUBJECT	SKS
	Semester 1	**1st Semester**	
ENEE800001	Matematika Terapan	Applied Mathematics	3
ENEE800501	Rekayasa Perangkat Lunak Berorientasi Objek	Object Oriented based Software Engineering	3
ENEE800502	Arsitektur Komputer Lanjut	Advanced Computer Architectures	3
ENEE800503	Jaringan Informasi Lanjut	Advanced Information Networks	3
Subtotal			**12**

	Semester 2	2nd Semester	
ENEE800002	Pemodelan dan Rekayasa Sistem	Modeling and System Engineering	3
ENEE800504	Simulasi Jaringan Berbasis Komputer	Computer Based Network Simulation	3
ENEE800505	Komputasi Multimedia	Multimedia Computing	3
ENEE800506	Sistem Embedded	Embedded Systems	3
Subtotal			**12**
	Semester 3	**3rd Semester**	
ENEE800507	Keamanan dan Kehandalan pada Jaringan	Network Security and Reliability	3
	Pilihan	Elective	3
ENEE800003	Seminar/Pra-Tesis	Seminar/Pre – Thesis	3
Subtotal			**9**
	Semester 4	**4rd Semester**	
ENEE800004	Tesis	Thesis	**8**
Subtotal			**8**
TOTAL			**41**

MAJOR IN SECURITY OF INFORMATION NETWORK ENGINEERING

KODE	MATA AJARAN	SUBJECT	SKS
	Semester 1	**1st Semester**	
ENEE800001	Matematika Terapan	Applied Mathematics	3
ENEE800801	Keamanan Jaringan Informasi	Information Network Security	4
ENEE800802	Infrastruktur Jaringan Informasi	Information Network Infrastructure	3
Subtotal			**10**
	Semester 2	**2nd Semester**	
ENEE800002	Pemodelan dan Rekayasa Sistem	Modeling and System Engineering	3
ENEE800504	Simulasi Jaringan Berbasis Komputer	Computer Based Network Simulation	3
ENEE800804	Manajemen Risiko Keamanan dan Penanganan Bencana	Security Risk Management & Disaster Recovery	3
ENEE800803	Manajemen dan Regulasi Keamanan Informasi	Information Security Management and Regulation	3
Subtotal			**12**
	Semester 3	**3rd Semester**	
ENEE800805	Keamanan Aplikasi dan Jaringan Bergerak	Application and Mobile Network Security	4
ENEE800806	Forensik Digital dan Jaringan	Network and Digital Forensic	4
ENEE800003	Seminar/Pra-Tesis	Seminar/Pre – Thesis	3
Subtotal			**11**

	Semester 4	4th Semester	
ENEE800004	Tesis	Thesis	**8**
Subtotal			**8**
TOTAL			**41**

CURRICULUM 0F SPECIAL MAGISTER PROGRAM AT SALEMBA

MAJOR IN TELECOMMUNICATION MANAGEMENT

KODE	MATA KULIAH	SUBJECT	SKS
	Semester 1	**1st Semester**	
ENEE800001	Matematika Terapan	Applied Mathematics	3
ENEE800601	Teknik Telekomunikasi Modern	Modern Telecommunications Engineering	2
ENEE800602	Manajemen Sistem Telekomunikasi	Management of Telecommunications System	3
ENEE800603	Manajemen Proyek Teknik	Engineering Project Management	3
	Subtotal		**11**
	Semester 2	**2nd Semester**	
ENEE800002	Pemodelan dan Rekayasa Sistem	Modeling and System Engineering	3
ENEE800604	Manajemen Strategis	Strategic Management	3
ENEE800605	Regulasi dan Kebijakan Publik	Regulation and Public Policy	2
ENEE800606	Komunikasi Nirkabel dan Multimedia	Wireless and Multimedia Communications	3
	Subtotal		**11**
	Semester 3	**3rd Semester**	
ENEE800607	Manajemen Jaringan Telekomunikasi	Telecommunications Network Management	3
ENEE800608	Inovasi dan Daya Saing Teknologi	Technological Innovation and Competitiveness	3
ENEE800609	Kapita Selekta	Capita Selecta	2
ENEE800003	Seminar	Pre-Thesis	3
	Subtotal		**11**
	Semester 4	**4rd Semester**	
ENEE800004	Tesis	Thesis	**8**
	Subtotal		**8**
	TOTAL		**41**

MAJOR IN ELECTRICAL POWER AND ENERGY MANAGEMENT

KODE	MATA KULIAH	SUBJECT	SKS
	Semester 1	**1st Semester**	
ENEE800001	Matematika Terapan	Applied Mathematics	3

ENEE800603	Manajemen Proyek Teknik	Engineering Project Management	3
ENEE800701	Energi & Lingkungan	Energy & Environment	3
ENEE800702	Ekonomi Perusahaan Pembangkitan Tenaga Listrik	Electric Utility Power Generation Economics	2
Subtotal			**11**
	Semester 2	**2nd Semester**	
ENEE800002	Pemodelan dan Rekayasa Sistem	Modeling and System Engineering	3
ENEE800202	Mutu Sistem Tenaga Listrik	Electrical Power System Quality	3
ENEE800204	Manajemen dan Ekonomi Energi	Economics Energy and Management	3
ENEE800604	Manajemen Strategis	Strategic Management	3
ENEE800206	Perencanaan Sistem Tenaga Listrik	Electric Power System Planning	3
Subtotal			**15**
	Semester 3	**3rd Semester**	
ENEE800203	Energi Baru dan Terbarukan	New and Renewable Energy	3
ENEE800703	Topik Khusus dalam Ketenagalistrikan dan Energi	Electrical Power and Energy Special Topics	2
ENEE800003	Seminar/Pra-Tesis	Seminar/Pre – Thesis	3
Subtotal			**8**
	Semester 4	**4rd Semester**	
ENEE800004	Tesis	Thesis	**8**
Subtotal			**8**
TOTAL			**42**

ELECTIVE COURSES

Odd Semester			
KODE	**MATA AJARAN**	**SUBJECT**	**SKS**
ENEE800005	CAD VLSI	CAD VLSI	3
ENEE800006	Optika Fourier	Fourier Optics	3
ENEE800007	Aplikasi Mikroprosesor Lanjut	Advanced Microprocessor Application	3
ENEE800008	Penginderaan Jauh	Remote Sensing	3
Even Semester			
ENEE800009	Mikroelektronika Terapan	Applied Microelectronics	3
ENEE800010	Sirkuit Logika Lanjut	Advanced Logic Circuit	3
ENEE800011	Mekanika Kuantum	Quantum Mechanics	3
ENEE800012	Sistem Pengukuran dengan Metode Optik	Optical Measurement System	3
ENEE800013	Praktikum Teknik Optoelektronika	Optoelectronics Laboratory	1

COURSE SYLLABUS

ENEE800001
APPLIED MATHEMATICS
3 SKS
Learning Objectives: On completion class, the students will be able to apply mathematic formulas to solve engineering problems; In the field of technology management, this course is also giving the statistical methods that can be used to formulate the technical and business issues solutions in the system and application of technology.
Syllabus: Series; Differential equations and partial differential equations; some of transformations; Optimization; Probability and statistics; Statistical Method; Mathematic modeling for business; Decision analysis; Forecasting; Business research for managers; Optimization in business and engineering; Survey theory.
Prerequisites: None
Text Books:
1. E. Kreyzig, "Advanced Engineering Mathematics", 9th Edition, John Wiley, 2006.
2. E.K.P. Chong dan S.H. Zak, "An Introduction to Optimization", 2nd Edition, John Wiley 2001.
3. R.I. Levin and D.S.Rubin, "Statistics for Management" , Prentice Hall, 1997.
4. D.R. Anderson, D.J. Sweeney, T.A. Williams, J.D. Camm, R.K. Martin, "Quantitative Methods for Business", South Western Colleg Publication, 2009.

ENEE800002
MODELING AND SYSTEM ENGINEERING
3 SKS
Learning Objectives: After completing the class, the students will be able to simulate, identify and realize some physic models in dedicated software; In the field of technology management, this course also aims to model problems and cases that occur in the system so that the technology can support the ideal strategy of designs.
Syllabus: Basic simulation & modeling: physical modeling, non-parametric model identification; Data analysis: least square, extended least square, generalized least square, validation, real-time identification; Model and prototyping; Software applications: Matlab/Simulink, PSpice, Network Simulator; Modeling for technological system and applications; System Engineering Model; Design for the improvement of performance and quality of technological applications.
Prerequisites: None
Text Books:
1. A. Law, "Simulation Modeling and Analysis", 4th Edition, McGraw-Hill, 2006.
2. B.P. Zeigler, T.G. Kim & H. Praehofer, "Theory of Modeling and Simulation", 2nd Edition, Academic Press, 2000.

ENEE800003
SEMINAR
3 SKS
Learning Objectives: In this course, students are directed to apply previously learned knowledge into a self conducting research under supervision by a lecturer. After completing this course, students are expected to be able to design and analyze under a supervised research, and able to write their research findings in a systematic scientific writing in form of seminar book. Students are also expected to present and defense their research design in front of their seminar council.
Syllabus: None
References: Have taken at least 24 SKS
Text Books:
1. Technical Guidance for Universitas Indonesia Students' Final Project
2. IEEE Citation Reference
3. IEEE Transactions on Parallel And Distributed Systems, Vol. 21, No. 2, February 2010, "How To Write Research Articles in Computing and Engineering Disciplines"

ENEE800004
THESIS
8 SKS
Learning Objectives: In this course, students are directed to apply previously learned knowledge into self conducting research under supervision by a lecturer. After completing this course, Students are expected to be able to make a research concept by applying existing theories. Under supervision from the lecturer, students are expected to design, integrate, implement and analyze their concept, and write their research findings in a systematic scientific writing in the form of undergraduate theses book. Students are also expected to present and defend their concepts and findings in front of examiner in the final defense council.
Syllabus: None
References: Have taken at least 24 SKS
Text Books:
1. Technical Guidance for Universitas Indonesia Students' Final Project
2. IEEE Citation Reference
3. IEEE Transactions on Parallel And Distributed Systems, Vol. 21, No. 2, February 2010, "How To Write Research Articles in Computing and Engineering Disciplines"

ENEE800101
ADVANCED MOBILE BROADBAND SYSTEM
3 SKS
Learning Objectives: Students are expected to be able to analyze the performance of the next generation communication system.
Syllabus: Background of 3G Evolution; High

data rates in mobile communications; OFDM transmission; Wideband single carrier; Multi antenna techniques; Scheduling; Link adaptation and hybrid ARQ; WCDMA evolution; High speed downlink packet access; Enhanced uplink; MBMS; HSPA evolution; LTE and SAE; LTE radio access; LTE radio interface architecture; Downlink and uplink transmission schemes; LTE access procedure.
Prerequisites: None
Text Books:
E. Dahlman, S. Parkvall, J. Skold, P. Beming, "3G Evolution: HSPA and LTE for Mobile Broadband," 2nd Edition, Elsevier, 2008.

ENEE800102
RADAR SYSTEM
3 SKS
Learning Objectives: Students are able to design simple radar system and to analyze the performance of radar systems.
Syllabus: Introduction; Radar equation; Propagation effect; Target radar cross section; Detection of signal in noise & pulse compression; Radar antenna; Radar cluster & chaff; Signal processing – MTI & Pulse Doppler Technique; Tracking & parameter estimation; Transmitter & receiver.
Prerequisites: None
Text Books:
1. M.I. Skolnik, "Introduction to Radar System," 3rd ed
2. M.A. Richard, J.A. Scheer, W.A. Holm, "Principle of Modern Radar: Basic principles," Scitech Publishing Inc., 2010.
3. E.W. Kang, "Radar System Analysis, Design and Simulation," Artech House, 2008.

ENEE800103
DIGITAL SIGNAL PROCESSING
3 SKS
Learning Objectives: Students are able to analyze and transform digital signal sistematically in several domains
Syllabus: Signal Analysis; Frequency and Transient Response; Discrete FT-FFT; Z Transform and its applications in signal processing; Correlation and convolution; Digital filter: FIR and IIR; Multirate signal processing; Advanced transforms (WHT, DCT, Wavelet Transform) and their applications; Projects.
Prerequisites: None
Text Books:
1. E.C. Ifeachor and B.W. Jervis, "Digital Signal Processing: A Practical Approach", 2nd Edition, Addison Wesley, 2002.
2. S.M. Kuo, B.H. Lee & W.S. Thian, "Real-Time DSP: Implementations & Applications", John Wiley & Sons Publisher, 2006.

ENEE800104
ADVANCED COMMUNICATION SYSTEMS
3 SKS
Learning Objectives: Students are be able to analyze the performance of the next generation communication systems based on their coding, modulation, access, and network.
Syllabus: Signal space concept in representing digitally modulated signals; Characterization of narrowband signals, noise, and systems in analyzing communications systems; Bandlimited channels: intersymbol interference, equalization, receiver algorithms; Baseband and bandpass modulation; Power spectral density of modulation signals; Optimum receivers for AWGN channel; Probability of error analysis for error correction codes with modulation; Maximum likelihood sequence estimation - viterbi algorithm; Combined coding and modulation - trellis codes; Turbo coding advanced digital communications concepts equalization; Continuous phase modulation; Advanced modulation concepts (e.g., OFDM, CDMA); Capacity of vector (MISO, SIMO, MIMO) channels and spatial multiplexing (capacity of MISO and SIMO channels for both time varying and time invariant cases; Capacity of MIMO systems; V-BLAST and D-BLAST; STBC and STTC); Multiuser detection (MUD): introduction to MUD, linear decorrelator, MMSE MUD, adaptive MUD; Application of convex optimization to wireless design: minimizing PAPR in OFDM systems via convex optimization, applications of convex optimization to MAC and flow control problems); Fading channels and countermeasures; Multiple access.
Prerequisites: None
Text Books:
1. J.G. Proakis and M. Salehi, "Digital Communications," 5th Edition, McGraw-Hill, 2008. ISBN 978-0-07-295716-7.
2. S.S. Haykin, "Modern Wireless Communications," Prentice Hall, 2004, ISBN-13: 978-0130224729.
3. D. Tse and P. Viswanath, "Fundamentals of wireless communications", Cambridge University Press, 2005.
4. S. Boyd and L. Vandenberge, "Convex optimization," (available online at www.stanford.edu/~boyd).

ENEE800105
OPTICAL COMMUNICATION NETWORKS
3 SKS
Learning Objectives: Students are expected to be able to elaborate optical communication networks technologies, and to analyze the performance of optical communication networks.
Syllabus: Introduction: Review of telecommunication and computer networks; Fiber types: physical impairments, DWDM systems; Overview of optical communication technologies; SONET/SDH: Multiplexing, framing, control and management, protection, packet-over-SONET, generic framing procedure; Optical transport

network: WDM network elements, G.709, optical layer protection and restoration, optical control plane, GMPLS; WDM network design: lightpath topology design, routing and wavelength assignment, maximum load dimensioning models; Optical access networks: hybrid fibre-coaxial networks, passive optical networks; Recent advances: photonic packet switching.
Prerequisites: None
Text Books:
1. R. Ramaswami, K. Sivarajan, and G. Sasaki, "Optical Networks: A Practical Perspective," 3rd Edition, Morgan Kaufman Publishers, 2010.
2. W.J. Goralski, "SONET," 3rd Edition, McGraw Hill, 2002.
3. B. Mukherjee, "Optical WDM Networks (Optical Networks)," Springer, 2006. ISBN: 0387290559.

ENEE800106
ADVANCED ANTENNA
3 SKS
Learning Objectives: Students are able to design antennas and analyze their performances
Syllabus: Basic Electromagnetic Theory: maxwell eqs, boundary condition, vector wave equation, image theory. Wire and loop antenna: ideal dipole; Loop antenna. Aperture antenna; Slot antenna; Microstrip antenna; Horn antenna; Reflector antenna; Fractal Antenna; EBG (Electromagnetic Bandgap); Metamaterial; Computational electromagnetic: method of moment; Finite difference time domain or finite method; Geometrical theory of diffraction; Basic measurement technique.
Prerequisites: None
Text Books:
1. C.A. Balanis, "Antenna Theory – Analysis and Design," 3rd Edition, Wiley, 2005.
2. W.L. Stutzman and G.A. Thiele, "Antenna Theory & Design," John Wiley & Sons, 2002.

ENEE800107
WIRELESS MEDICAL SYSTEM ENGINEERING
3 SKS
Learning Objectives: Students are able to design and develop the medical devices; Have knowledge to build a medical engineering system and its applications
Syllabus: Introduction of Class; Body-Centric Wireless Communications; Electromagnetic properties and modeling of the human body; Wearable devices; Body-centric UWB communications; Body-sensor networks; Medical implant communication systems; Wireless medical diagnosis: magnetic resonance imaging (MRI), MRI safety; Wireless medical diagnosis: microwave computed tomography, advanced imaging techniques; Wireless treatment technology; Electromagnetic Interference (EMI) to medical devices; Wireless power technology for medical implant devices.
Prerequisites: None
Text Books:
1. J.D. Bronzino, "Medical Devices and Systems, in the Biomedical Engineering Handbook," CRC Taylor & Francis, 2006.
2. P.S. Hall, "Antennas and Propagation for Body Centric Wireless Communications," Artech House, 2006.

ENEE800108
ADVANCED RF ENGINEERING
3 SKS
Learning Objectives: Students are able to design RF devices, and to analyze their performance of wireless RF.
Syllabus: RF and radio access network design essentials: modulation, demodulation, and multiple access techniques; LNA and Mixers designs; Oscillator; Frequency Synthesizers; Filter Design; PA Design technologies; Wireless communication system design; Wireless LAN technologies.
Prerequisites: None
Text Books:
1. D. M. Pozar, "Microwave Engineering" 3rd ed, Prentice Hall, 2008
2. A. Hussain, "Advanced RF Engineering for Wireless Systems and Networks", John Wiley and Sons, 2004.

ENEE800201
POWER GENERATION OPERATION AND CONTROL
3 SKS
Learning Objectives: After completing the course, the student will be able to operate thermal and hydro power generation, distribute and control power system and create electric power production cost models.
Syllabus: Characteristics of power generation units; Economic dispatch of thermal units; Transmission system effects; Unit commitment; Generation with limited energy supply; Hydrothermal coordination; Production cost models; Control of generation; Interchange of power and energy.
Prerequisites: None
Text Books:
A.J. Wood and B.F. Wollenberg, "Power Generation, Operation and Control", 2nd Edition, John Wiley & Sons Inc., 1996

ENEE800202
ELECTRICAL POWER SYSTEM QUALITY
3 SKS
Learning Objectives: Able to analyze the operating conditions of electrical power system, both in steady state and disruption because of voltage swells / voltage sag and harmonic distortions.
Syllabus: Transients; Overvoltage; Undervoltage; Interruptions; Sags; Swells; Voltage imbalance;

Voltage fluctuations; Waveform distortion; Power frequency variations; Harmonic distortions; Voltage vs current distortion; Harmonic vs transients; Controlling harmonics; Filter design; Power quality benchmarking; Distributed generation and power quality; Wiring and grounding; Power quality monitoring.
Prerequisites: None
Text Books:
R.C. Dugan, M.F. Mc.Granaghan, S.Santoso, H.W. Beaty, "Electrical Power System Quality", 2nd Edition, Mc.Graw Hill, 2002.

ENEE800203
NEW AND RENEWABLE ENERGY
3 SKS
Learning Objectives: The students will be able to combine usage of new and renewable energy resources to become optimum power systems.
Syllabus: Forms and sources of new and renewable energy; Concepts and technology of: nuclear energy, solar energy, wind energy, sea energy (tidal, wave, ocean thermal energy conversion), geothermal energy, water energy (run of river, reservoir and pumped storage hydro power plants); Biomass; Biofuels (liquid, gaseous); Fuel cells; Economics of new and renewable energy.
Prerequisites: None
Text Books:
1. H.L. Wilis, "Distributed Power Generation: Planning and Evaluation – Power Engineering", CRC Press, 2000.
2. A.M Borbely, J.F. Kreider, "Distributed Generation, The Power Paradigm for the New Millenium", London, U.K., CRC Press 2001.

ENEE800204
ECONOMICS ENERGY AND MANAGEMENT
3 SKS
Learning Objectives: Understand the energy management by applying supply/demand side management that related with the resource, for both fossil and non-fossil.
Syllabus: Fosil and Non Fosil Resources; Power System Management; incuding Generation; Transmission and Distribution of Electrical Power. Supply Side Management and Demand Side Management; known as Integrated Resource Planning.
Prerequisites: None
Text Books:
1. J.M. Griffin, H.B. Steele, "Energy Economics and Policy", Academic Press New York, 1980.
2. Zuhal, "Ketenagalistrikan Indonesia", PT. Ganesha Prima, April 1995.

ENEE800205
INDUSTRIAL POWER ELECTRONICS
3 SKS
Learning Objectives: To deal with the applications of high power semiconductor devices in industries and utilities.
Syllabus: Review of Power Electronic Systems and Power Semiconductor Switches; Diode Rectifiers; Controlled Rectifiers; Inverters; Resonant Converters and Switching D.C. Power Supplies; Power Conditioners and Uninterruptible Power Supplies; Introduction to Motor Drives; D.C. Motor Drives; Induction Motor Drives; Synchronous Motor Drives; Residential; Industrial and Electric Utility Applications; Optimizing the Utility Interface with Power Electronic Systems.
Prerequisites: None
Text Books:
N. Mohan, T.M. Undeland, W.P. Robbins, "Power Electronics", 3rd Edition, John Wiley and Sons, 2003.

ENEE800206
ELECTRICAL POWER SYSTEM PLANNING
3 SKS
Learning Objectives: Able to analyze the identity of forecasts demand to changes in economic variables and able to forecasts system reliability of variable economic conditions.
Syllabus: Electrical Power Increased Demand Forecasting; Long Term Electrical Power Supply; Electrical Power Generation (Production) Planning; Power System Plant Maintenance Scheduling; Indonesia's Electricity Development Strategic Factors; Indonesia's Electricity Development Prospects; Electrical Power System Development Models; Optimization Methods.
Prerequisites: None
Text Books:
1. X. Wang, J.R. McDonald, "Modern Power System Planning", McGraw Hill Book Co., 1994.
2. Zuhal, "Ketenagalistrikan Indonesia", PT. Ganesha Prima, April 1995.

ENEE800301
INTEGRATED CIRCUIT THEORY
3 SKS
Learning Objectives: Able to master the Basic concept and design the simple application in integrated circuits.
Syllabus: Integrated component circuit technology; CMOS technology; modeling of CMOS analog circuit; device characteristic; operational amplifier sub circuit with CMOS analog; CMOS amplifier; Analog to Digital converter; Digital to Analog Converter; Computer based design of electronic circuits.
Prerequisites: None
Text Books:
1. R.S. Muller and T.I. Kamins, "Device Electronics for Integrated Circuits", 2nd Edition, John Wiley and Sons, 1986.
2. R.L. Boyleslad & L. Nashelsky, "Electronic Devices & Circuit Theory", 10th Edition,

Prentice Hall, 2008.

ENEE800302
ELECTRONIC PHYSICS
3 SKS
Learning Objectives: On completion of course, the students will be able to understand the structur of crystal lattice, X-ray crystal analysis, dynamic of cry-quantum mechanic and statictical mechanic.
Syllabus: Space Lattice and Crystal; X-ray Crystal Analysis; Dynamic of Cry-Quantum Mechanic & Statistical Mechanic.
Prerequisites: None
Text Books:
1. J.P. McKelvey,"Solid State & Semiconductor Physic", REK Publishing, 1986.
2. S.S. Li, "Semiconductor Physical Electronics", 2nd Edition, Springer, 2006.

ENEE800303
PHOTONIC DEVICE
3 SKS
Learning Objectives: This course aims at providing students with the systematic introduction to modern photonic devices and subsystems for applications in optical communications, optical sensing and imaging, optical data-storage and computing and solid state illumination.
Syllabus: Guided wave optics; fiber optics; resonator optics; photon optics; photons and atoms; photon in semiconductors; laser amplifiers; semiconductor photon sources; photonic modulators (electro-optics, nonlinear optics and acousto optics).
Prerequisites: None
Text Books:
1. B.E.A. Saleh and M.C. Teich, "Fundamentals of Photonics", John Wiley & Sons, 1991.
2. S.L. Chuang, "Physics of Photonic Devices", 2nd Edition, Wiley, 2009. ISBN-10: 0470293195, ISBN-13: 978-0470293195.

ENEE800304
SOLID STATE DEVICE
3 SKS
Learning Objectives: On completion of course, the students will able to design simple solid state device, such as: bipolar device, FET, IMPATT, transferred electron devices.
Syllabus: Bipolar Devices; JFET; MOSFET; MIS Diode; Charge Couple Devices; Tunnel devices; IMPATT and Related Transit – Time Devices; Transferred Electron Devices.
Prerequisites: None
Text Books:
1. S.M. Sze, K.K. Ng, "Physic of Semiconductor Devices", 3rd Edition, John Wiley & Sons, 2006.
2. R.F. Pierred, "Advanced Semiconductor Fundamental", 2nd Edition, Pierson Publisher, 2002.

ENEE800305
HETERO-STRUCTURE DEVICES
3 SKS
Learning Objectives: The students are able to analyze the account of device physics and operational principles of heterostructure devices comprehensively.
Syllabus: A review of the Physics and Properties of Semiconductor: direct and indirect bandgap; Heterojunction; Design of heterostructures devices; Solar cell; Photodetector; LED.
Prerequisites: None
Text Books:
1. S.M. Sze, K.K. Ng, "Physic of Semiconductor Devices", 3rd Edition, John Wiley & Sons, 2006.
2. J.P. McKelvey, "Solid State and Semiconductor Physics", Robert E. Krieger Publishing Company, 1986.

ENEE800306
MICROELECTROMECHANICAL SYSTEM
3 SKS
Learning Objectives: After completing the course, the students are able to design and analyze a simple device based on MEMS. In addition, the students will understand fabrication process of MEMS dan Microsensor and its applications in industry.
Syllabus: Introduction to MEMS; Material for MEMS; Processes for Micromachining; MEMS Structure and System in Inductrial and Automotive Application; MEMS Structures and Systems in Photonic Applications; MEMS Applications in Life Sciences; MEMS Structures and Systems in RF Applications; Packaging and Reliability Considerations for MEMS.
Prerequisites: None
Text Books:
1. Nadim Maluf & Kirt William, "An Introduction to Microelectromechanical Systems Engineering, Second Edition, Artech House Inc, 685 Canton Street Norwrod, MA02062, USA, 2004
2. Mohamed Gad El Hak, MEMS Handbook, CRC Press LLC, 222 Rosewood Drive - Denvers, MA01423, USA, 2004

ENEE800401
ANALOG AND DIGITAL CONTROL
3 SKS
Learning Objectives: This course is a review of basic modeling, analysis, and design of feedback control systems. It gives them insight into the problems of control and intuition about methods available to solve such problems. Both frequency response and state space methods for analysis and

design of continuous and discrete time systems are considered.
Syllabus: Open-loop and closed-loop control systems; basic concepts and definitions; Block diagram; Nyquist Diagrams; Bode Diagrams analysis and design; Steady-state error analysis; Root locus analysis and design; State space equations; controllability and observability; solution of state equations; Controller design using pole-placement method; Full order observer design; Z-transformation; solution of difference equations; mapping between s-plane and z-plane; discrete-time state space; controller design using pole assignment; design of state observers; deadbeat control.
Prerequisites: None
Text Books:
1. N.S. Nise, "Control Systems Engineering", 5th Edition, Wiley (December 10, 2007), ISBN-10: 0471794759, ISBN-13: 978-0471794752.
2. K. Ogata, "Discrete-Time Control Systems", Prentice Hall; 2nd Edition, 1997. ISBN-10: 0130342815, ISBN-13: 978-0130342812.

ENEE800402
MEASUREMENT AND PROCESS CONTROL
3 SKS
Learning Objectives: The learning objective of course is to build student skills in process control. The fundamental concepts are reduced to practice throughout. The development of practical correlations, design rules, and guidelines are explained so that the student understands the basis, correct application and limitations of each.
Syllabus: Industrial process instrumentation; transfer function and system responses; PID controllers basic structures and characteristics; control loops and system stability; single loop – tuning (SISO); graphical identification method; controller parameter calculations; case studies.
Prerequisites: None
Text Books:
1. F.G. Shinskey, "Process Control Systems, Application, Design and Adjustment", 2nd Edition, McGraw Hill Book Inc., 1979.
2. D.M. Considine, "Process Instruments and Control Handbook", 3rd Edition, McGraw Hill Book International, 1987.

ENEE800403
MULTIVARIABLE CONTROL SYSTEMS
3 SKS
Learning Objectives: This course makes the students able to understand the concept of interaction loops in multivariable systems, analyze the stability of multivariable systems, and design multivariable controllers in frequency domain and time domain.
Syllabus: Frequency domain: Multivariable system representation; input-output model ; interaction loop; relative gain array; decoupling method Baksenbom-Hood; stability. Time domain: state space model; diagonal form; controllable form; observable form; stability of multivariable system; controllability dan observability; poles dan zeros; pole placement method; decoupling Falb-Wolovich method; observer Luenberger design.
Prerequisites: None
Text Books:
1. P. Albertos and A. Sala, "Multivariable Control Systems: An Engineering Approach", Springer-Verlag, 2004.
2. K. Zhou, "Robust & Optimal Control", Prentice Hall, 1996.

ENEE800404
INTELLIGENT ROBOTICS
3 SKS
Learning Objectives: Provide knowledge and skill to students for designing mobile robot in closed loop control with sensor fusion. When models are realized, a simulation with OpenGL followed by real-word implementation are conducted.
Syllabus: Introduction and implementation of sensor and actuator; Control system review; C programming for ATMEL AVR microcontroller; Modelling simulation with openGL; Mobile robot modelling along with sensor and its simulation with openGL; Live Recocking; Real-time system concept; Advanced control system and communication; Navigation system; Command-control monitoring; Localication; Knowledge based system concept along with realization on mobile robot.
Prerequisites: None
Text Books:
1. G. McComb, M. Predko, "Robot Builder's Bonanza", 3rd Edition, McGraw-Hill, 2006, ISBN 0071468935/9780071468930.
2. J.M. Holland, "Designing Autonomous Mobile Robots: Inside the Mind of an Intelligent Machine", Newnes, 2004. ISBN-10: 0750676833, ISBN-13: 978-0750676830.

ENEE800405
ADAPTIVE AND OPTIMAL CONTROL
3 SKS
Learning Objectives: The students are able to design of control law for slowly time varying, uncertain or nonlinear processes (local description depending on the operating point). Such task can be realised with different kind of adaptive controllers or optimal controls where a fixed control law is replaced by off-line optimization performed over infinite horizon.
Syllabus: Structure adaptive control; online identification for slowly varying processes as an extension of the least squares method; self tuning controllers based on parameter estimation and different controller synthesis such as pole assignment and minimum variance; realisation

of adaptive control in extended Matlab environment; aspect of pratical realisation: sampling time; model order and online supervision of the control loop; Random process; criterion function; robustness; linear quadratic controller; Kalman filter; linear quadratic Gaussian controller; reduced controller order.
Prerequisites: None
Text Books:
1. P.E. Wellstead dan M.B. Zarrop, "Self-Tuning Systems: Control and Signal Processing," John Wiley and Sons, 1991.
2. J.B. Burl, "Linear Optimal Control: H2 and H∞ Methods," Addison Wesley, 1999.

ENEE800406
INTELLIGENT SYSTEM AND CONTROL
3 SKS
Learning Objectives: Learning the computational intelligence method to develop an intelligent control system considering biological system and human cognitive capabilities, possesing learning, adaptation and classification. Real application on single input single output (SISO) system is experimentally conducted.
Syllabus: Introduction to pattern recognition; introduction to artificial neural networks; backpropagation learning; self-organized map learning; learning vector quantization; system identification; system control; SISO experiments.
Prerequisites: None
Text Books:
1. F.M. Ham and I. Kostanic, "Principal of Neuroconputing for Science and Engineering", McGraw-Hill, 2001.
2. J. Sarangapani,"Neural Networks Control of Nonlinier Discrete-Time System", CRC Press, 2006.

ENEE800501
OBJECT ORIENTED BASED SOFTWARE ENGINEERING
3 SKS
Learning Objectives: In this course students learn topics on object oriented based software engineering life cycle, requirements and specifications. After completing this course, students will be able to outline concepts of object oriented based software engineering and models used in development. Students will also have capability in problem analyzing, apply necessary stages of software life cycle, create documentation in a software development, describe software specification based on software requirements and apply verification methods, implement design in a program, test the program, perform system maintenance and produce complete documentation of the system development up to the user manual for a relatively complex system in the real world.
Syllabus: Object oriented based software engineering concept, problems in software development, the waterfall model, prototyping approaches; evolutionary development models; cost estimation; configuration management; software metrics; requirements engineering; project and risk management; PSP; TSP; analysis; definition; specification; requirements document; functional and nonfunctional requirements; UML - Use-cases; designing for reusability; adaptability and maintainability; software architecture design quality; software implementation; test plans dan its implementation; data modeling; software maintenance; system documentation.
Prerequisites: None
Textbooks:
1. E. Braude, "Software Engineering: An Object Oriented Perspective", John Wiley and Sons, 2000.
2. E. Braude, M. Bernstein, "Software Engineering: Modern Approaches", John Wiley and Sons, 2010.
3. C. Larman, "Applying UML and Patterns: An Introduction to Object-oriented Analysis and Design and the Unified Process", Prentice Hall International, 2004.
4. D. Brown, "An Introduction to Object Oriented Analysis, Object and UML in Plain English", John Wiley and Sons, 2002.
5. E. Yourdon, "Modern Structured Analysis", Prentice Hall International, 1992.
6. Sommerville, "Software Engineering", 9th Edition, Addison Wesley, 2010.
7. R. Pressman, "Software Engineering: a Practitioner's Approach", 7th Edition, McGraw-Hill, 2009.

ENEE800502
ADVANCED COMPUTER ARCHITECTURES
3 SKS
Learning Objectives: After completing this lecture, the students are expected to be able to **analyse** computer architecture, in particular from the instruction set design and it's influence to computing performance. The students are also expected to be able to **analyse** various computer organizations. In addition, the students are expected to analyze the advanced concept of computing performance improvement of a machine, through special techniques including cache memories, specifically the cache organization, the consistency and coherency issues; able to **design** innovative ways of instruction sequencing through pipelining. Students are expected to be able to **elaborate** the architecture of superscalar processors, able to **elaborate** the superscalar data conflicts; true, anti and output data dependency; able to **elaborate** superscalar program execution techniques; in order issue in order completion, in order issue and out of order completion and out of order issue and out order

completion. The students are expected to be able to **analyze** parallel computing techniques using parallel processors and multicore organizations. Students are expected to **analyze** the techniques of load distribution and balancing, tasks or thread schedulling and message-passing in parallel processors; and it's influence to speed-up.

Syllabus: Clocks and it's influence to computing performance, cache memory organization, cache update mechanism and it's influence to computing performance, instruction set architectures, influence of instruction design to programming productivity and processing performance, pipelining techniques and it's application to processing speed, pipelining conflicts, instruction reordering to improve speed-up; superscalar processors, instruction execution in superscalar processors, conflicts in instruction execution : true, output and anti data dependency; instruction look ahead and window of instruction execution, order of instruction issue and completion; parallel processing techniques, notion of speed-up in parallel program execution, load distribution and balancing and it's influence to processing performance; multicore processor architecture.

Prerequisites: None

Text Books:

1. **Computer Organizations and Architecture**, Eight Edition, William Stallings, Prentice Hall 2010 or newer editions.
2. Additional Reading Materials : **Modern Computer Design: Fundamentals of Superscalar Processors**, oleh: J.P Shen dan M.H. Lipasti, Mc Graw Hill 2005. Computer Architecture : A Qualitative Approach oleh Hennessy and Patterson - Fourth Edition, Morgan Kaufmann, 2006 or newer editions.

ENEE800503

ADVANCED INFORMATION NETWORKS

3 SKS

Learning Objectives: After completing this course the students are expected to be able to **differentiate** based on analysis among different kind of the present advanced information networks. The students networks that support QoS (and also QoE); both wired and wireless networks. The students are expected to be able to **analyze** the current strengths and weakness of the IP networks, and ways to improve information the speed and safety of information transfer on the IP networks. The students are also expected to be able to **elaborate** the concepts of proposed architecture of future information networks that are able to support QoS, such as the asynchronous transfer mode (ATM), integrated services architecture, the differentiated services architecture, the multiprotocol label switching (MPLS), the WiMaz and some variant of WiFi technology (802.11n, in particular), and other newly developed high speed information transfer technology. These later part of technology will be contributed and presented by the students to demonstrate their capability in **analyzing** the complexity of the emerging technology.

Syllabus: Overview of the current Internet Technology. Brief discussion about the IP technology and it's problems. Security issues in IP based networks. The information networks revisited: The notion of QoS (Quality of Service) and QoE (Quality of Experience) characteristic of traffic, traffic class, QoS parameters, ATM (Asynchronous Transfer Mode), discussion on connection set-up, label swapping, traffic management : traffic polishing, traffic shaping, etc: MPLS (Multiprotocol Label Switching) : notion of label, label assignment, the benefits of label swapping, VPN.GMPLS (Generalised MPLS), why GMPLS, what are the goals/benefits of GMPLS, GMPLS technology in general. Integrated Services and Differentiated Services, Coverage of IEEE 802 based wireless access technology

Prerequisites: None

Text Books:

W. Stallings, "High Speed Networks", Prentice Hall, 2002.

ENEE800504

COMPUTER BASED NETWORK SIMULATION

3 SKS

Learning Objectives: By the end of the course, students should be able to describe the role of network simulation in the new internet protocols research and be able to use NS network simulator to conduct research in networking.

Syllabus: Introduction; Network Simulation Fundamentals; The Basic of NS: OTCL; Simple Simulation example (topology; events; marking flows; monitoring a queue); Architecture (nodes; links; applications; protocols; packets; loss modules; math support); Event Scheduler; Network Components; Packet; Post Simulation: Analyzing ns trace file; Queue Monitor (examples); Best Practice in Network Performance Evaluation Techniques; Ns topology generation; OTCL and C++; routing (unicast; multicast; network dynamics); multicast transport; NAM network animator; further features (abstraction; multicast; RTP/RTCP; SRM; QoS; Scenario generation; test suites); Extending ns: Ns structure; OTCL linkage; Add new application and agent; add new queue; A New Protocol for ns: Header file; C++ code; necessary changes; the TCL code; Introduction to NS-3.

Prerequisites: None

Text Books:

1. J. F. Kurose and K. W. Ross, "Computer Networking, A Top-Down Approach Featuring the Internet", Addison Wesley, 2003
2. A. Law and W. Kelton, "Simulation Modeling and Analysis", McGraw-Hill, 2001.
3. R. Jain. "The Art of Computer Systems Performance Analysis: Techniques for Experi-

mental Design, Measurement, Simulation, and Modeling", John Wiley and Sons, New York, 1991.

ENEE800505
MULTIMEDIA COMPUTING
3 SKS
Learning Objectives: In this course, students will be able to implement technology in multimedia and its delivery via networks. After completing this course, students are expected to be able to analyze multimedia file components, multimedia file compression techniques, real time delivery of multimedia file, multimedia QoS in computer networks, and also able to analyze the network characteristics to support multimedia file distribution through the Internet.
Syllabus: The concept of Multimedia Computing; Digital Representation of Audio; Image and Video; Characteristics and Requirements of Multimedia Data; Digital Audio Compression Principles; Techniques and Standards; Image and Video Compression Principles; Techniques and Standards; End-to-End Quality of Service Guarantee for Digital Audio and Video Communication; Network Support for Multimedia Communication; Transport Protocol Support for Multimedia Communications; End-System Support for Distributed Multimedia Applications; Networked Multimedia Synchronization Requirements and Mechanisms; Multimedia Information Indexing and Retrieval.
Prerequisites: None
Text Books:
1. G. Lu, "Communication & Computing for Distributed Multimedia Systems", Artech House, 1998.
2. K.R. Rao, Zoran S. Bojkovic, D.A. Milovanovic, "Multimedia Communication System: Techniques, Standards and Networks", Prentice Hall, PHTR, 2002.

ENEE800506
EMBEDDED SYSTEMS
3 SKS
Learning Objectives: To introduce and expose the students to methodologies for systematic design of embedded systems. At the end of the course the students have the capability to analyse, design and develop an embedded system. The topics include, but are not limited to, system specification, architecture modeling, component partitioning, estimation metrics, hardware and software co-design, diagnostics, FPGA-based system design and development
Syllabus: Embedded System Introduction; Software Introduction; Real-time Models and Scheduling; Periodic/Aperiodic Tasks; Resource Sharing; Real-time OS; Case Study: Mars Pathfinder; System Components; Communication; Low Power Design; Architecture Synthesis; FPGA Introduction; FPGA-based System Sample Project; FPGA Design and Development
Prerequisites: None
Text Books:
1. P. Marwedel, "Embedded System Design," Springer Verlag, 2005.
2. W.Wolf, "Computers as Components – Principles of Embedded System Design," Morgan Kauffman Publishers, 2000.

ENEE800507
SECURITY & RELIABILITY IN INFORMATION NETWORKS
3 SKS
Learning Objectives: In this course, students will learn current issues of privacy and security associated with information systems. After completing this course, students will be able to describe protocols and model of security system in communications. Students are also able to analyze networks vulnerabilities and apply security system on networks and web.
Syllabus: Introduction to security and privacy issues associated with information systems; basic notions of confidentiality; integrity; availability; identity & authentication; protocols & data integrity; access control; security models; cryptographic systems and protocols for privacy; networks & web security; intrusion detection and prevention; Vulnerabilities and attacks; security risk analysis; disaster recovery planning; security policies; security audit and ISO17799
Prerequisites: None
Textbook:
1. R.R. Panko, "Corporate Computer and Network Security," Prentice Hall, 2004.
2. W. Stallings, "Cryptography and Network Security: Principles and Practice," 3rd Edition, Prentice Hall, 2003.

ENEE800601
MODERN TELECOMMUNICATIONS ENGINEERING
2 SKS
Learning Objectives: This lecture aims to discuss the basic principles of the telecommunications system focused on the engineering aspects of modern telecommunication applications. By following this course, students are expected to analyze a telecommunication system and calculate its technical aspects.
Syllabus: Digital communications system; Technological elements in Transmission channel; Backbone and Backhaul network; The modern application of broadband network; Interconnection system; Spectrum Analysis; Techniques of Modulation and Coding; Mobile cellular evolution towards 5G; Broadband Wireless Access; Technological platform for modern applications: Digital TV; Cloud Computing; Green IT; Next Generation Network; Open Systems in Digital Convergence; Content Governance; Emerging trend of technol-

ogy; Technology for Ubiquitous Network.
Prerequisites: None
Text Books:
1. R. Frieden, "International Telecommunications Handbook", Artech House, 1996.
2. R.L. Freeman, "Telecommunications System Engineering", Wiley-Interscience, 2004.
3. S. Park, "Strategies and Policies in Digital Convergence", Information Science Reference, 2007.

ENEE800602
MANAGEMENT OF TELECOMMUNICATIONS SYSTEM
3 SKS
Learning Objectives: The material in this lecture will discuss the basic concepts of management of telecommunication systems including the concept of regulation for implementation of the national telecommunications system.
Syllabus: Long-range planning; Feasibility Analysis; Wide Area Network; Telecommunications Operations – from fraud and disaster prevention to project management; Quality control and Security; Telecommunications Regulation; The Emerging Economics of Telecommunications; Economic Tools for Telecommunications Strategies; Network and Marketing Plan; Analysis of Indonesian Telecommunications Act; Universal Service Obligation.
Prerequisites: None
Text Books:
1. J.K. Shaw, "Strategic Management in Telecommunications", Artech House Publisher, 2000.
2. J.K. Shaw, "Telecommunications Deregulation and The Information Economy", 2nd Edition, Artech House Publisher, 2002.

ENEE800603

ENGINEERING PROJECT MANAGEMENT
3 SKS
Learning Objectives: This lecture aims to give the concept of project management so that students are able to understand the basic theories to support a feasibility analysis of investment and service development/technology application.
Syllabus: Understanding Project and Project Management; Organizational Structure; Management Functions; Leadership in Project Environment; Management of Conflicts; Investment Analysis; Control Analysis for Infrastructure Development; Cost and Resource Allocation; Risk Management and Control.
Prerequisites: None
Text Books:
1. H. Kerzner, "Project Management: A System Approach to Planning, Scheduling and Controlling", John Wiley & Sons, 2009.
2. J.R. Meredith, S.J. Mantel, Jr. "Project Management: A Managerial Approach", 6th Edition, John Wiley & Sons, 2006.

ENEE800604
STRATEGIC MANAGEMENT
3 SKS
Learning Objectives: This lecture aims to give the concept of strategic management to generate business excellence and industrial competitiveness. Students are expected to understand theapplied theories and develop relevant strategies in technology industry.
Syllabus: The Nature of Strategic Management; Strategy in Practice; External factors evaluation; Internal factors analysis; Strategy Analysis and Choices; Strategy Control Review and Evaluation; Quality Management; Strategy Management Global Problem; Risk Management; Business Ethics; Corporate Level Strategy; Strategic Leadership.
Prerequisites: None
Text Books:
1. F.R. David, "Concepts of Strategic Management," 13th Edition, Prentice Hall, 2010.
2. M.A. Hitt, R.D. Ireland, R.E. Hoskisson, "Strategic Management: Concepts and Cases: Competitiveness and Globalization", 9th Edition, South-Western College Pub., 2010

ENEE800605

REGULATION AND PUBLIC POLICIES
2 SKS
Learning Objectives: The competency built is the students' ability to understand the international and national law aspects and the standardization process in telecommunication industry.
Syllabus: International Telecommunications Organization; Indonesia Telecommunication Law and Regulation; Public Policy Making; Standardization process in ITU; International Standardization bodies for Telecommunications industry; Universal Service Obligation; Intellectual Property Management; Case of Policy and Regulation in the world.
Prerequisites: None
Text Books:
1. H.J. Brand, E.T.Leo, "The Law and Regulation of Telecommunications Carrier", Artech House Publisher, 1999.
2. P. de Bijl, M. Peitz, "Regulation and Entry into Telecommunications Markets", Cambridge University Press, 2002.

ENEE800606
WIRELESS AND MULTIMEDIA COMMUNICATIONS
3 SKS
Learning Objectives: This lecture is aimed to discuss the wireless technology principles sup-

porting the multimedia services. In the end, students are expected to be able to explain wireless technology design aspects including the cellular broadband network and able to calculate the technical parameters.

Syllabus: Cellular Radio; Packet Radio Networks; Fading Countermeasures power control; Equalization; CDMA; Capacity of Cellular Network; Quality of Service; Mathematical and Qualitative treatment of existing systems; Traffic Engineering; Mobility Management; Multimedia computing; Network Support for Multimedia communications; Interactive Multimedia System; Satellite system; Intersystem operation.

Prerequisites: None

Text Books:

1. T. Rapaport, "Wireless Communications: Principles and Practice", Prentice Hall, 2002.
2. K.R. Rao, Z.S. Bojkovic, D.A. Milovanovic, "Multimedia Communications System: Techniques, Standards and Networks", Prentice Hall, 2002.

ENEE800607

TELECOMMUNICATIONS NETWORK MANAGEMENT

3 SKS

Learning Objectives: This lecture is aimed to form the technical competency related to network management and telecommuncation system audit. In the end, students are expected to be able to design and analyze the performance of the network in a telecommunication operator.

Syllabus: Introduction to Network Management System; Internet Network Management; OSI Network Management; TMN Information and Generic Model; Performance Management; Fault Management; Billing and Security Management; Numbering Plans; Traffic Management; Mobile Network Design; Frequency and Capacity Planning; Interoperability technique; Network Audit and Control.

Prerequisites: None

Text Books:

1. H.H. Wang, "Telecommunications Network Management", McGraw Hill, 1998
2. T. Plevyak, V. Sahin, "Next Generation Telecommunications Networks, Services and Management", Wiley-IEEE Press, 2010.

ENEE800608

TECHNOLOGICAL INNOVATION AND COMPETITIVENESS

3 SKS

Learning Objectives: The purpose of this lecture is to give students the concept of innovation and technology management system in the telecommunication sector. At the end of the course, the students are expected to be able to understand and develop a holistic strategy of technology development for an industrial or a state policy makers by considering the factors of innovation system support. In addition, the students also are expected to have an leadership insight in using information and communication technology so they can enhance the competitiveness of institution and country.

Syllabus: National and Sectoral System of Innovation; Macroeconomic Theory and Technical Change; Evolutionary theory; Innovation in telecommunications industry; R&D Management in Telecommunications Firms; Technological Diffusion; Innovation in ICT Services; Globalization, National Competitiveness and Economic Growth; Science Technology and Innovation Policies; Technological forecasting; Technoeconomy paradigm; Intellectual Property and Standardization; The Knowledge Economy and ICT paradigm; Economic Policy analysis and the Internet; Market and Policies in New Knowledge Economy.

Prerequisites: None

Text Books:

1. J. Fagerberg, D.C. Mowery, R.R. Nelson, "The Oxford Handbook of Innovation", Oxford University Press, 2006.
2. M.R. Milson, D. Wilemon, "The Strategy of Managing Innovation and Technology", Prentice Hall, 2007.
3. R. Mansell, C. Avgerou, D. Quah, R. Silverstone, "The Oxford Handbook of Information and Communication Technologies", Oxford University Press, 2007.

ENEE800609

CAPITA SELECTA

2 SKS

Learning Objectives: This lecture is aimed to build the leadership vision and holistic insight to students by conducting knowledge sharing with telecommunication industriy stakeholders (operators, vendors) and regulator including in convergency, macro economy, and micro economy fields. Students are expected to be able to have integrated perspective supporting national interests and Indonesia development.

Syllabus: -

Prerequisites: None

Text Books:

Handout

ENEE800701

ENERGY AND ENVIRONMENT

3 SKS

Learning Objectives: On completion of class, the students will be to analyze effect of energy usage which harmfull to the environment.

Syllabus: Global Warming caused by the Usage of Fosil and Non Fosil Energy Resources; Environment problem solving nationally and globally; Kyoto

Protocol Implementation in the form of Clean Development Mechanism; CO2 trading.
Prerequisites:
Prerequisites: None
Text Books:
1. W.W. Nazaroff, L.A. Cohen, "Environment Engineering Science", John Wiley and Sons Inc., 2001.
2. R.A. Ristineu, J.J. Kroushaar, "Energy and Environment", John Wiley and Sons Inc., 2006.

ENEE800702
ELECTRIC UTILITY POWER GENERATION ECONOMICS
2 SKS
Learning Objectives: On completion class, the students are able to learn and understand the methods of utility power plan operation efficiently without compromising business growth.
Syllabus: Introduction; Utility Organization; Basic Accounting Principles; The Time Value of Money; Revenue Requirements: The Fixed Charge Rate; Methods of Economic Analysis; Electric Utility System Loads; System Operation; System Stability: Reserves; Economic Characteristics of Generating Units; Problems in Total System Analysis; Analysis of Storage and Renewable Energy; Direct Unit Comparisons; Future Developments.
Prerequisites: None
Text Books:
1. W.D. Marsh, "Economics of Electric Utility Power Generation", Clarendon Press, Oxford University Press, New York.
2. W.D. Marsh, "Economics of Electric Utility Power Generation", Oxford University Press, 1980. ISBN-10: 019856130X, ISBN-13: 978-0198561309
3. W.G. Sullivan, E.M. Wicks, J.T. Luxhoj, "Engineering Economy", 13th Edition, Pearson Education Ltd., 2006.

ENEE800703
ELECTRICAL POWER AND ENERGY SPECIAL TOPICS
2 SKS
Learning Objectives: able to analyze risk management, safety and security comprehensively in the operation management and electricity planning.
Syllabus: This course is dedicated to Selected Topics on the current and future of Electrical Power & Energy.
Prerequisites: None
Text Books:
1. Handouts.

ENEE800801
INFORMATION NETWORKS SECURITY
3 SKS
Learning Objectives: In this course, students will learn current issues of privacy and security associated with information systems. After completing this course, students will be able to describe protocols and model of security system in communications. Students are also able to analyze networks vulnerabilities and apply security system on networks. In addition, students will be able to perform proof techniques in protecting & hardening the network as well as implementing the encryption.
Syllabus: Introduction to security and privacy issues associated with information systems; basic notions of confidentiality, integrity, availability; identity & authentication; protocols & data integrity; access control; security models; cryptographic systems and protocols for privacy; networks & web security; intrusion detection and prevention; Vulnerabilities and attacks; security risk analysis; disaster recovery planning; security policies; security audit and ISO17799; introduction to cryptography; encryption; classic encyption techniques; block ciphers and data encryption standard; advanced encryption standard; pseudo-random generation; digital signatures; two-party protocols and zero-knowledge.
Prerequisites: None
Textbooks:
1. R.R. Panko, "Corporate Computer and Network Security", Prentice Hall, 2004.
2. W. Stallings, "Cryptography and Network Security: Principles and Practice", 3rd Edition, Prentice Hall, 2003.
3. O. Goldreich, "Foundations of Cryptography: Basic Tools", Cambridge University Press, 2001.

ENEE800802
INFORMATION NETWORK INFRASTRUCTURE
3SKS
Learning Objectives: This course introduces students with the basic concepts behind the design and scaling of server farms using data center and content switching technologies. It addresses the principles and concepts needed to take on the most common challenges encountered during planning, procurement, implementing, and managing Internet and intranet IP-based server farms. An in-depth analysis of the data center technology with real-life scenarios also discussed. After completing this course, students will be able to design, apply and analyze the design of server farm. Students will also able to administer and manage a server farm.
Syllabus: Introduction to Server Farms; Server Farm Protocols; Infrastructure Protocols; Security and Server Load Balancing; Data Center Design: Designing the Data Center Infrastructure; Integrating Security into the Infrastructure; Performance Metrics of Data Center Devices; Data Centre Administration and Management; State of the Art Data Centre.
Prerequisites: None

Text Books:
1. M. Arregoces, M. Portolani, "Data Center Fundamentals", Cisco Press. 2004.
2. D. McCabe, "Network Analysis, Architecture and Design", 3rd Edition, Morgan Kaufman, 2007.
3. M. Lankhorst, "Enterprise Architecture at Work: Modeling, Communication and Analysis", 2nd Edition, Springer, 2009.
4. M. Liotine, "Mission-Critical Network Planning", Artech House, 2003.

ENEE800803

INFORMATION NETWORK MANAGEMENT AND REGULATION

3 SKS

Learning Objectives: The course introduces students to standard, regulation, and management aspects of information network security. At the end of the course students are expected to understand principles of information networks, capable of implementing the principles to design solutions and to manage information security risks in effective manner. Students understand information network security and how to implement information network security principles in various and latest contexts.

Syllabus: Governance and security policy; threat and vulnerability management; incident management; risk management; information leakage; crisis management and business continuity; dealing with classified/ sensitive data; contingency planning; legal and regulatory drivers and issues; certification; legal and compliance; security awareness and security implementation considerations; SNI ISO/IEC 27001:2009 standard.

Prerequisites: None

Text Books:
1. C.P. Pfleeger, and S.L. Pfleeger, "Security in Computing", 4th Edition, Prentice Hall, 2008.
2. M. Subramanian, "Network Management Principles & Practices", Pearson, 2010.

ENEE800804

SECURITY RISK MANAGEMENT & DISASTER RECOVERY

3 SKS

Learning Objectives: In this course, student will learn an ability to manage risk security on network security through properly framework that effectively links security strategies and related costs. Students also able to recover after information network security incident.

Syllabus: Introduction to security risk management; Risk Analysis; Risk Management Approach; System Security Engineering; Security Policy; Legal Issues; Planning for Organizational Readiness; Incident Response; Contingency Strategies for Business Resumption Planning; Disaster Recovery; Business Continuity; Crisis Management.

Prerequisite: None

Textbooks:
1. E. Wheeler, "Security Risk Management: Building an Information Security Risk Management Program from the Ground Up", Syngress, 2011.
2. T. R. Peltier, "Information Security Risk Analysis", 3rd Edition, Auerbach Publications, 2010.

ENEE800805

APPLICATION AND NETWORK MOBILE SECURITY

4 SKS

Learning Objectives: In this course, students will learn and apply securing application and computer network. After completing this course, students will be able to describe forms of security attack on application and network, analyze security problems on desktop based application and web-based application, also implementing security concept on application and computer network.

Syllabus: Application and Network Security Introduction; Network Penetration Detection; Web-based Application Penetration Detection; Wireless Network Penetration Detection; Secure Coding in Java; Secure Coding in PHP; Secure Database Development.

Prerequisites: None

Text Books:
1. G. McGraw, "Software Security: Building Security In", Pearson Education, Inc., 2006.
2. M. Zalewski, "The Tangled Web: A Guide to Securing Modern Web Applications", No Starch Press, 2011.

ENEE800806

NETWORK AND DIGITAL FORENSIC

4 SKS

Learning Objectives: In this course, students will learn network and digital forensic. After completing this course, students will be able to identify digital trace on computer and network, identify attack forms based on the digital trace, and analyze the digital trace and gathering digital law evidence.

Syllabus: Network and Digital Forensic Introduction; Windows Forensic; Linux Forensic; Computer Network Forensic; Mobile Device Forensic.

Prerequisites: None

Text Books:
1. E. Casey, "Digital Evidence and Computer Crime: Forensic Science, Computers, and the Internet", 3rd Edition, Academic Press, 2011.
2. A. J. Marcella Jr. and F. Guillossou, "Cyber Forensics: From Data to Digital Evidence",

Wiley, 2012.

ELECTIVE COURSES

ENEE800005
CAD VLSI
3 SKS
Learning Objectives: After completing the course, the student will be able to create software (CAD) for IC design which contains a million of transistors. It should be able to display layout of integrated circuit and able to simulate netlist for fabrication.
Syllabus: Introduction; Technology and Design; VLSI architecture layout methodology; system design; basic PLA design; product design simulation; automatic testing pattern; design by testing; solving; placement and automatic placement; high level material in design.
Prerequisites: None
Text Books:
1. N.E. Weste and K. Eslughian, "Principle of CMOS VLSI Design", Addison-Wesley, 1985.
2. F.M. Berti, "Analog Design For CMOS VLSI System", Kluwer Academic Publisher, 2006.

ENEE800006
FOURIER OPTICS
3 SKS
Learning Objectives: The overall aim of the course is that you should be able to analyze optical problems with the help of the approximations made in Fourier optics, i.e: Analyze the Two-Dimensional Signals and Systems, understanding the Foundations of Scalar Diffraction Theory, Fresnel and Fraunhofer diffraction and Wave-optics Analysis of Coherent Optical Systems. Finally, demonstrating understanding of Frequency analysis of Optical Imaging Systems, wavefront modulation and analog optical information processing and holography.
Syllabus: Analysis of Two-Dimensional Signals and Systems; Foundations of Scalar Diffraction Theory; Fresnel and Fraunhofer diffraction; Wave-optics Analysis of Coherent Optical Systems; Frequency analysis of Optical Imaging Systems; wavefront modulation and analog optical information processing and holography.
Prerequisites: None
Text Books:
J.W. Goodman, "Introduction to Fourier Optics ", McGraw-Hill, 1996.

ENEE800007
ADVANCED MICROPROCESSOR APPLICATION
3 SKS
Learning Objectives: In this course, students will able to learn basic architecture of microprocessor, microprogramming, and basic and advanced instruction set. The students also are able to design the sistem based on microprocessor.
Syllabus: Review of logic circuit; ADC/DAC Circuit; Basic Architecture of Microprocessor; Instruction Cycle; Microprogramming; Basic and Advanced Instruction Set; Programming with Assembler; Memory Organization; Interrupt; External Component Interfacing; Keyboard Controller; DMA Controller; Interfacing with DAC and ADC; New Types Microprocessor Architecture; MCS51 Family Microcontroller Architecture; Data Memory and Program Memory relationship; Timer; Counter and Interrupt; Serial Input/Output; Interface Engineering; Case Study.
Prerequisites: None
Textbook:
1. W.A. Trieble and A. Singh, "The 80880 and 8086 Microprocessor", Prentice Hall, 1997.
2. L. Ciminiera, A. Valenzano, "Advanced Microprocessor Architectures", Addison-Wesley Longman Publishing Co., Inc., 1987.

ENEE800008
REMOTE SENSING
3 SKS
Learning Objectives: In this course, students will learn basic concept of remote sensing, algorithms and all components supporting the remote sensing applications from large-scale acquisition of information to analysis in specific fields. This course is offered in active learning environment and students will involve mainly in focus group discussions and presentations. After completing this course, students are able to explain and analyze remote sensing satellite data processing using specific algorithms; Remote Sensing Applications.
Syllabus: Introduction; Image Acquisition; Land Observation Satellite; Active & Passive Sensor (Optics; Radar); Microwave; Data Analysis: GIS (Geographic Information System); Plant & Earth Sciences; Land Use & Land Cover; Global remote Sensing; Remote Sensing Applications.
Prerequisites: None
Textbook:
1. J.B. Campbell, "Introduction to Remote Sensing", Guilford press, New York, 1996.
2. C.H. Chen, "Signal and Image Processing for Remote Sensing," 2nd Edition, CRC Press, 2012.

ENEE800009
APPLIED MICROELECTRONICS
3 SKS
Learning Objectives: Designing integrated circuit for processing Fast Fourier Transform, therefore the integrated circuit can be simulated and ready for fabrication.
Syllabus: Introduction; Fast Fourier Transform (FFT); FFT implementation in VLSI Circuit; Logic circuit of FFT; Hierarchical structure of components constructing FFT circuit; Analytical Theory;

CMOS logic circuit design; Butterfly FFT microprocessor design; Sub-system CMOS design; Testing and Analysis of FFT Microprocessor Circuit.
Prerequisites: None
Text Books:
1. S. Natarajan, "Microelectronics: Analysis & Design", Tata-McGraw Hill, 2006.
2. T.P. Kabaservice, "Applied Microelectronics", St. Paul-West Pub., 1978.

ENEE800010
ADVANCED LOGIC CIRCUIT
3 SKS
Learning Objectives: On completion of class, successful students will be able to: design an digital IC using VHDL and programmable gate array.
Syllabus: Logic Design Fundamental; Introduction to VHDL; Designing with Programmable Logic Devices; Design of Networks for Arithmetic Operation; Digital Design with SM Chart; Designing with Programmable Gate Array & Complex Programmable Logic Devices; Additional topic in VHDL.
Prerequisites: None
Text Books:
C.H. Roth Jr., "Digital System Designing using VHDL", PWS Publishing, 1998.

ENEE800011
QUANTUM MECHANICS
3 SKS
Learning Objectives: On completion of class, successful students will be able to: demonstrate an understanding of how quantum states are described by wave functions; solve the Schrödinger equation and describe the properties of a particle in simple potential wells; solve one-dimensional problems involving transmission, reflection and tunnelling of quantum probability amplitudes; demonstrate an understanding of the significance of operators and eigenvalue problems in quantum mechanics; demonstrate an understanding of angular momentum in quantum mechanics; and demonstrate an understanding of how quantum mechanics can be used to describe the hydrogen and helium atoms.
Syllabus: Introduction; Wave Packet; Uncertain Principles; Schrodinger Wave Equation; 1- Dimension Potential; Hydrogen Atoms; Perturbation Theory; Radiated Transition; Modern Topics; Linear Harmonic Oscillator; Angular momentum in Quantum Mechanics.
Prerequisites: None
Text Books:
1. E. Merzbacher, "Quantum Mechanics" John Wiley, 1998.
2. E. Zaarur, P. Reuven, "Schaum's Outline of Quantum Mechanics (Schaum's)," 1st Edition, McGraw-Hill, 1998. ISBN-10: 0070540187, ISBN-13: 978-0070540187.

ENEE800012
OPTICAL MEASUREMENT SYSTEM
3 SKS
Learning Objectives: To provide the students with the understanding of laser, fiber optic and their various applications within measurement system.
Syllabus: Laser basic concept and its properties; optical phenomena: diffraction and interference. Fiber optics basic concept and its properties; fiber optic sensor including intensity; polarization and interference based. Examples of several applications for measuring many kinds of measurement:temperature; pressure and displacement.
Prerequisites: None
Text Books:
1. E. Hecht, "Optics", Addison Wesley, 1998.
2. F.T.S. Yu, "Fiber Optic Sensor", Marcel Dekker Inc, 2002.
3. A.S. Moris, "Measurement and Instrumentation Principles", Butterworth-Heineman, 2001.

ENEE800013
OPTOELECTRONICS LABORATORY
1 SKS
Learning Objectives:
Syllabus: Introduction; Safety Precaution; Laser; Spectrometer; Interferometer; Difraction; Fourier Optics; Fiber optics; Holography.
Prerequisites: None
Text Books:
Laboratory Workbook – Optoelectronics Laboratory

ENEE800014
ADVANCED NANOELECTRONICS
1 SKS
Learning Objectives: Students are able to design simple electronics circuits based on nano engineering.
Syllabus: Physical limit of IC and expectation of semiconductor nanostructure; Fabrication technology of semiconductor nanostructures; Evaluation technology of semiconductor nanostructures; Basic Quantum Theory of Nano Electronics; Solid state and low dimensional physics; Numerical simulation for nanoelectronics; Quantum wells, wires and dots; Nano structure and semiconductor device; Tunneling effect; Applications of tunneling; Resonance Tunneling Diodes and Superlattice; Quantum well laser; nano-photonics; Single electron devices.
Prerequisites: None
Text Books:
1. G.W. Hanson, "Fundamental of Nanoelectronics," CRC Press, 2005.
2. S. Oda, D.K. Ferry, "Silicon Nanoelectronics," CRC Press, 2005.

6.4. MASTER PROGRAM IN METALLURGY AND MATERIALS ENGINEERING

Program Specification

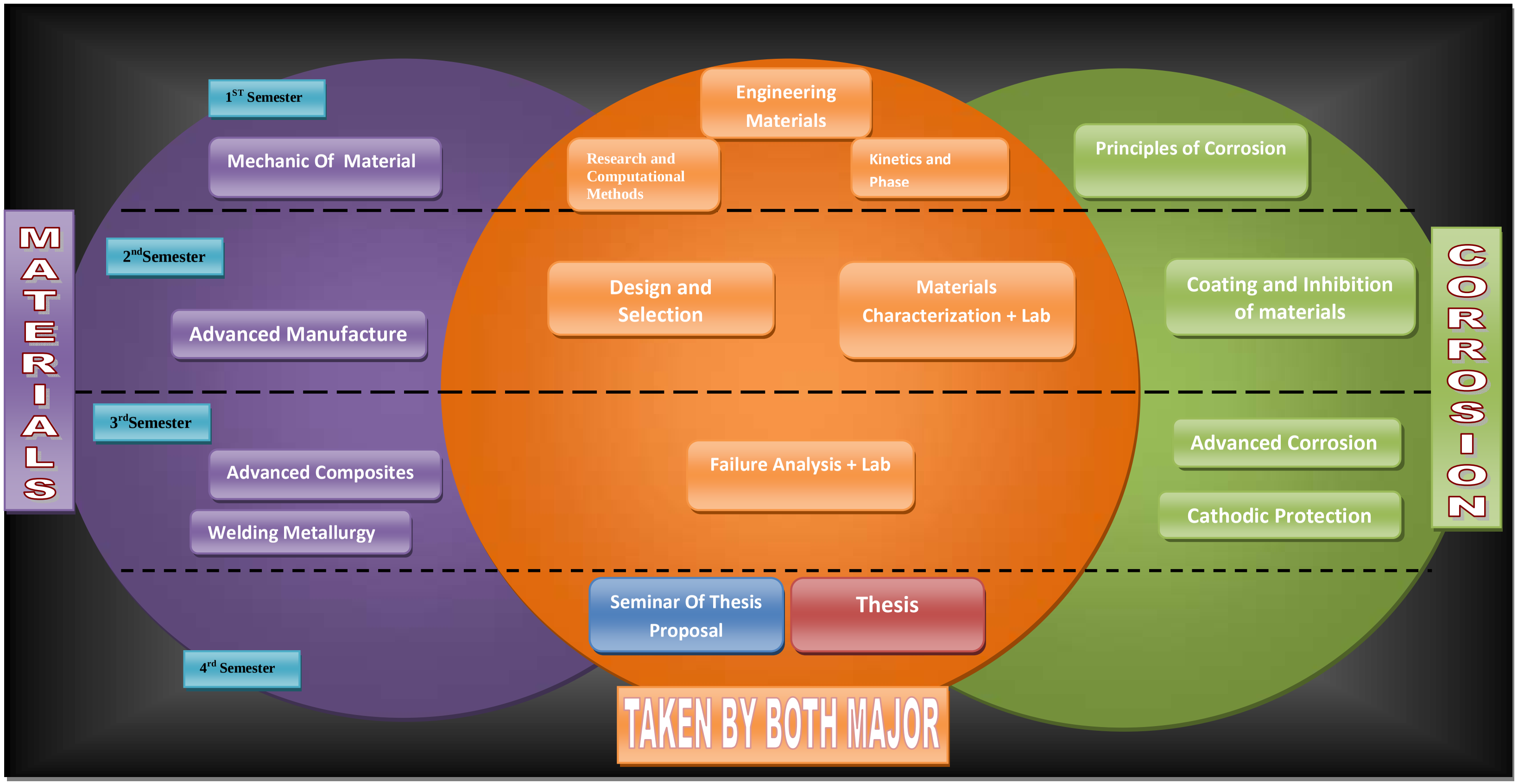
1	**Degree Awarding Institution**		Universitas Indonesia Double degree : Universitas Indonesia & partner universities
2	**Organizing Institution**		Universitas Indonesia Double degree : Universitas Indonesia & partner universities
3	**Name of Study Program**		Master Degree Department of Metallurgy & Materials
4	**Type of class**		Regular, Profesi
5	**Awarding Degree**		Master Teknik (M.T) Double degree: Master Teknik (M.T) and M.Eng
6	**Grade of Accreditation**		BAN-PT : “A” Grade AUN-QA : “A” Grade
7	**Literate Language**		Bahasa (Indonesia) and English
8	**Scheme of Learning (Full-time / Part-time)**		Full-time
9	**Study requirements**		Bachelor Graduate / equivalent
10	**Term of Study**		Programmed for 2 years
	Type of Semester	Number of semester	Number of weeks /semester
	Regular	4	17
	Short (optional)	1	8
11	**Specialization:** Materials Specialization Corrosion Specialization		
12	**Graduate profile:** Graduate of Master Engineering who is able to apply science ,metallurgical processes and material technology in solving problems as well as analyzing material failure.		
13	**List of Competence Graduates:** 1. Have the ability to develop and update knowledge of metallurgy and material science and technology by mastering and understanding, approaches, methods, scientific principles with their application skills. 2. Have the ability to solve problems in the field of metallurgy and materials through research and development based on scientific principles.		
14	**Course Composition**		

No	Types of Courses	(SKS)	Percentage
i	Compulsory Courses	29	72.5 %
ii	Elective Courses	3	7.5 %
iii	Seminar and Thesis	8	20 %
		40	100 %
14	**Total Credits to Graduate**		**40 SKS**

With the increasing development of technology-based industrial materials, the Department of Metallurgical Engineering & Material continuously seek to improve the curriculum in accordance with technological developments. Metallurgy and Materials engineering is a discipline that studies the production, characterization, materials selection and engineering design (engineering materials). Functionally, the role of a master engineering such as designing new materials / modification, develop new manufacturing processes / modifications, material selection, structural characterization (nano, micro and macro) and properties of the material and analyzing the event of a failure in its use.
Master's program curriculum in the field of metallurgical engineering and materials designed to provide opportunities for learners are able to design, select and develop metallurgical processes and material technology, new materials characterization / modifications and be able to control the damage / degradation of material due to media and the environment through corrosion protection techniques and material selection. To that end, the curriculum syllabus 2012 master program FTUI metallurgical engineering and materials designed for 2 (two) types of specialization are:

1. Specialisation of Materials (Materials)
2. Specialisation Corrosion (Corrosion)

Curriculum Structure of Master Program in Metallurgy and Materials Engineering



Course Structure of Master Program in Metallurgy and Materials Engineering

KODE	MATA AJARAN	SUBJECT	MAJOR		FAST TRACK	
	Semester 1	**1st Semester**	M	K	M	K
ENMT800101	Material Teknik	Engineering Materials	2	2		
ENMT800102	Kinetika & Transformasi Fasa	Kinetics and Phase Transformation	3	3		
ENMT800103	Metodologi Penelitian & Komputasi	Research and Computational Methods	3	3	3	3
ENMT800201	Mekanika Material	Mechanics of Materials	3		3	
ENMT800301	Prinsip Korosi	Principles of Corrosion		3		
			11	**11**	**6**	**3**
	Semester 2	**Semester 2**				
ENMT800104	Disain dan Pemilihan Material	Design and Selection of Materials	3	3	3	3
ENMT800105	Karakterisasi Material + Lab	Materials Characterization + Lab	3	3		
ENMT800202	Manufaktur Lanjut	Advanced Manufacture	3			
ENMT800302	Pelapisan & Inhibisi	Coating and Inhibition of Materials		3		
	Pilihan 1	Elective 1	3	3	3	3
			12	**12**	**6**	**6**
	Semester 3	**3rd Semester**				
ENMT800106	Analisa Kerusakan + Lab	Failure Analysis + Lab	3	3		
ENMT800203	Komposit Lanjut	Advanced Composites	3			
ENMT800204	Metalurgi Las	Welding Metallurgy	3		3	
ENMT800303	Korosi Lanjut	Advanced Corrosion		3		3
ENMT800304	Proteksi Katodik	Cathodic Protection		3		3
	Pilihan 2	Elective 2	3	3	3	3
			9-12	**9-12**	**6**	**9**
	Semester 4	**4th Semester**				
ENMT800107	Seminar Proposal Thesis *)	Seminar of Thesis Proposal *)	2	2		
ENMT800108	T e s i s *)	Thesis *)	6	6		
			8	**8**		
			40-43	**40-43**	**15-18**	**15-18**

*) Open both in Odd and Even Semesters.

ELECTIVES

Semester Gasal

KODE	MATA AJARAN	SUBJECTS	SKS
ENMT800001	Baja Khusus & Paduan Super	Special Steels & Super Alloys	3
ENMT801002	Material Aditif & Turunan Polimer	Additive & Derivative of Polymers	3
ENMT800003	Peralatan Mekanika Industri	Industrial Mechanic Equipment	3
ENMT801004	Korosi Temperatur Tinggi	High Temperature Corrosion	3

ENMT800005	Sistem Manajemen Mutu	Quality Management System	3
ENMT800006	Material Mutakhir *dan mata kuliah pilihan lintas dept/ fakultas	Advanced Material	3

Semester Genap

KODE	MATA AJARAN	SUBJECTS	SKS
ENMT801007	Permesinan & Teknologi Daur Ulang Polimer	Machining & Polymer Recycling Technology	3
ENMT801008	Rekayasa Permukaan Material Lanjut	Advanced Surface Engineering	3
ENMT800009	Metalurgi Ekstraksi Lanjut	Advanced Extractive Metallurgy	3
ENMT800010	Pemrosesan Lanjut Produk Polimer	Advanced Polymer Product Processing	3
ENMT800011	Manajemen Projek	Project Management	3
ENMT800012	Teknologi Nano *dan mata kuliah pilihan lintas dept/ fakultas	Nanotechnology	3

Maximum credits that can be taken by Fast Track students to be transferred to Master Program, are 12 SKS.

Note:

M : Major in Materials Engineering

K : Major in Corrosion

Course Description (Master Program)

ENMT800101
ENGINEERING MATERIALS
2 SKS

Objectives: Students are able to describe the fundamental theories, analyse the mechanical and physical properties of materials and its applications in industries including technological aspects and material selection.

Syllabus : Fundamental theories of materials including theories of atom, atomic bonding, bonding system; crystal structures; material structures and properties; ferrous material selection: classification designation and specifications of steel, low alloy steel, heat treatable carbon steel, and low alloy steel; selection of tool steels, stainless steels, cast irons; non-ferrous material selection (Al, Ti, Mg, Ni, and their alloys); shape memory alloys (smart materials); inorganic materials: ceramics and glasses, mechanical behaviour of ceramics; polymer materials, selection of plastics, polymerisation and composite materials.

Prerequisite: -

Textbooks:

1. Robert W Cahn and Peter Hasen, Physical Metallurgy, Fourth, Revised Enhanced Edition, Vol. I, 1996.
2. Callister, W.D., Materials Science and Engineering: An Introduction, 6th ed., John Wiley & Sons, 1998.
3. Mangonon, P.L, The Principles of Materials Selection for Engineering Design, Prentice-Hall.
4. Jurnal Material Science.
5. Jurnal Advanced Material.

ENMT800102
KINETICS AND PHASE TRANSFORMATION
3 SKS

Objectives: Students are expected to be able to understand mechanism of diffusion in advanced materials and processing, to understand the role of interfaces in phase transformation of materials, to understand transformation between crystallographic and non-crystallographic states of materials, and to comprehend and be able to apply the principles governing kinetics and phase transformations in material systems in order to select materials and to design processes that yield desired microstructures and properties.

Syllabus : (1) Review on Thermodynamics and Phase Equilibrium: Single Component System, Binary Component System, The Phase Rule, Binary Phase Diagrams, Reactions in the solid state; (2) Fe-Fe3C Phase Diagram; (3) Ternary System Representation, Ternary System containing 2 phase; (4) Diffusion in Materials: Atomic mechanism of diffusion, Interstitial diffusion, Substitutional diffusion, Tracer diffusion in binary alloys, Diffusion in multiphase binary system, Journal review; (5) Crystal Interface and Microstructure: Interfacial free energy, Grain boundary, Interphase interfaces in solids, Interface migration, Morphology of precipitates, Case study in Crystal Interface; (6)

Solidification: Nucleation in pure metals, Growth of pure solid, Cellular and dendritic solidification, Solidification of alloy, Application of solidification theory in casting and welding, Solidification during quenching from the melts, Case study; (7) Diffusional Transformation in Solids: Homogeneous and heterogeneous nucleation in solids, Precipitate growth, Transformation kinetics, Eutectoid transformation, Ordering transformation, Case study; (8) Diffusionless Transformation in Solids: Theories of martensite nucleation, Martensite growth, Tempering of ferrous martensite, Martensite transformation in nonferrous metals, Spinodal transformation, Case study in Diffusionless transformation

Prerequisite: -

Textbooks:

1. Porter, D. A and Easterling, K.E, Phase Transformation in Metals and Alloys, 3rd. ed., CRC Press, 2009.

ENMT800103
RESEARCH AND COMPUTATIONAL METHODS
3 SKS

Objectives :
Students are able to:
(1) elaborate research plan and proposal, write thesis and scientific publication in accordance with scientific norms;
(2) understand and analyse computational method for process problems and design in metallurgical and materials area and its applications

Syllabus : Scientific understanding, research method, problem specification, hypothesis, literature study, data collection and processing, elaboration of research proposal and scientific work presentation; Computation, matlab basics, logical expression, vectorisation, flow control using if and while, loop in matlab, function and m-file, test output, programming matlab, binary number, floating point numbers, device precision, linear equation, curve fitting, differential equation, statistics and analysis of process data.

Prerequisite : -

Textbooks :

1. Uma Sekaran., Research Methods for Business, A Skill Building Approach, 2nd Ed., John
2. Willey & Son Inc., 1992 Richard Fellow, Anita Liu,. Research Methods for Construction, Black-Well Science Ltd., 1997
3. Palm III ,William J, Introduction to MAT-LAB 7 for engineers', 2nd edition McGraw-Hill, 2005
4. Martinez Wendy L., Exploratory Data Analysis with MATLAB (Computer Science and Data Analysis)"
5. Martinez Wendy L., Computational Statistics Handbooks With MATLAB (Computer Science and Data Analysis)", 2nd edition

ENMT800201
MECHANICS OF MATERIALS
3 SKS

Objectives : Students are able to analyse theory and application of methods of material mechanics beginning originating from loaded/stressed materials and its analysis on engineering and technological design to avoid material failure.

Syllabus : Introduction to mechanics of materials, types of material failure, engineering and selection of materials, elastic deformation and theory of strength, inelastic deformation, metals and alloys processing, composites, ceramics and glasses, polymers, concept of stress and strain, rheological model, plastic deformation, creep deformation, anisotropic materials, theory of mechanical testing of materials, stress-strain properties, tendency of tensile behaviour, interpretation of true stress-strain, compression, hardness, impact, bending and torsion testings, plane stress, plane strain, three dimensional stress condition, stress on octahedral plane, complex strain condition, common form of failure criteria, concept of fracture mechanics, fracture toughness value, application of K value in design and analysis, fatigue based on stress, loading cycle, stress-time curve, average stress, multiaxial stress, fatigue crack growth, fatigue based on strain, strain vs age, effect of average stress, lifetime estimation of structural components and creep.

Prerequisite : -

Textbooks :

1. Dowling, Norman E., Mechanical Behavior of Materials, Engineering Methods for Deformation, Fracture and Fatigue, Prentice Hall International Edition, 1993.
2. Hearn J. E., Mechanics of Materials, Pergamon Press, 1985.

ENMT800301
PRINCIPLES OF CORROSION
3 SKS

Objectives: Students are able to understand electrochemical principles to analyse problems and application of aqueous corrosion, high temperature corrosion, and corrosion protection.

Syllabus : Fundamental concepts of electrochemistry and its application, definition of corrosion, forms of corrosion, cost of corrosion, electrical concept relevant to corrosion, relevant concept of chemistry and electrochemistry, thermodynamic prediction of corrosion propensity, electrolyte, Kinetics of corrosion, over-potential (polarisation), passivation, corrosion rate measurement, metallurgical aspects, forms of corrosion and joint potential theory, corrosion testing (weight loss coupon method, electrochemistry).

Prerequisite: -

Textbooks:

1. D.A. Jones, Principles and Prevention of Cor-

rosion, Macmillan Publishing Co., 1992.
2. Piron, DL, The Electrochemistry of Corrosion, NACE, 1991.
3. Roberge Pierre R, Handbook of Corrosion Engineering, Mc Graw-Hill Handbook, 1999.

ENMT800104
DESIGN AND SELECTION OF MATERIALS
3 SKS
Objectives: Students are able to describe the material selection methods and able to choose over various types of materials in engineering area
Syllabus : Classification of engineering materials, factors and systematics of design and selection of materials, material property chart and performance index, design for corrosion resistance, design of high temperature materials and design of wear and fatigue resistant materials, design of plastics and composites, design of various carbon steel, cast iron and steel alloys (tool steel, stainless steel, heat resistant steel, wear resistant steel), super alloys, and case studies of material selections.
Prerequisite : -
Textbooks :
1. Materials Selection and Design , 1997, Volume 20 of ASM Handbook
2. Mangonon,P.L, The Principle of Material Selection for Engineering Design, Prentice- Hall International, Inc, Melbourne, 1999
3. Dieter,G.E.(Ed), ASM Volume 20, Material Selection & Design, 1997
4. Crane,F.A.A. and J.A.Charles, Selection and Use of Engineering Material, Butter-worth & Co, 1984 Bradley, Elihu F, Super Alloys, ASM International, 1988

ENMT800105
MATERIALS CHARACTERIZATION + LAB
3 SKS
Objectives: Students are able to master the principles of testing and the analysis of materials testing result by diffraction methods, spectroscopy, image analysis and thermal analysis.
Syllabus : Introduction, standards and procedure of testing, principles and methods of advanced analysis for engineering materials chemical composition (AAS, OES, EDS, XPS), identification of crystal structure (x-ray diffraction), advanced metallography (SEM, EPMA, TEM), and thermal analysis (DTA, TGA, DSC, TMA).
Prerequisite : -
Textbooks :
1. G. W. Ewing, Analytical Instrumentation Handbook, M. Decker, New York, 1990.
2. D. A. Skoog, E. J. Holler, T. A. Nieman, Principles of Instrumental Analysis, 5th Ed., Saunders College Publishing, Philadelphia, 1998.
3. H. H. Willard, L. L. Merritt, J. A. Dean, F. A. Settle, Instrumental Methods of Analysis, 7th Ed., Wadsworth Publishing Company, California,1988.

ENMT800202
ADVANCED MANUFACTURE
3 SKS
Objectives: Students are able to describe the principles, phenomena, process mechanism and metal forming techniques through liquid, solid and powder phase, and able to design and select the appropriate forming process for certain products.
Syllabus : Metal forming as part of design and manufacture process; general principles, phenomena and mechanism related to casting of metals; mold (sand, ceramics, metals), gating system, and simulation. Solidification process of cast iron and aluminium, liquid treatment for ferrous metal (innoculation, Mg treatment) and non-ferrous (modifier, grain refiner), various methods of casting, casting defects; General principles, phenomena and mechanism of solid phase metals through forging, rolling, extrusion, drawing, sheet metal forming, and thermo mechanical treatment. The phenomenon and mechanism of powder metallurgy, fabrication of metal powder, and mechanism of powder formation, characterisation and characters of powder, mechanical alloying, pre compaction process, compaction, preform characteristics, sintering, and powder consolidation, full density processing; types of sintering devices and related aspects, application and utilization of powder metallurgy products. Case study of processing selection and evaluation of manufacturing process
Prerequisite : -
Textbooks :
1. John Campbell, Castings, Second Edition, Elsevier Butterwoth-Heinemann, 2004
2. John Campbell, Castings Practice: The Ten Rules of Castings, Elsevier Butterwoth-Heinemann, 2005
3. Hosford W.F and Robert M. Caddel., Metal Forming: Mechanic and Metallurgy, Prentice Hall Inc, 1983
4. Harris, J.N., Mechanical Working of Metals. Theory and Practice, Pergamon Press, 1983
5. Dieter, G.F., Mechanical Metallurgy, Mc-Graw-Hill, 1976
6. Lenel, Powder Metallurgy, Principles and Application, MPIF, 1980
7. German R.M, Powder Metallurgy Science,1987

ENMT800302
COATING AND INHIBITION OF MATERIALS
3 SKS
Objectives: Students are able to understand the principles of metal protection through coating

and inhibition methods.
Syllabus : Coating: metallic coating , type and classification of metallic coating, protection mechanism, electroplating and electroless plating, anodizing, phosphating, chromatting, hot-dip galvanizing, service lie prediction, Organic Coating (paints), properties of organic coating, classification and formulation of paints, mechanism of protection, standard of surface preparation, application method, coating defects and painting failure. Inhibition; types, classification, and mechanism of inhibition (anodic, cathodic, and mixed inhibitor), formulation of corrosion inhibitor in general, application and limitation (in automotive, water coolant, drinking water system, petrochemical and refinery plant) VCI, layer forming corrosion resistant materials
Prerequisite : -
Textbooks:
1. Philip A. Schweitzer, P.E., Paint and Coating: Applications and Corrosion Resistance, Taylor & Francis, 2006.
2. Chatterjee U.K., Bose S.K., Roy S.K., Environmental Degradation of Metals, Marcel Dekker Inc., New York, 2001.
3. Kenneth Graham A., Electroplating Handbook, 3rd.
4. Frederick A. Lowenheim, Modern Electroplating, 3rd, The Wiley International Pub., New York, 1974.
5. Denny A Jones, Principles and Prevention of Corrosion, Hearle, 2nd, Macmillan Pub. Co., New York, 1992.
6. Nathan C.C., Corrosion Inhibitor, NACE, Houston, 1997.

ENMT800106
FAILURE ANALYSIS + LAB
3 SKS
Objectives: Students are able to (a) describe engineering failure mechanism, (b) conduct failure analysis investigation using standard procedure, (c) select and decide testing tools and methods to analyze material failure, and (d) analyze material failure (via case studies) by literature study, report-making and presentation.
Syllabus : Definition and goals of failure analysis, general factors contributing to material failure, general procedure in failure analysis techniques, classification of failure origins, characteristics & mechanism of failure analysis, ductile fracture, brittle fracture, fatigue fracture, and failure or brittleness affected by environmental conditions (thermal/ creep, corrosion, and wear), method and tool selections on failed material, yield criteria, initiation of plastic deformation, stress concentration, residual stress, static failure, fundamental principles of fracture mechanics, failure analysis case study analisa and report making and presentation of failure analysis results.
Prerequisite : -
Textbooks :
1. Wulpi, D.J., Understanding How Components Fail, ASM.
2. Brooks and A.Choudhury., Metallurgical Failure Analysis,. McGraw Hill
3. Sheils, Stuart; Bagnall, Chris, et.al ., Corrosion, Failure Analysis, And Metallography, ASM
4. ASM Handbook Vol. 11., Failures Analysis & Prevention, 8th Ed. ASM
5. ASM Handbook Vol. 12., Fractography & Atlas Fractography, 9th Ed. ASM
6. Khlefa A. Esaklul., Hand Book Of Case Histories In Failure Analysis, Vol. 1 & 2

ENMT800203
ADVANCED COMPOSITES
3 SKS
Objectives: Students are able to conduct systematic approach to design composite materials based on mechanical properties and understand the practical consideration related to manufacturing factor and application needs.
Syllabus : Concepts, definition and classification of composites, matrix and reinforcement, composite fabrication, rule of mixture, interfacial and wetting theory, nano composites, composites mechanics, geometric aspect in composites, lamina and laminate, elastic behaviour, fibre end effect, theory of laminate, unidirectional strength of lamina, strength of laminate, strength of short fibre composites, fracture energy of composites, and case studies of composites.
Prerequisite : -
Textbooks :
1. Kaw, Autar K, Mechanics of composite Materials, CRC Press, New York, 1997
2. Gibson, R.F., Principle of composite Materials Mechanics, McGraw-Hill, 1994
3. Hull, D., An Introduction to composite Materials, Cambridge Uni. Press, 1981
4. Mattew, F.L. and R.D. Rawlings, Composite Materials: Engineering and Science, Chapman Hall, 1993

ENMT800204
WELDING METALLURGY
3 SKS
Objectives: Students are able to describe weldability of select ferrous and non-ferrous materials for engineering application and able to describe and analyze the effect of alloying element, the effect of thermal cycle and cooling rate and some welding parameter to the characteristics of welding to control welding quality in engineering construction.
Syllabus : Introduction to material joining, classification, basic principles and process characteristics of electric arc welding and its benefits and drawbacks, classification & characteristics

of welding machines and welding electrodes, flux and gas, parameter of welding and heat input, fundamental principles of welding metallurgy, metal transfer inside electric arc welding, microstructure of weld joint, alloying effect, temperature change in welding (HAZ), factors affecting cooling rate of weld metal, weldability of ferrous metal (steel and alloys, heat resistant steel and cast iron) & non-ferrous (Al, Cu, Mg, Ni, and their alloys), welding defects and prevention, heat treatment for welding (preheating & PWHT), weld joint quality control, case studies

Prerequisite: -

Textbooks:

1. Kou, S., Welding Metallurgy, Wiley & Sons, ISBN 0-471-43491-4
2. Granjon, H., Fundamentals of Welding Metallurgy, Abington Publishing, ISBN 1
3. Easterling, K., Introduction to the Physical Metallurgy of Welding, Butterworth-Heneimann Ltd. ISBN 0-7506-0394-1
4. AWS Welding Handbook, Metals and Their Weldability, AWS, ISBN 0-87171-218-0 85573-019-7
5. Norrish, J., Advanced Welding Processes, IOP Publishing Ltd., ISBN 0-85274-326-2

ENMT800303
ADVANCED CORROSION
3 SKS

Objectives : Students are able to understand, analyze, and synthesize mechanism of metal corrosion in aqueous and high temperature environment and how to control it in an effective and efficient manner, and its application in industrial practice.

Syllabus : Introduction, thin and aqueous solution, thermodynamics aspects of aqueous corrosion, kinetics of corrosion, application of aqueous corrosion in practice (sea water corrosion, under soil corrosion, corrosion on soil environment), application of corrosion for non-ferrous metal, atmospheric corrosion, oxidation reaction at high temperature, thermodynamics of oxidation, growth of oxide later, characteristics and properties of oxides, pilling-bedworth ratio, oxidation reaction rate, effect of oxygen pressure corrosion in specific environment, carburization at high temperature, decarburization, metal dusting, hot corrosion, high temperature corrosion testing, material protection at high temperature, high temperature resistant material, coating (aluminizing, chromizing, siliconizing). Case studies

Prerequisite : -

Textbooks :

1. D.A. Jones, Principles and Prevention of Corrosion, Macmillan Publishing Co., 1992.
2. ASM Handbook Vol. 13, Corrosion, ASM, 1987
3. N. Birck & G.H. Meier, Introduction to High Temperature and Oxidation of Metals, Arnold. Publishing Co., 1987

ENMT800304
CATHODIC PROTECTION
3 SKS

Objectives: Students are able to understand, analyze or synthesize methods of cathodic protection as a manner of prevention of corrosion in aqueous environment. Students are also able to conduct calculation and design of cathodic protection system applicable in practice, together with design and selection of material methods.

Syllabus : Fundamental theory of cathodic protection, protection criteria, cathodic protection system using sacrificial anode, properties of sacrificial anode material and its selections, application of sacrificial anode cathodic protection, impressed current corrosion protection system (ICCP), instrument for corrosion protection, cathodic protection in sea water, soil, and internal structure of concrete (cement) environment, classification of material, specific relation of material and environment, corrosion protection design guidelines, resistant properties of stainless steel and super duplex SS, corrosion resistance of commonly used engineering materials (cast iron, carbon steel, low alloy steel, nickel, aluminium, copper, zinc, titanium, and their alloys), corrosion resistance of non metallic material (rubber, plastic, composite, ceramic).

Prerequisite : -

Textbooks :

1. H. Morgan, Cathodic Protection, NACE, 1987
2. M.E. Parker, E.G. Pettie, Pipeline Corrosion and Cathodic Protection, Gulf Publishing Co.,1984
3. D.A. Jones, Principles and Prevention of Corrosion, Macmillan Publishing Co., 1992.
4. Mangonon, P.L, Principle of Material Selection for Engineering Design, Prentice-Hall International, Inc, Melbourne, 1999.
5. ASM, Corrosion, ASM Hand-Book Vol. 13

ENMT800107
SEMINAR OF THESIS PROPOSAL
2 SKS

Objectives: Students are able to express a problem and her/his opinion in form of a work sheet/short communication/scientific paper and discuss it in a scientific forum/seminar in a correct, clear, orderly, and systematic manner.

Syllabus : Work sheet/paper that will be presented in a seminar according to thesis proposal. Paper includes: problem and hypothesis, methodology and its discussion.

Prerequisite : -

Textbooks : -

ENMT800108
THESIS
6 SKS

Objectives: Students are able to complete a research of a certain topic in a specified scope agreed by advisor.
Syllabus : Application of various courses attended in an integral manner in a research to solve a metallurgical and materials engineering problem. The research result is written to a scientific report and presented before a panel of lecturer.
Prerequisite : -
Textbooks : -

ELECTIVE COURSES of Master Program

ENMT800001
SPECIAL STEELS & SUPER ALLOYS
3 SKS
Objective : Students are able to explain and choose from various types of alloy steels and super alloys and its utilization in engineering
Syllabus : Classification and utilisation of special steels and super alloys, alloying element and microstructure of alloy steels and super alloys, stainless steels (ferritic, austenitic, duplex, martensitic, precipitation-hardening stainelss steels), heat resistant steels, wear resistant steels, tool steels, other alloy steels, super alloys (Co- and Ni- based alloys)
Prerequisite : -
Textbooks :
1. J.R. Davis, Stainless Steel, ASM Specialty Hand Book, 1994
2. J.R. Davis, Heat Resistant Materials, ASM Specialty HandBook, 1997
3. Tool Steel Handbook, Fifth Edition, Geoge Roberts, ASM, 1998
4. E.F. Bradley, Super Alloy A Technical Guide, ASM International, 1998

ENMT801002
ADDITIVE AND DERIVATIVE OF POLYMERS
3 SKS
Objective : Students are able to understand the function and the properties of additives, additive and plastic mixing techniques, and evaluation of the mix and able to understand the basic principles of adhesives, its properties and its applications
Syllabus : The role, types, structures, chemical properties, function & properties of additive materials. Additive selection and handling, and techniques of mixture. Definition and mechanism of adhesive, mechanics of joining (interlocking), interdiffusion theory, adsorpsion and surface reaction, surface topography, wetting, thermodynamics work of adhesive, constituent influence in adhesive bond, interface bonding, fracture mechanics, peeling, adhesive testing, inextensible fibre pulling, adhesive polymer and its application.
Prerequisite : Organic Chemistry
Textbooks :
1. Gachter Müller, Plastics Additives
2. P. D. Ritchie, Plasticiser, Stabiliser, and Fillers
3. Ferry and Chilton, Chemical Engineering Handbook
4. Michael L Berins, SPI Plastics Engineering Handbook
5. Handbook of Adhesives, American Cynamid Company

ENMT800003
INDUSTRIAL MECHANIC EQUIPMENT
3 SKS
Objective : Students are able to explain the basic principles, types and mechanical equipment in industrial applications such as equipment diverter pipe (pipeline), power plant equipment (boilers and turbines), heat exchanger equipment (heat exchanger) and the design of materials used and the code (standard).
Syllabus : Code and Standard, Pipes and Pipe Fittings, Special Items, Valves, Pipe Connection to Process Equipments (Tanks, Pressure Vessels, Heat Exchangers, Columns, Pumps, Compressors), Piping System for Oil, Gas, LNG, Geothermal, Water, Chemical, Piping System for Instrumentation, Piping and Instrument Diagram (P & ID), Plot Plan, Isometric, Cross Section, Pipe Fabrication Drawings, Process Pipes, Utility Pipes, Onshore and Offshore
Prerequisite : -
Textbooks :
1. Peter Smith, Piping Materials Selection & Applications, Gulf Professional Publishing, Elsevier, 2005
2. Mohinder Nayyar, “Piping Handbook”, 7th Ed., McGraw-Hill Professional; 1999, ISBN: 0070471061
3. Tyler G. Hicks, Power Plant Evaluation & Design Reference Guide, McGraw Hill, 1986
4. Saranavamutto et. al., Gas Turbine Theory, 5th Ed., Prentice Hall, 2001
5. Smith Eric, Thermal Design of Heat Exchanger, Jon Willey & Son, 1996, New York.

ENMT801004
ENMT811004
HIGH TEMPERATURE CORROSION
3 SKS
Objective : After following this course students are expected to be able to understand and analyze the phenomenon, the mechanism of high temperature and corrosion rate based on the aspects of thermodynamics and kinetics as well as the application of protection methods for metal-alloy materials engineering.
Syllabus : Thermodynamics of metal oxidation

reactions, Ellingham Diagram, Structure oxide (corrosion products) and non-stoikhiometri stoikhiometri, oxide-type and n-type p, Pilling-Bedworth ratio, oxide growth mechanisms: diffusion and migration, the kinetics of oxide growth rate: Wagner-parabolic, logarithmic, linear, aspects of the morphology of the oxide layer (corrosion products), high temperature corrosion in specific environments: salt melt (hot corrosion), boiler, carburizing / metal dusting, sulfidisasi and thermal cycling, high temperature corrosion protection method: material selection, high temperature resistant alloys, coating / surface treatment.

Prerequisite : -

Textbooks :

1. N. Birks and G.H. Meier, "Introduction to High Temperature Oxidation of Metals", Cambridge University Press, 2006
2. D.John Young, "High Temperature Oxidation and Corrosion of Metals", Publisher: Elsevier Science, 2008.
3. Per Kofstad, "High Temperature Corrosion", Elsevier Applied Science, 1988.

ENMT800005
QUALITY MANAGEMENT SYSTEM
3 SKS

Objective : Students are able to understand the quality management system in accordance to international standard and are able to conduct auditing process to find the requirements of the standard and its application on the industry that has implemented the standard.

Syllabus : General, process approach, relation to ISO 9004, adaptation with other system such health safety and environment management. The terms on quality management system are including; scope of implementation, regulating model, term and definition, terms of documentation, management responsibility, resources management, product realization, performance measurement, analysis and monitoring and also enhancement of sustainable system including internal audit, prevention and correction action.

Prerequisite : -

Textbooks :

ISO Standard 9000:2000 series including ISO 9000, 9001 and ISO 9004, ISO 19011

ENMT800006
ADVANCED MATERIAL
3 SKS

Objective : Students are able to explain the recent development of advanced engineering materials, along with its manufacturing process and application

Syllabus : Avanced metallic materials (steels, aluminium alloys, magnesium, super alloys), ultra-light materials in aeroplane constructions, smart materials (shape memory alloys), nanocomposites, Advanced ceramics, magnetic materials, liquid crystal polymers, biomaterials, and metallic glass

Prerequisite : -

Textbooks :

1. Manganon, P. L., The principles of Material Selection for Engineering Design, Prentice Hall, 1999
2. ASM Handbooks (Metals, Ceramics, Composites, and Polymers), 1991

ENMT801007
MACHINING & POLYMER RECYCLING TECHNOLOGY
3 SKS

Objective : Students are able to understand the construction, working mechanism and the set up of the plastic forming machines and the relation of operational parameters with the plastic product quality Students are able to understand the construction, working mechanism and the set up of the plastic forming machines and the relation of operational parameters with the plastic product quality

Syllabus : Introduction to plastic forming machines: process parameter, quality of the products. Extrusion machine: main elements, auxiliary elements, operation control. Plastic injection machine: main elements, mould construction, introduction to mould design, problems and operation control, types of injection machine. Composite machine technology.

Prerequisite : -

Textbooks :

1. Herold Belofsky, Plastics: Product design and process engineering, Hanser Publishers, Munich Vienna New York, 1995
2. Michaeli, Kaufmann, Greif Vosseburger., Technologie der Kunststoffe, Carl Hanser Verlag Munchen Wien, 1982
3. Injection Molding Handbook, Hanser Publisher, Munich 2002.

ENMT801008
ADVANCED SURFACE ENGINEERING
3 SKS

Objective : Students are able to (1) describes the phenomenon of changes in material properties and microstructure of metal associated with a series of heat treatment process. (2) selecting and designing a variety of heat and surface treatment methods and their application in industry. (3) analyze case studies.

Syllabus : Understanding the fate of heat, phase transformations and microstructure, the rate of warming and cooling influences on the structure of the material, the microstructure of stable and metastable, TTT and CCT diagrams, the influence of alloying elements, hardening, softening, distortion and prevent temper brittleness, heat treatment of non-ferrous, various types of kitchen heat treatment and atmosphere. phenomenon of surface damage of metals, heat treatment and thermochemical thermal surface, drift on further heat treatment process such as laser surface hardening, CVD, PVD, the selection of surface treatment processes. The case study analysis of the deviation of heat treatment and surface engineering.

Prerequisite : -

Textbooks :

1. Bill Bryson, Heat Treatment: Selection and application of Tool Steel, Hanser Gardner Publication, Germany 1997.
2. ASM Handbook Vol. 4; Heat Treating, ASM International, Ohio , USA,1991
3. ASM, Practical Heat Treating, ASM International, 2006.
4. K.E.Thelning, Steel and Its Heat Treatment, Butterworths, London,1985
5. T.Burakowski,T.Wierzchoni., Surface Engineering of Metals: Principles, Equipment, Technologies, CRC Press, 1998.
6. H.K.Pulker et al, Wear and Corrosion Resistant Coating by CVD and PVD, expert Verlag, 1989.

ENMT800009
ADVANCED EXTRACTIVE METALLURGY
3 SKS

Objective : Mahasiswa mampu memahami dan mengkaji inovasi proses perolehan logam dari sumber daya primer (proses ekstraksi) maupun sekunder (proses daur ulang), terkait dengan mekanisme proses maupun bahan bakunya.

Syllabus : Waste characterization processes for raw materials. Innovation wet metallurgical process (hydrometallurgy) and metallurgical heat (pyrometallurgy) for low grade raw materials and energy efficiency: reaction mechanisms and applications, such as metal esktraksi with plasma, microwave. Metal recycling process. Slag processing, metallurgical dust and ash particles. Processing and utilization of by-products (by product): the use of slag, dross processing, processing of fly ash. Obtaining metals from waste processes (such as tailings, residue, sludges) from the mineral processing tailings, red mud from metal recovery, metal recovery from waste sludge. The new technology of metal recycling process.

Prerequisite : Extractive Metallurgy

Textbooks :

1. S. Ramachandra Rao, Resources Recovery and Recycling from Metallurgical Waste, waste Management Series vol. 7, Oxford, 2006.
2. Publikasi terkait pada jurnal-jurnal seperti Metallurgical and Materials Transaction, B; Journal of Metals, Hydrometallurgy, dll.

ENMT800010
ADVANCED POLYMER PRODUCTS PROCESSING
3 SKS

Objective : Able to explain: The purpose and the type and mechanism of the process of finalizing prosuk polymer, type of process in detail in assembling and decorating, comparing the process of finalizing the type of polymer products, polymer selection process of finalizing prosuk, Finalize several fabrication of polymer products in many polymer products on the market.

Syllabus : Fabrication steps of polymer production (formulation, establishment and finalization). Purpose and process of finalizing the type of polymer products (deflashing, smoothing and polishing, sawing and cutting, drilling, grinding and sanding, routing, milling & turning, tapping & threading, cleaning, annealing, assembling, and decoration). Types of assembling processes (mechanical joining, welding and adhesive bonding). This type of decorating process (painting, plating, thermal spray coating, vacuum metalizing, hot stamping, coloring). Construction machinery and mechanisms work finalization processes. The selection of the process of finalizing the fabrication of a polymer product. Case studies on the fabrication process of finalizing the product packaging (rigid and flexible), automotive, electronics and construction equipment.

Prerequisite : -

Textbooks :

1. Harold Belofsky, Plastics: Product Design and Process Engineering, Hanser Publishers, Münich Vienna New York, 1995
2. Michaeli Kaufmann, Greif Vosseburger, Technologie der Kunststoffe, Carl Hanser Verlag, Munchen Wien, 1982
3. Injection Moulding Handbook, Hanser Publisher, Münich, 2002

ENMT800011
PROJECT MANAGEMENT
3 SKS

Objective : Develop knowledge about the processes and activities Project Management Facilities Planning and Construction Plant or Mineral and Metal Processing, especially in the administration of technical, economical, and available resources. Train the ability to discuss critically on system development and project management procedures, an understanding of the project organization, and context of project management in the field of metallurgy and materials; This course introduces the skills necessary for project management throughout the project life cycle in chronological order

Syllabus : The concept of project management, system and system approaches enjirening, systems and procedures, basic planning, cost estimation and budgeting, project quality management, execution and project control, project organization, and context of project management, project communication, and project risk management.

Prerequisite : -

Textbooks :

1. John M. Nicholas & Herman Steyn, Project Management for Business, Engineering and Technology, Principles and Practice, 3rd edition, Butterworth-Heinemann, Oxford, UK, 2008
2. James P. Lewis, PhD. PMP, Project Planning, Scheduling, and Control, 5th edition, McGraw Hill, 2011
3. Handout mengenai proyek, dokumentasi, keberhasilan proyek.

ENMT800012
ENMT810012
NANOTECHNOLOGY
3 SKS

Objective : Students are able to explain the multi-disciplinary aspects of nanotechnology which includes: basic knowledge of nanomaterials phenomena, synthesis technique, and its characterization and application

Syllabus : Definition and scopes, physical chemistry of solid surface, nanostructures (zero-, one-, and two-dimensional), special nanomaterials, fabrication processes (lithography, nanolithography, soft-lithography, assembly), characterization (structural, physical and chemistry) and application (chemical sensors, biosensors, MEMS/Microelectromechanical system, DNA chips, photonic crystals).

Prerequisite : -

Textbooks :

Guazhong Cao, Nanostructural and Nanomaterials: Synthesis, Properties and Applications, Imperial College Press, 2004.

6.5. MASTER PROGRAM IN ARCHITECTURE

Program Specification

1	Awarding Institution		Universitas Indonesia
2	Teaching Instituion		Universitas Indonesia
3	Program		Master Prorgram in Architecture
4	Class		Regular
5	Degree Offered		Magister Arsitektur (M.Ars)
6	Accreditation / Recognition		A Accredited from BAN PT; AUN-QA
7	Language of Instruction		Bahasa Indonesia and English
8	Study Scheme (Full time/Part time)		Full time
9	Entry requirement		S1 Graduate/equivalent
10	Duration of Study		2 years-Program
	Type of Semester	Number of semester	Number of weeks /semester
	Regular	4	16 - 17
	Short (optional)	2	8
11	**Graduates profile:** Master's degree of architecture is an alumnus who mastering architecture knowledge by its majority and able to demonstrate the state of the art in research methods and architectural design.		
12	**Graduates Competence:** 1. Hardskills ability in academically and professionally are an advanced architectural knowledge mastery and independent research that can be demonstrated towards advanced architectural knowledge or presentation, scientific writing, and knowledge application technique and methods in reveal phenomena and architectural design solution; 2. Softskill ability as regard to an individual living skill that related to interhuman relationship and part of society, including attitude, behavior, and thinking method to support society living success – work in team, responsive to environment around.		
13	**Course Composition**		
No	Type of Courses	Credits	Percentage
i	Compulsory Subjects	7	17,5 %
ii	Stream Subjects	13	32,5 %
iii	Electives	9	22,5 %
iv	Seminar, Thesis	11	27,5 %
	Total	40	100 %
14	**Total Credit Hours to Graduate**		**40 Credit Semester Unit**

Job Opportunity
Job opportunities to the alumnus of Master of Architecture program are: architecture practitioner, academician, researcher, government consultant, businessmen, and actuator in humanities environment sector.

Curriculum Structure of Master of Architecture Study Program

KODE	MATA AJAR	SUBJECTS	BIDANG KEKHUSUSAN					
			AD	UD	UHS	P	ATH	AS
		Semester 1						
ENAR800001	Metode Perancangan Lanjut dan Penelitian	Advance Design and Research Method	4	4	4	4	4	4
ENAR800002	Teori Arsitektur Lanjut	Advanced Architectural Theories	3	3	3	3	3	3
ENAR801004	Studio Perancangan Arsitektur 1	Architecture Design Studio 1	5					
ENAR802007	Studio Perancangan Perkotaan 1	Urban Design Studio 1		5				
ENAR803010	Studio Perumahan dan Permukiman Perkotaan 1	Urban Housing and Settlement Studio 1			5			
ENAR804013	Workshop Properti 1	Property Workshop 1				5		
ENAR805016	Workshop Sejarah dan Teori Arsitektur 1	Architecture History & Theories Workshop 1					5	
ENAR806019	Workshop Arsitektur dan Keberlanjutan 1	Architecture and Sustainability Workshop 1						5
	Sub Total		12	12	12	12	12	12
		Semester 2						
ENAR801003	Teori Perancangan Arsitektur	Architectural Design Theories	3					
ENAR802006	Teori Perancangan Perkotaan	Urban Design Theories		3				
ENAR803009	Teori Perumahan dan Permukiman Perkotaan	Urban Housing and Settlement Theories			3			
ENAR804012	Teori Properti	Property Theories				3		
ENAR805015	Teori dan Sejarah Arsitektur	Architecture Theory & History					3	
ENAR806018	Teori Arsitektur dan Keberlanjutan	Architecture and Sutainability						3
ENAR801005	Studio Perancangan Arsitektur 2	Architectural Design Studio 2	5					
ENAR802008	Studio Perancangan Perkotaan 2	Urban Design Studio 2		5				
ENAR803011	Studio Perumahan dan Permukiman Perkotaan 2	Urban Housing and Settlement Studio 2			5			
ENAR804014	Workshop Properti 2	Property Workshop 2				5		
ENAR805017	Workshop Sejarah dan Teori Arsitektur 2	Architecture History & Theories Workshop 2					5	
ENAR806020	Workshop Arsitektur dan Keberlanjutan 2	Architecture and Sustainability Workshop 2						5
	Pilihan	Elective	3	3	3	3	3	3
	Sub Total		11	11	11	11	11	11

KODE	MATA AJAR	SUBJECTS	BIDANG KEKHUSUSAN					
			PA	PP	PPP	P	STA	AS
Semester 3								
ENAR800021	Seminar Tesis	Pra-Thesis Seminar	3	3	3	3	3	3
	Pilihan	Elective	3	3	3	3	3	3
	Pilihan	Elective	3	3	3	3	3	3
		Sub Total	9	9	9	9	9	9
Semester 4								
ENAR800022	Tesis	Thesis	8	8	8	8	8	8
		TOTAL	40	40	40	40	40	40

Notes: AD - Architectural Design
UD - Urban Design
UHS - Urban Housing and Settlement
P - Property
ATH - Architecture Theory &History
AS - Architecture and Sustainability

ELECTIVE COURSES*

MATA AJAR PILIHAN

KODE	MATA AJAR	SUBJECT	SKS
ENAR800023	Akustik	Accoustics	3
ENAR800024	Arsitektur Etnik	Ethnics Architecture	3
ENAR800025	Arsitektur, Kota dan Kuasa	Architecture, City and Power	3
ENAR800026	Arsitektur di Kawasan Pesisir	Coastal Architecture	3
ENAR800027	Arsitektur Pusaka	Heritage in Architecture	3
ENAR800028	Arsitektur dan Ruang Sinematik	Architecture and Cinematic Space	3
ENAR800029	Arsitektur dan Teks	Architecture and Texts	3
ENAR800030	Bangunan Hemat Energi	Energy Efficient Building	3
ENAR800031	Fasad Bangunan Tinggi	High Rise Building Facades	3
ENAR800032	Geometri dan Arsitektur	Geometry and Architecture	3
ENAR800033	Keseharian dan Arsitektur	Everyday and Architecture	3
ENAR800034	Manajemen Proyek Lanjut	Advanced Project Management	3
ENAR800035	Memahami Fenomena: Plato to Derrida	Understanding Phenomenon: From Plato to Derrida	3
ENAR800036	Perencanaan Kota dan Wilayah	Urban and Regional Planning	3
ENAR800037	Sejarah Arsitektur Lanjut	Advanced History of Architecture	3
ENAR800038	Struktur dan Konstruksi Lanjut	Advanced Structure and Construction	3
ENAR800039	Utilitas Bangunan Lanjut	Advanced Building Utility	3
ENAR800040	Kajian Mandiri	Independent Study	3
ENAR800041	Kapita Selekta	Capita Selecta	3
ENAR800042	Teaching Assistanship	Teaching Assistanship	3

***)** Elective courses can also be taken outside the Department of Architecture both inside and outside the Faculty of Engineering.

Course Description

ENAR800001
ADVANCED DESIGN AND RESEARCH METHODS
4 CREDIT HOURS
Learning Objectives: To explore theory and design method that earns many critics in architecture and design field. Student can choose an appropriate approach for architectural research, related with architecture design research, urban design, urban housing and settlement, architecture history and theory, real estate, building technique. The aim is student can arrange an architecture research proposal appropriately.
Prerequisites: There's no perquisite for Master Program student. Need lecturer permission for Undergraduate Program student. Can apply design process and knowledge that related to design. Can apply certain design method when designing architecture object; can explain design process and knowledge that related to design.
Syllabus: Exploring theory and design method that get many attention from many critics in architecture and planning. Architectural thinking and research (asking, epistemological understanding, ontology); researcher as thinking subject; researcher, imaging and signs; theory of knowledge – the right and the truth; pragmatical thinking – potivism, theologism; phenomenologism – Husserl phenomenology (essensialism) and Heidegger (existencialism); architecture and phenomenology of architecture; research tactic and strategy; experimental; simulation and modeling; case study
References:

1. J.M. Bochenski, *The Methods of Contemporary Thoughts*, New York & Evanston,Harper Torchbook, 1968.
2. Buku/artikel yang beredar pada saat pertemuan kelas.
3. Margolin & Buchanan (eds), *The Idea of Design: A Design Issues Reader*, Cambridge: MIT Press, 1995 4. V. Papanek, *Design for the Real World*, Thames and Hudson, 1981
4. C. Alexander, *Notes on the Synthesis of Form' Timeless Way of Building*, Harvard University Press, 1964
5. John Chris Jones, *Design Methods*, Wiley, 1972;
6. Tom Heath, *Methods in Architecture*, John Wiley and Son Ltd, 1984
7. G. Broadbent, *Design in Architecture: Architecture and the Human Sciences,* David Fulton Publisher, 2000;
8. B. Hillier, *Space is the Machine; A Configurational Theory of Architecture,* Cambridge University Press, 1999;
9. Donald A Schon, *The Reflexive Practitioner: How Professionals Think in Action*; Basic Book, 1984
10. Peter G Rowe, *Design Thinking*, The MIT Press, 1991
11. Bryan Lawson, *How Designers Think: The Design Process Desmystified, Architectural Press, 2005 The Language of Space*;
12. J. Van Ettinger, *Towards a Habitable World*, Elsevier, 1960
13. Edward T. Hall, *Hidden Dimension*, Anchor, 1990
14. Herbert A. Simon, *The Sciences of the Artificial,* The MIT Press, 1996;
15. Jean-Pierre Protzen, David J. Harris.*The Universe of Design: Horst Rittel's Theories of Design and Planning*, Routledge, 2010;
16. Villem Flusser, *The Shape of Things: A Philosophy of Design*, Reaktion Book, 1999
17. Linda Groat & David Wang. *Architectural Research Methods*, John Wiley and Sons, 2002
18. TY. Hardjoko, *Panduan Meneliti dan Menulis Ilmiah*, Departemen Arsitektur, 2005
19. F. Crews, *The Random House Handbook*, 3rd ed. New York: Random House, 1980
20. D. Moran, *Introduction to Phenomenology*, London & New York, Routledge, 2000, especially Chp. 4 & 7
21. Martin Heidegger, *Being and Time*, translated by Joan Stambaugh, State University of New York Press, 1996
22. J. Bell. *Doing Your Research Projects: A Guide for First Time Reserachers in Education & Social Science*, 2nd ed.Buckingham and Philadelpia: Open University Press, 1993
23. J. Bell and C. Opie, *Learning from Research: Getting More from Your Data*. Buckingham and Philadelphia: Open University Press, 2002
24. E.M. Phillips & DS. Pugh. *How to Get a PhD*, Milton Keynes and Philadelphia, Open University Press, 1987.
25. Hazel Clark dan David Brody (eds), *Design Studies: A Reader*, Oxford and New York: Berg, 2009.
26. Grace Lees-Maffei and Rebecca Houze (eds), *The Design History Reader*. Oxford and New York: Berg, 2010.
27. Kari Jormakka. *Basic Design Methods*.

Basel; Berkhauser, 2008.

28. John Heskett. *Design: a Very Short Introduction*. Oxford: Oxford University Press, 2002.

29. Nigel Cross. *Designerly Ways of Knowing*. Basel: Birkhauser, 2007

ENAR800002
ADVANCED ARCHITECTURAL THEORIES
3 CREDIT HOURS
Learning objectives:
Students are introduced by advanced architectural theory in general that provides the basic of research of each majority, which are, advanced architectural design (creative process); architecture and the humanities, and architecture and technology (especially sustainability).
The focus remains on the architectural phenomenon - aspects of space, place and form / shape; in a scale from private spaces to urban areas.
Syllabus:
Divided into learning modules for each majority:
1. Architecture as a Discipline: *Space, Place/Non-place* (topia, utopia, heterotopia, dystopia), Architectural Form, Design Thinking and Process (positivism, rationalism, tame/wicked problem, IBIS, pattern language, diagram)
2. Architecture and Property Development
3. *Socio-Cultural aspects in architecture*: historiography, evolution/ history of human settlement (human life-cycle space, culture and the politics of space)
4. Architecture and Sustainability: Building physics, Construction and Technology

Prerequisites: N/A
Assessment:
Group readings and presentation; individual essays; term paper
References:

1. -----, The Appraisal of Real Estate, Appraisal Institute, 13rd edition.

2. Alexander, Christopher, *Notes on the Synthesis of Form* (Harvard: Harvard University Press

   Publication, 1964).

3. Ballantyne, Andrew (ed.), *Architecture Theory, A Reader in Philosophy and Culture* (London, New York: Continuum, 2005).

4. Bell, S. et.al. *Sustainability Indicators: Measuring the Immeasurabel*?, Earthscan Publications Ltd, London and Sterling, VA, 2000.

5. Bertaud, A. *The Regulatory Environment of Urban Land in Indonesia: Constrains Imposed on the Poor and Impact of World Bank's Urban Projects*, Singapore: Asia Technical Department, 2003.

6. Burdet, Ricky (eds.), *Living in the Endless City: The Urban Age Project* by the London School of Economics and Deutsche Bank's Alfred Herrhausen Society, London: Paidhon, 2011.

7. Cairns, Stephen; Crysler, Greig C.; Heynen, Hilde. *The SAGE Handbook of Architectural Theory,* Sage Publication, 2012.

8. Forty, Adrian, *Words and Buildings, A Vocabulary of Modern Architecture* (London: Thames and Hudson, 2000).

9. Evers, Bernd; Thoenes, Christof (eds). *Architectural Theory from the Renaissance to the Present* (Koln: Taschen, 2003).

10. Hays, Michael K, *Architecture Theory since 1968* (Cambridge: MIT Press, 1998).

11. Hardjoko, Triatno Y. *Urban Kampung. Its Genesis and Transformation into Metropolis, withparticular reference to Penggilingan in Jakarta* (VDM, 2009).

12. Jencks, Charles (eds.) *Theories and Manifestoes* (Chicester: Academy Editions, 1997).

13. Jenkins, Keith, *Re-thinking History* (London & New York: Routledge, 1991).

14. Johnson, Paul Alan. *The Theory of Architecture: Concepts, Themes & Practices* (New York: Van Nostrand Reinhold, 1994).

15. Kruft, Hanno-Walter, *A History of Architectural Theory from Vitruvius to The Present* (New York: Princeton Architectural Press, 1994).

16. Larice, M., and Mcdonald, E. (eds), *Urban*

Design Reader, Routledge (New edition edition), 2006.

17. Lefebvre, Henri, translated by Donald Nicholson-Smith, *The Production of Space* (Oxford UK & Cambridge USA: Blackwell, 1991).

18. Miles, Miko E; Berens, Gayle; Weiss, Marc A. *Real Estate Development*, Urban Land Institue, edisi terakhir.

19. Mostavi, M. at all (eds.), *Ecological Urbanism*, London: Lars Muller Publisher, 2010.

20. Nesbitt, Kate (Ed). *Theorizing, A New Agenda for Architecture, An Anthology of Architectural Theory* (1996).

21. Protzen, Jean-Pierre; Harris, David J. *The Universe of Design: Horst Rittel's Theories of Design and Planning* (London: Routledge, 2010).

22. Rutz, W. *Cities and Towns in Indonesia: Their Development, Current Positions and Functions with Regard to Administration and Regional Economy*, Berlin: Gebrunger Borttraeger, 1987.

23. Schulz, Christian Norberg. *Intentions in Architecture*

24. Shane, D. G. *Recombinant Urbanism: Conceptual Modeling in Architecture, Urban Design and City Theory*, Academy Press, 2005.

25. Shilling, James D, *Real Estate,* South Western Thomson Learning, edisi terakhir

26. Thompson, D'Arcy, *On Growth and Form* (Cambridge: Cambridge University Press, 1987).

ENAR801004
ARCHITECTURAL DESIGN STUDIO 1
5 CREDIT HOURS

Learning Objectives: Student can explore and develop argument in design based on research in urban context.

Prerequisites:

Syllabus: Argument development in design research which includes design concept trigger, keywords, design issue, design theory and program in urban context based on certain idea. Data selection that becomes a determining parameter of internal and external strength that creates space. Design program formulation as a space journey. Design issue identification which related to energy conservation, site orientation in tropical climate context, and natural and architectural environment integration. Tectonic aspect includes form, structure and building system for building structure of two stories minimum with car parking. Consideration in healthy and safety aspects suited with regulation. Architectural expression mastery includes model, sketch, and computer modeling.

References:

1. William McDonough and Michael Baumgart. *Cradle to Cradle: Remaking the Way We Make Things*. North Point Press, 2002.
2. Vincent Canizaro and Kim Tanzer. *The Journal of Architectural Education*: Sustainability, Volume 60, Issue 4, May 2007. "Introduction"
3. Kevin Lynch. *The Image of the City*. MIT Press, 1960.
4. Edward T. Hall. *The Hidden Dimension*. Peter Smith Publications, 1992.
5. Christopher Alexander. *A Pattern Language*. Oxford University Press, 1977.
6. Charles Jencks. *The New Paradigm in Architecture*. Yale University Press, 2002.
7. Charles Moore & Donlyn Lyndon. *Chambers for a Memory Palace*. MIT Press, 1994.
8. Ian McHarg. *Design with Nature*. Wiley, 1995.
9. D'Arcy Thompson. *On Growth and Form*.
10. Works and thoughts of Zaha Hadid, Frank Gehry, Rem Koolhaas Geoffrey Bawa, etc.
11. DKI, Jakarta, 7: 1991, *Indonesian Building and Urban Planning Codes*,
12. SK Menteri Pekerjaan Umum no. 441/ KPTS/1008 tentang *Persyaratan Teknis Bangunan Gedung*
13. SK Menteri Pekerjaam Umum no. 468/ KPTS/1998 tentang *Persyaratan Teknis Aksesibiliatas Pada Bangunan, Umum dan Lingkungan*.
14. Renzo Piano, A. Calatrava, *Structural References: .*
15. All other relevant materials including web sites.

ENAR803010
URBAN HOUSING AND SETTLEMENT STUDIO 1
5 CREDIT HOURS

Learning Objectives: The purpose of Urban Housing and Settlement Studio 1 is – student can design urban housing that commonly developed by developer for high, high-middle, and low-middle classes requirements. Project review begins from the expediency of market, location, housing type, and facility requirement up to physical design solution with mock-up.
Prerequisites: none
Syllabus: Early stage – site feasibility study, market demand/growth in population and area. Second stage – the economic assessment of the housing project: the project cost (preparation, design, permitting, construction, loan/return cost), the balance of capital investement, stage development towards the loan/payback schedule. Third stage – Review on type and physical design and model development
References:

1. Doxiades, C. A, *Ekistics: An Introduction to the Science of Human Settlements*. 1968
2. John Macsai F.A.I.A. *et. al., Housing*, John Wiley & Sons, 1982.
3. Jörg Blume (ed.), *Housing for the Future: Projects in Germany 1996*. Bonn: Inter NAtiones, 1996.
4. Direktorat Jenderal Cipta Karya, Dep. PU, *Pedoman Teknik Perencanaan Perumahan Flat dan Maisonette*, 1981.
5. DC Corporate Documentation, *Real Estate Investment Calculations*, Draft, tak ada tahun penerbitan.
6. The Dewberry Companies, *Land Development: Planning, Engineering and Surveying*, McGraw-Hill, 2004.
7. Joshua Kahr and Michael C. Thomsett, *Real Estate Market Valuation and Analysis*. John Wiley & Sons, 2005.

ENAR802007
URBAN DESIGN STUDIO 1
5 CREDIT HOURS
Learning Objectives: Offer the student a comprehension in urban design principle application simultaneously, from urban elements that related to activity spaces such as: dwelling, working, trafficking, also recreation and sport, range from organize urban elements up to organize urban usage controller until certain limit.

Prerequisites:
Syllabus: Formulate the objectives of urban design after observing the field condition through comparison approach to cases and theories that explain ideal condition of the city. Present the field data into information that developed in area issues. Present solution scenario after observing the data presentation issue that commonly presented in urban design. Present interpretation and urban design for urban area case up to certain limit. Arrange control device of urban space usage or City Design Guideline to a certain extent.
References:

1. Jonathan Barnet, *An Introduction to Urban design*. New York: Harper & Row. 1982.
2. Jonathan Barnet, *Redesigning Cities*. Chicago: APA American Planning Association, 2003.
3. Matthew Carmona, et.all, *Public Spaces Urban Spaces*. Oxford: Architectural Press, 2003.
4. Arthur B Gallion, *The Urban Pattern: City Planning and Design*. New York: Van Nostrand & Reinhold, 1986.
5. Gideon Golany, *Ethic and Urban Design*. New York: John Willeys & Sons, 1995.
6. Allan B. Jacobs, *Making City Planning Work*. Chicago: American Planning Association. 1980.
7. Spiro Kostof, *The City Assembled*. London: Thames and Hudson, 1991.
8. Rob. Krier, *Urban Space*. New York: Rizzoli Int. Publication, 1970.
9. Kevin Lynch, *The Image of the City*. Cambridge, MA: MIT Press., 1960.
10. Kevin Lynch, *Good City Form*. Cambridge, MA: MIT Press, 1984.
11. Aldo Rossi, *The Architecture of the City*. Cambridge, MA: MIT Press, 1982.
12. Colin Rowe, and Fred Koetter, *Collage City*. Cambridge, MA: MIT Press. 1978.

ENAR804013
PROPERTY WORKSHOP 1
5 CREDIT HOURS
Learning Objectives: Studying the relevancy between architecture and real estate activity in a small scale project. It is related with space innovation for human activities such as new building type, lifestyle, market segmentation, etc.
Prerequisites: -
Syllabus: The dream & the product; the products (precedence): residential property, commercial/ retail property, office building/ property for working; money matters/ feasibility study; the products & the users/ lifestyle; management aspects of a property product; The proposed products (future): residential

property, commercial/ retail property, office building/ property for working; finance & management
References: -

ENAR805016
ARCHITECTURE HISTORY & THEORIES WORKSHOP 1
5 CREDIT HOURS

Learning Objectives: Student can make a research and study various historygraphical aspects and methods in architectural history and can present it in various media.
Syllabus: Divided into learning modules, such as: Topic I: Historiography Architecture: Students try to use different methodologies to make the Historiography of Architecture; Topic II: Artifact: Heritage ofArchitecture andCities: This module introduces how Heritage Cities / architecture as a significant artifact to be documented .
Prerequisites: -
References:

1. Iain Borden, David Dunster(eds). *Architecture and the Sites of History. Interpretations of Buildings and Cities*, Oxford: Butterworth Architecture, 1995
2. EH Carr, *What is History*? England: Penguin Books, 1961
3. Keith Jenkins, Keith. *Rethinking History*, London and New York: Routledge, 1991
4. Hayden White. *Tropics of Discourse: Essays in Cultural Criticism.* Baltimore: The Johns Hopkins University Press. 1978.
5. Hayden White. “The Burden of History”, *History and Theory,* Vol. 5, No. 2 (1966), pp. 111-134.
6. Mona Lohanda(ed). *Arsip dan Sejarah*, Jakarta: ANRI, 1980.
7. Hegel, GWF. *Phenomenology of Mind, tr. J. B. Baillie*, 1910; 2nd ed. 1931,
8. Hegel, GWF. *Hegel’s Phenomenology of Spirit,* tr. A. V. Miller, 1977

ENAR806019
ARCHITECTURE AND SUSTAINABILITY WORKSHOP 1
5 CREDIT HOURS

Learning Objectives: Student can develop and apply buiding technology theory in a project with a small scale design.
Prerequisites: none
Syllabus: Measuring thermal comfort and passive cooling, designing and evaluating natural ligh, methods in control and evaluate the sound, alternative energy planning.
References:

1. Dominique Gauzin-Muller, *Sustainable Architecture and Urbanism*, Birkhausser, 2002
2. Earl R. Babbie, *The Practice of Social Research*, Belmont: Wadsworth Publ. Co.Inc, 1973
3. Giancolli DC. *General Physics*, Prentice Hall Inc, 1984
4. James Ambrose, *Simplified Design for Building Sound Control*, John Wiley & Sons, 1995
5. Leslie L Doelle and Lea Prasetio, *Akustik Lingkungan*, Erlangga, 1993
6. KE Watt, *Understanding the Environment*, UC Press, 1982
7. SFPE Handbook, *Society of Fire Protection Engineering*.

ENAR801003
ARCHITECTURAL DESIGN THEORIES
3 CREDIT HOURS
Learning Objectives: Student understands and can make a critical analitize towards architecture idea in architecture literature, both classic and contemporer, and also can finds out the relation between theory discourse and architecture design practice.
Prerequisites: Students have taken Advanced Architectural Theories
Syllabus: Development in architectural forming mechanism since classic architecture up to contemporer; the latest idea in theory discourse and architectural design practice; ideal idea in architecture; interdiscipline approach (art, mathematic, natural and social sciences) in architecture theory and design
References:

1. Michael Hays, *Architecture Theory since 1968,* MIT Press, 1998.
2. Kate Nesbitt, *Theorizing a New Agenda of Architecture: An Antology of Architectural Theory 1965-1995*. Princeton Architectural Press, 1996.
3. Charles Jenks & Karl Kropf, *Theories and Manifestos of Contemporary Architecture*. John Wiley and Sons, 1997.

4. Vitruvius. *The Ten Books on Architecture*, trans by M. H. Morgan. New York: Dover Publications, 1960.
5. D'Arcy Thompson, *On Growth and Form*. 1961.
6. Henri Lefebvre, *The Production of Space*. Wiley-Blackwell, 1992.
7. Iain Borden, Joe Kerr, Jane Rendell & Alicia Pivaro, *The Unknown City: ContestingArchitecture and Social Space*. MIT Press. 2002.
8. Aaron Betsky & Erik Adigard, *Architecture Must Burn*. Gingko Press, 2000.
9. A+P Smithson. Irenee Scalbert, *Towards a Formless Architecture: The House of the Future*, 1999.

ENAR803009
URBAN HOUSING AND SETTLEMENT THEORIES
3 CREDIT HOURS
Learning Objectives:
1. Student understands and can deliver about condition, development, alteration risk, housing development opportunity, and urban housing in one settlement case in humid tropical archipelago enevironment, with own words.
2. Student can arrange a written paper completely about simultaneous analize in one settlement or urban housing case that happen in Indonesia.

Prerequisites: Students have taken Advanced Architectural Theories
Syllabus:
1. Understanding the issues of housing and urban settlements in general and its relation to anthropogenic and ecological aspects. Understanding of the condition of the soil-water Indonesia is an archipelagic country in the worlds largest with an area of humid tropical climate and natural environment features a highly diverse.
2. Identification of housing typologies and urban settlements in the mountains, on land or waters of swamps, lakes, rivers and coastal areas. Understand variety of life and livelihood of its citizens and its relation to the typology of settlements in the region.
3. Understanding of environmental change and human nature on land the big island, in waters or coastal areas, small islands, clusters of micro and sea island tropical islands and the local community living strategies. Also understand risk of changes in the natural environment and human-induced activities including the introduction of development, the impact of changes to the sustainability of urban settlements and housing before.
4. Theoretical and empirical case studies on the development of housing or housing in a particular region of the tropical archipelago. As a place to live urban settlements Indonesia has problems antroposistem diverse ecoregions according to their respective peculiarities. Strategies for coping with disasters, mitigation, adaptation and innovation. Anticipation of specific conditions such as extreme weather, rising influence of marine sandstone, natural disasters, fires, etc.,
5. Development of science, technology, art and culture of living, development paradigms and development opportunities of housing and urban settlements in the tropical archipelago in the future. Understand the role of architects, building designers and planners of the city and the region towards the development of tropical islands in the future. The idea of housing and urban settlements in one of the coastal waters of Indonesia or in the future along with reasons, evidence or arguments supporting the design.

References:

1. Abrams, Charles 1964. *Housing in the Modern World: Man's struggle for shelter in an urbanizing world.* Faber and Faber. London.
2. Bell, W., P. d'Ayala and P.Hein, eds. 1990. *Sustainable Development and Environmental Management of Small Islands*, UNESCO, Paris.
3. Carter,T.R. 1996. Assessing climate change adaptation. The IPCC guidelines *In* Adapting to Climate Change : Assessment and Issues. Springer . p : 27-43.
4. Casey, E.S., *The Fate of Place, A Philosophical History;* University of California Press, Berkeley, 1997.
5. Heidegger, Martin, 1996. *Being and*

Time (A translation of Sein und Zeit), translated by Joan Stambaugh. State University of New York Press, New York.

6. ICPQL 1996. *Caring for The Future.* International Commission on Population and Quality of Life. Oxford University Press. Oxford.
7. Kay, R. and Alder, J. 1999. *Coastal Planning and Management*, London, E & FN SPON.
8. Kurnia, Lasti 2005. *Kampung Bajo, negeri di atas air*. Kompas on line, 27 November 2005.
9. Lim, F. 2008. Filsafat Teknologi. Don Ihde tentang Dunia, Manusia, dan Alat.
10. McDonough, W. dan M. Braungart, 2003. *Cradle-to-Cradle Design and the Principal of Green Design.. Toward New Perspectives and Practices for Engineering and Design.* http://www.mcdonough.com/writings/c2c_design.htm
11. Newson, Malcolm. 1992. *Land, Water and Development. River Basin Systems and their sustainable development.* Rotledge. London.
12. Schreier, Hans, Ken Hall, Sandra Brown, Les Lavkulich dan Paul Zandbergen. 1997. *Integrated Watershed Management*. Institute for Resource and Environment. University British Columbia, Vancouver, B.C.
13. Turner, J.F.C., 1976. *Housing by People: towards autonomy in building environments*; London: Marion Boyars.
14. Trujillo, Alan P., Harold V. Truman. *Essentials of Oceanography* (ninth edition). Pearson Prentice Hall, 2008.
15. Vies, Heather and Tom Spencer. 1995. *Coastal Problems.Geomorphology, Ecology and Society at the Coast.* Edward Arnold, London.
16. Books, Journals, Internet or other subjects which inline with the urban housing and settlement issues in tropical humid archipelago for the last 10 years.

ENAR802006
URBAN DESIGN THEORIES
3 CREDIT HOURS

Learning Objectives: To answer the question on how building environment plan and design have a contribution on a good city figuration towards: urban design theory analysis, both traditional and contemporer; analysis on how and in which condition urban design theory can be formulated; inquiring how urban design idea can improve building environtment character; why that idea is expected to facilitate living quality improvement in urban and sub-urban area; analysis social and spatial from building environtment; analysis and critic toward perceptual and performative aspect in urban design.

Prerequisites: Students have taken Advanced Architectural Theories

Syllabus: This course is divided into three major sections. First, a review of theunderstanding of the design of the City. Second part contains historical anddiscourse about what constitutes “good city” through the view on teorists, among others: Cosmological belief, formalist, fungsionalists, picturesques, organics utopians, livability, ecological. The third part, questioned the “performancedimension” in the theory of urban design and understanding of urban designrelationship with the dimensions of Perceptual / Visual / Social. Once students are introduced to the views of the teorist, this section will explore the different ways theyinterpret and understand the urban environment. Discussion on how the urban environment has a different meaning to different people, depending on cultural background, race and economic gender. Brief review of the relationship between urban design activity and political-economic context of urban development process.

References:

1. R. Legates, *The City Reader,* 2nd ed, Routledge, 1999
2. Henri Pirenne, *The Medieval Cities: Their Origins and the Revival of Trade*, Princeton University Press, 1969
3. Aristoteles, *The Politics* (especially Book III and Book VII), Penguin Classics, revised edition, 1981

ENAR804012
PROPERTY THEORIES
3 CREDIT HOURS

Learning Objectives: Develop student knowledge and perception in: Understanding role that related to Real Estate development with a wide spatial area aspect; Mastering methods and topic discussion related to Real Estate development in wide area. This course addresses

to student that have attended Real Estate 1 course. This course is designed with visceral discussion to complete student requirement for strong basic conceptual and ability to apply it to various things related to issue and broader Real Estate problems.
Prerequisites: Students have taken Advanced Architectural Theories
Syllabus: This course is given in several sections. The first section will outline the basics and concepts of appraisal / valuation. In the second part will discuss regional development issues related to urban management. In the next sections will be studied variety issues related to the construction area, the fundamental construction, and cost and benefit analysis, ie risk management techniques, sources of finance and taxation, markets and marketing, asset management / property. Learning will be more emphasis on understanding the principles and concepts of Real Estate in an urban context without ignoring the technical methods and calculations. The approach through the international students are expected to understand the development of Real Estate as a concept that can be used to help a variety of problems to be encountered in the workplace
References:

1. Michael Ball et.al., *The Economics of Commercial Property Markets*, Routledge, 1998
2. Sheman J Maisel, *Real Estate Investment and Finance*. McGraw-Hill, Inc., 1976
3. Hugh O. Nourse, *Managerial Real Estate Corporate Real Estate Asset Management*. Prentice Hall, 1990
4. Mark W. Patterson, *Real Estate Portfolios*, John Willey & Sons, Inc, 1995

ENAR805015
ARCHITECTURE THEORY & HISTORY
3 CREDIT HOURS

Learning Objectives:
Students are introduced to theories associated with the development of historiography in the world, and all thoughts sejarahan to test aspects of theoretical and historical in their research.
Syllabus:
Divided into learning modules, among others: Phenomenology, semiology (Structuralism, Post-Structuralism (Deconstruction)), Modern and postmodern, Colonialism and Poscolonialism, Gender in Architecture.
Prerequisites: Students have taken Advanced Architectural Theories
References:

1. Andrew Ballantyne (ed.), *Architecture Theory, A Reader in Philosophy and Culture* (London, New York: Continuum, 2005).
2. Homi K Bhabha, *The Location of Culture*. (London ; New York: Routledge, 1994).
3. Iain Borden, BarbaraPenner; Jane Rendell, (Eds). *Gender Space Architecture: An Interdisciplinary Introduction* (Architext), London: Routledge, 2000.
4. Celik, Zeynep.*Displaying The Orient:Architecture of Islam at Nineteenth-Century World's Fairs* (Berkeley: University of California Press, 1992).
5. Guy Debord.*The Society of the Spectacle*, translated by Donald Nicholson Smith (2004).
6. M. Foucault, *The Archeology of Knowledge*, 1972, Parts II & III.
7. Terence Hawkes,*Structuralism and Semiotics,* London: Routledge, 1997.
8. Steven Holl,Juhani Pallasmaa,Alberto Perez-Gomez. *Questions of Perception: Phenomenology of Architecture*
9. Jenkins, Keith, *Re-thinking History*, London& New York: Routledge, 1991.
10. Leach, Neil (ed.), *Rethinking* Architecture: A Reader in Cultural Theory, London and New York: Routledge, 1998.
11. Edward Said.*Orientalism.* London: Penguin, 1977.
12. Panayotis Tournikiotis. *The Historiography of Modern Architecture.*Cambridge, Massachusetts: The MIT Press, 1999.

ENAR806018
ARCHITECTURE AND SUTAINABILITY THEORY
5 CREDIT HOURS
Learning Objectives: Student can explain building technology theory, especially in material, structure, and building/environtment safety.
Prerequisites: Students have taken Advanced Architectural Theories
Syllabus: Material structure and characteristic, building structure and firm, continuity development, ecology, building economic, edge engineering, management aspect in design and building maintenance, energy efficiency, regulation and law in built environment.
References:

1. Edward Allen, *Fundamentals of Building Construction: Material and Methods*, John

Wiley and Sons, 1999
2. James Ambrose, *Simplified Design of Masonry Structures*, John Wiley and Sons,1992
3. Wolfgang Schuller, *High Rise Building Structure,* Krieger Publishing Co, 1986
4. Benjamin Stein, *Building Technology: Mechanical and Electrical Systems*, John Wiley and Sons, 1995
5. DS Barrie, *Professional Construction Management*, New York: Mc.Graw-Hill, 1986
6. J.M Boschenski, *The Methods of Contemporary Thought*, NY: Herper and Row, 1968
7. Graham Haughton, et.al, *Sustainable Cities*, Cromwell Press, 1995
8. D. Chiras, et.al, Environmental Science: A Framework for Decision Making, California: Cummings Publishing, 1985
9. Sears-Salinger, *Theormodynamics, Kinetic Theory and Statistical Thermodynamics*, Wesley, 1975.

ENAR801005
ARCHITECTURAL DESIGN STUDIO 2
5 CREDIT HOURS

Learning Objectives: Student can develop ability to create space as a architectural design solution for a problem that formulated before, in some phase apply space design theme independenly.

Prerequisites: Have a basic knowledge in arrange program and room connection; can apply basic knowledge in environmental physic (natural and artificial); have applied design method for building with mid complexity; have applied structure and construction principle for highrise or widespan building; and have applied site analysis principle for urban area and oblique terrain.

Syllabus: This course include: (1) foreign culture exploration in Indonesian context: urban space tipology, building tipology, requirement program and site analisys, theme and idea of space (2) three-dimensional exploration: Translate the program in to layout, circulation, and interior. Building group arrangement and space design application. Solution with sketch and three-dimensional model (3) tectonic exploration: connection tipology, tectonic theme that adjusted with the main theme, tectonic space exploration, document arrangement, building

References: -

ENAR803011
URBAN HOUSING AND SETTLEMENT STUDIO 2
5 CREDIT HOURS

Learning Objectives: Students are confronted with urban housing and settlement problem that begin with holistic approach and other speciality – from urban design aspect, urban housing and settlement, property development (Real Estate) – afterwards, can be traced design development per-speciality. Housing planning is focused to people with low income. Design theme is 'Green Architecture'.

Prerequisites: Students have taken Urban Housing and Settlement Studio 1

Syllabus: Exploration – urban duality, development process (public, privat, popular), environtmental issue and sustainability architecture, movement and transport, construction issue. Support and detach unit. Identification the regulation develops.

References:

1. Nabeel Hamdi, *Housing Without Houses: Participation, Flexibility, Enablement,* New York: Van Nostrand Reinhold, 1991.
2. John N Habraken, *Support: An Alternative to Mass Housing*, New York: Prager Publishers, 1972.
3. Balwant Saini, 'Site Development and Sanitary Services', dalam H S Murison & J P Lea (eds.), *Housing in Third World Countries Perspectives on Policy and Practice*, The Macmillan Press, Ltd., 1979, hal. 89-95.
4. Norman Sheridan, 'Energy for the Built Environment', op. cit., H S Murison & J P Lea, hal. 100-110.
5. United Nations, *Guidebook on Biogas Development*,Energy Resourve Development Series, No. 21, New York, 1980
6. Jan Martin Bang, *Ecovillages: Practical Guide to Sustainable Communities,* New Society Publishers, 2005.
7. SB05Tokyo Student Session, *Sustainable Design Book*, The 2005 World Sustainable Building Conference in Tokyo, Student Session23-29 September 2005, Tokyo, Japan.
8. Gernot Minke, *Building with Earth: Design and Technology of a Sustainable Architecture*, Basel, Berlin, Boston: Birkhäuser – Publishers for Architecture, 2006

ENAR802008
URBAN DESIGN STUDIO 2
5 CREDIT HOURS

Learning Objectives: Generally: Offer the

student ability to apply urban design theory in stages, on elements that related to urban spaces activities such as: trafficking, dwelling, recreation and sports, also work. Started by arranging the elements of urban spatial structure, develop urban space usage control device to certain limit. In particular, able to formulate the design of urban space purposes after observing the field condition through a comparative approach to the case and theory that describe the ideal conditions of city; Able to present the field data into grouped information in issues that are ready proceed to the completion of the scenario after studying the case presentation of the data that commonly presented in design; Able to formulate the early concept of the urban design problems for the small scale sector in selected city after get the information about the good city and intensive discussions through out the program; Able to determine design zoning area with the macro and micro landuse details, buiding intensity, and the green ratio to the human activities in the area after comparing different concepts; Able to determine the circulation, the building horizon, access points, building façade, blind corridors, point of orientation, connection (linkages), pedestrian networks, shade patterns, patters of continuity, the sign system, the general character of the environment.
Prerequisites: Understanding urban problem, mastering architecture design skill, understanding infrastructure and city transportation problem, understanding problem in urban development.
Syllabus: Goal, problem, and good city condition formulation. Field data presentation: the way and result. To integrated some urban concepts. Zoning determining: macro and micro landuse, building intensity, green ratio. Application of urban planning regulation method: building fasade, pedestrian, and signage.
References: -

ENAR804014
PROPERTY WORKSHOP 2
5 CREDIT HOURS
Learning Objectives: To observe the relation between urban architecture and real estate activity in a big scale project. Related with urban management, public and private sector rule in urban planning, reposition, and revitalization an area, etc.
Prerequisites: Students have taken Real Estate Workshop 1
Syllabus: (1) Private sector/commercial development project, area development approximately 50 ha. Property product (physical regulation obtained). Project fund and purchasing scheme: e.g. mortage. Right and duty of developer and government (developer: on site, off site, cash payment, etc. government: tax holiday, insentive, city facility, etc). Plan implementation (right and duty + building schedule time) (2) urban facility development that related with property development (public-private development): Investigation/exploration of a public project towards recovery opportunity by put in property development element such as: education area development/ science center, MRT/ busway/tollway that connected with property development through out the entire track. Urban infrastructure and structure supply.
References:

ENAR805017
ARCHITECTURE HISTORY & THEORIES WORKSHOP 2
5 CREDIT HOURS
Learning Objectives: Student can apply representation research method and architecture and city preserve in historical research.
Syllabus: Divided into learning modules, among others: Topic I: The Representation of Architecture: Architecture As Text: Architecture As Profession: Architecture As Film: Architecture As Identity (Race & Gender); As Memory Architecture: Architecture & Disaster; Topics II : Application of Architectural History: Teaching Architectural History; exhibiting Architecture: Architecture on Television / Radio: Architectural Journalism.
Prerequisites: Students have taken Advanced Architectural Theories
References:

1. Nezar AlSayyad, *Cinematic Urbanism:A History of the Modern from Reel to Real,* London & New York: Routledge, 2006.

2. J. Bloomer, *Architecture and the Text: the (s)crypts of Joyce and Piranessi (Theoretical Perspectives in Architectura),* New Haven and London: Yale University Press, 1995.

3. Iain Borden, Jane Rendell, *Intersections, Architectural Histories and Critical Theories*, London & New York: Routledge, 2000.

4. Iain Borden, et.al (eds.). *The Unknown Cities: Contesting Architecture and*

Social Space, Massachusetts: The MIT Press, 2001.

5. Iain Borden, et al. *Strangely Familiar: Narratives of Architecture in the City*, London: Routledge, 1996.

6. Mike Davis, *Ecology of Fear: Los Angeles and the Imagination of Disaster,* New York: Metropolitan Books, 1998.

7. Nan Ellin, *Architecture of Fear,*Princeton Architectural Press, 1997

8. Murray Fraser. *'Dreams about Cities: REM and Koolhaas*,'The Oxford Review of Architecture, vol. 2, 1997, p:76.

9. bellhooks. *Art on My Mind; Visual Politics* (The New Press, 1995)

10. Keith, Michael, Steve Pile, *Place and the Politics of Identity (London & New York:*

    Routledge, 1993).

11. Naomi Kleine, *The Shock Doctrine: the Rise of Disaster Capitalism,* Metropolitan Books, New York, 2008.

12. R. Koolhaas, and B. Mau,*S,M,L,XL.* Rotterdam: Office for Metropolitan Architecture (O.M.A.), 1995

13. Spiro Kostof (ed.). *Architect.*New York, Oxford: Oxford University Press, 1977.

14. Intan Paramaditha, 'City and Desire in Indonesian Cinema' in *Inter-Asia Cultural Studies: RunawayCity/Leftover Spaces*, vol. 12, no: 4. London: Routledge T&F, 2011, pp:500-512

15. A. Palladio, A. *The Four Books on Architecture, trans. by: Robert Tavernor & Richard Schofield.*MIT Press, 1997.

16. Leonie Sandercock, (ed.). *Making the Invisible Visible, A Multicultural Planning History,* Berkeley & Los Angeles: University of California Press, 1998.

17. Moira G Simpson. *Making Representations Museum in the Post colonial Era*, London: Routledge, 1996.

18. R. Venturi. *Complexity and Contradiction in Architecture* (New York: The Museum of Modern Art, 1966).

ENAR806020
ARCHITECTURE AND SUSTAINABILITY WORK-SHOP 2
5 CREDIT HOURS
Learning Obejectives: Student can develop and apply building technology theory 2 in a small scale project.
Prerequisites: Had attended Building Technology Workshop 1
Syllabus: Ecology aspect in technology utilization, material utilization effect towards building safety, economical aspect in technology utilization, value engineer, technology resource management in buinding/design, technology utilization effect in design towards project management, energy efficiency value in design, law and regulation impact in technology utilization
References:

1. James Cowan, *Architectural Accoustics: Design Guide*, McGraw-Hill, 2000
2. Frei Otto, *Tensile Structure*, MIT Press, 1997
3. Harold J. Rosen, *The Professional Practice of Architectural Detailing*, John Wiley & Sons, 1999
4. Moh, Soeryani, ed, *Lingkungan: Sumberdaya Alam dan Kependudukan dalam Pembangunan*, UI Press, 1987
5. Finatya Legoh dan Siti Handjarinto, *Buku Ajar Akustik*, 2002
6. Ganijanti AS, *Mekanika*, Penerbit Salemba Teknik, 2000.

ENAR800021
PRE-THESIS SEMINAR
3 CREDIT HOURS
Learning objectives: Produce a research proposal (for academic thesis) or design proposal (for design thesis) minimum 4000 words. Student who chose academic thesis method will make a research project that contain theory review result that indicate 'mastery' level in selected issue, also make a proposition and research method. Student who chose design thesis method will make a design proposal that contain theory review result that indicate 'mastery' level in design issue, alsp make a 'design statement' that ready to conduct and develop towards design project. Student that has been passed through this stage is already

to make a design activity in the framework to change the factual event.

Prerequisites:

Syllabus: During pre-thesis seminar process, student have been started to work with lecture that will assist them in thesis making. Each student is assisted by two lecturers that have special competence that mutual with selected research theme. Special for design thesis, at least one of the lecturer have to have profession qualification. Pre-thesis activity consist of (1) submit issue and question of research; (2) make theorical study; (3) develop methods for response issue and answer the research question.

References:

1. Borden and K. Ruedi, *The Dissertation : An Architecture Students' Handbook*. Oxford University Press, 2000.
2. TY Hardjoko, *Panduan Meneliti dan Menulis Ilmiah,* Depok: Departemen Arsitektur Universitas Indonesia., 2005
3. Linda Groat & David Wang. *Architectural Research Methods*, John Wiley and Sons, 2002
4. J. Bell. *Doing Your Research Projects: A Guide for First Time Researchers in Education & Social Science,* 2nd ed.Buckingham and Philadelpia: Open University Press, 1993
5. J. Bell and C. Opie, *Learning from Research: Getting More from Your Data*. Buckingham and Philadelphia: Open University Press, 2002
6. E.M. Phillips & DS. Pugh. *How to get a PhD*, Milton Keynes and Philadelphia, Open University Press, 1987.

ENAR800022
THESIS
8 CREDIT HOURS

Learning Objectives: can identificate, examine, and communicate issues in particular study area that related with architecture. Can develop advance ability in reading, researching, and writing a thesis. In the end thesis arrangement, student that chose academic thesis method are required to produce a thesis of not more than 20.000 words. For student who chose design thesis method are required to produce (1) Design report that not more than 10.000 words (including design proposal that contain statement produced at the stage of pre-thesis seminar); (2) The final design (3) Design portfolio that gives a comprehensive picture about process that has been done to produce the design.

Prerequisites: Students have passed Pre-Thesis Seminar

Syllabus: Thesis common contents. Definition selected issue, research question that formulated clearly, the aim in research. Theoritical base, strategy and method determination, reveal fact and synthesis matter that direct to the answer of research, conclusion.

References:

1. Borden and K. Ruedi, *The Dissertation : An Architecture Students' Handbook*. Oxford University Press, 2000.
2. TY Hardjoko, *Panduan Meneliti dan Menulis Ilmiah*, Depok: Departemen Arsitektur Universitas Indonesia., 2005
3. Linda Groat & David Wang. *Architectural Research Methods*, John Wiley and Sons,2002
4. J. Bell. *Doing Your Research Projects: A Guide for First Time Researchers in Education & Social Science*, 2nd ed.Buckingham and Philadelpia: Open University Press, 1993
5. J. Bell and C. Opie, *Learning from Research: Getting More from Your Data*. Buckingham and Philadelphia: Open University Press, 2002
6. E.M. Phillips & DS. Pugh. *How to get a PhD*, Milton Keynes and Philadelphia, Open University Press, 1987.

ELECTIVE COURSES

ENAR800023
ACOUSTICS
3 CREDIT HOURS

Learning objectives: providing students with basic acoustics principles in relation to space and environs. Improve ability to conduct analysis, to produce good acoustics design.

Syllabus: Acoustics basics, characteristics of sounds, criterion of acoustics in a room, sound isolation, intensifying sound, sound pollution.

Prerequisites:

References:

1. Leslie L. Doelle & Lea Prasetio, *Akustik Lingkungan*, Erlangga,1993.
2. PH Parkin & HR Humpreys, *Acoustics Noise and Buildings*: Faber and Faber Ltd., London, 1984.
3. Finarya Legoh & Siti Hajarinto, *Buku Ajar AKUSTIK,* 2002.

ENAR800024
ETHNICS ARCHITECTURE

3 CREDIT HOURS

Learning objectives: Provide students with subjects pertaining to architectures which arise from ethnic groups' traditions, in order to explain and classify elements and principles of each ethnic group's architecture. Improve ability to comprehend phenomena of ethnic architectures in general as well as analyze architecture tradition of each ethnic group.

Syllabus: comprehension of principles and elements of ethnic architecture, formation factors, symbolic classification, cosmological view and worldview, space, place, time, meaning, anthropomorphic, construction process

Prerequisites:

References:

1. Amos Rapoport, *House Form and Culture*, New Jersey: Englewood Cliffs, 1960
2. N. Egenter, *Architectural Anthropology* Lausanne: Structura Mundi 1996
3. Roxanna Waterson, *The Living House: An Anthropology of Architecture in Southeast Asia*, Oxford University Press, Singapore/ Oxford/New York, 1990
4. E. Guidoni, *Primitive Architecture* New York : Harry N. Abrams, 1978.
5. Paul Oliver (ed.), *Sign, Symbol, and Shelter* , New York: The Overlook Press 1977
6. J. Fox (ed.), *Inside Austronesian House*. Canberra: The Australian National University, 1993
7. Djauhari Sumintardja, *Kompendium Sejarah Arsitektur.* Bandung: Yayasan Lembaga Masalah Bangunan, 1978
8. Bourdier & N.AlSayyad (eds), *Tradition, Dwellings and Settlements:Cross-cultural Perspectives*. Lanham, MD: University Press of America, 1989.

ENAR800025

ARCHITECTURE, CITY AND POWER

3 CREDIT HOURS

Learning objectives: Understanding of the role of architecture, planning and design within and between the urban context. Improved understanding of the relationship between environmental design and community development authority. Increased awarenessto no longer be narrowly defined architecture (only in the realm of design / art or profession architect), which generally separates the visual and spatial aspects ofthe social, political, economic and cultural. Understanding that the environment is composed of community development and will result in: a specific power relationship between the wearer in a specific context.

Syllabus: The role of architecture and planning in the broader context. The relationship between design and power. Syllabus prepared according to the theme that shows the relationship, including: Architecture and consumption, poverty and inequality; illegality, informality, disaster, theme parks / leisure, enclaves / zone / segregation, housing, and infrastructure. As an alternative, seminar which offered in this master level, syllabus prepared according to the theme such as: *Empire; Colonial/Postcolonial; Modernitas; Alternatives Modernities; Pacific Rim Capitalism; Transnational Urbanism; Racialization of the City; Latino Metropolis; City and Country; Marginality; City Rebuilding; Entrepreneurial City; Dystopia; Post Urban*.

Prerequisites: Students have taken Design Theories & Methods in Architecture, like to read and watch movie.

References:

1. Various movie titles related to learning objectives
2. David Harvey, *Spaces of Hope,* University of California Press, 2000
3. James C. Scott, *Seeing Like a State: How Certain Scheme to Improve the Human Condition Have Failed*, Yale University Press, 1998
4. Robert Neuwirth, *Shadow Cities*, A Billion Squatters, A New Urban World, Routledge, 2005
5. James Holston, *The Modernist City: an Anthropological Critique of Brasilia*, The University of Chicago Press, 1989
6. Mike Davis, E*vil Paradise: Dreamworlds of Neoliberalism*, The New Press, New York, 2007
7. Sharon Zukin, *Landscape of Power: from Detroit to Disney World*, University of California Press, 1991
8. Janice Perlman, *The Myth of Marginality*
9. Rafi Segal and Eval Weizman, *Civilian Occupation: the Politics of Israeli Architecture*, Babel and Verso, 2003
10. Teresa Caldeira, *City of Wall*, University of California Press, 2000
11. Nan Ellin (ed) *Architecture of Fear*, Princeton University Press,1997
12. Don Mitchell, *The Right to the City: Social Justice and the Fight forPublic Space*, The Guilfor Press, 2003
13. Neil Smith, *The New Urban Frontier: Gentrification and the Revanchist City*, Routledge, 1996

14. Edward S. Popko, *Transition: A Photographic Documentation of a Squatter Settlement*, McGraw-Hill, 1978
15. tephen Graham and Simon Marvin, *Splintering Urbanism: Networked Infrastructures, Technological Mobilities and the Urban Condition*, Routledge, 2001
16. Brenda S.A Yeoh, *Contesting Space in Colonial Singapore: Power Relations and the Urban Built Environment*, Singapore University Press, 2003

ENAR800026
COASTAL ARCHITECTURE
3 CREDIT HOURS

Learning objectives: Improved understanding of the known relationship between the change in time-space-eco-cultural antroposistem in a coastal region with the development ofspatial structure and architecture of local buildings is increasing. Improved understanding can improve the care to know more about eco-antroposistem local peculiarities before realizing his work in a coastal area. Students are able to write with his own words in a systematic and clear understanding of and concern for them.

Syllabus: Water and architecture, understanding and knowledge base of coastal areas, land, sea, beach, sea, islands, time-space-cultural, eco-antroposistem and island-sea interaction effects, the activities of human life, livelihood, spatial, architecturalbuildings and facilities coastal region, the dynamics of settlement activities, and entities residing in coastal areas of Indonesia, and the risk of catastrophic environmental changes in coastal areas of Indonesia, the change of time-space-eco-cultural antroposistem a specified coastal area in Indonesia, the role of architects in laying out the space, building and architecture of the front in the coastal zone.

Prerequisites:

References:

1. Abimanyu Alamsyah, *Regionisme dalam Penataan Permukiman di Gugus Pulau Mikro*, Disertasi Yang Tdak Dipublikasikan, PSIL Universitas Indonesia, 2006
2. Subandono Diposaptono dan Budiman, *Tsunami*, Penerbit Buku Ilmiah Populer, 2006
3. Charles Moore and Jane Lidz, *Water + Architecture*, Thames and Hudson, Ltd, 1994
4. Malcolm Newson, *Land, Water and Development*. River Basin Systems and their Sustainable Development. Routledge, London, 1992
5. Djoko Pramono, *Budaya Bahar*i, Gramedia Pustaka Utama, Jakarta, 2005
6. Heather Vies and Tom Spencer, *Coastal Problems: Geomorphology, Ecology and Society at the Coast*. Edward Arnold, London, 1995
7. Ary Wahyono, AR Patji, SS Laksono, R. Indrawasih, Sudiyono dan Surmiati Ali, *Hak Ulayat Laut di Kawasan Indonesia Timur*, Media Presindo Yogjakarta, 2000.

ENAR800027
HERITAGE IN ARCHITECTURE
3 CREDIT HOURS

Learning objectives: This course introduces to architecture of the past as part of the heritage; know the process of data collection and documentation of past architecture (buildings and areas) and learn conservation efforts including re-use of heritage buildings.

Syllabus: Introduction to the architecture of the past (Architecture Heritage). The material consists of three parts: introduction to heritage; conservation and preservation; technical aspects (measurement / documentation); and the reuse of the building /area documented (historic buildings); task / project exercise.

Prerequisites: -

References:

1. Bernard M Feilden, *Conservation of Historic Building*, Butterworth-Heinemann Ltd, Oxford, 1994,
2. Adolf SJ Heuken, *Tempat-tempat besejarah di Jakarta*, Cipta Loka Caraka. Jakarta, 1997,
3. Indonesian Heritage Society, 3rd ed *The Jakarta Explore,* Equinox Publishing (Asia), Jakarta, 2001.
4. Bryan Lawson, *The Language of Space*, Architectural Press, Amsterdam, 2003,
5. Laurence LOH, *Suffolk House*, HSBC Bank Malaysia Berhad, Malaysia, 2007,
6. Pemerintah Pripinsi DKI Jakarta, Dinas Kebudayaan dan Permuseuman, *Ensiklopedi Jakarta, Culture Heritage.Buku 1. Buku II, Buku III* Yayasan Untuk Indonesia, Jakarta, 2005.
7. Pemerintah Pripinsi DKI Jakarta. Dinas Kebudayaan dan Permuseuman, *Pedoman Teknis Pemugaran Bangunan Gedung dan Lingkungan Kawasan Kebayoran Baru Jakarta Selatan*, Jakarta, 2005
8. Peraturan Daerah Daerah Khusus Ibukota Jakarta Nomor 9 Tahun 1999 Tentang Pelestarian dan Pemanfaatan Lingkungan dan

Bangunan Cagar Budaya

ENAR800028
ARCHITECTURE AND CINEMATIC SPACE
3 CREDIT HOURS

Learning objectives: This course discusses the urban history of Modernity and post-modernity through the lens of cinema. By considering how the real city and another city reel to refer to each other in a mutually beneficial practice of representation, the eye traces the teaching and discuss the history and interpretation of the cinematic space / cinematic city as well as the blurring of boundaries between 'the real' and 'reel' through space and time, through a series of films that represent a variety of different modernity.

Prerequisites: -

Syllabus: Modernity, Post Modernity, Globalization: The traditional small town; the industrial modern city; modernist dystopias, cynical modernity; postmodern city themes; postmodern dystopia; the voyeuristic city; the city through different eyes; the contested city/alternative modernity (race, ethnicity and urban experience); the anti city: nostalgic imaginaries.

References:

1. Louis Wirth, "Urbanism as a Way of Life", in *American Journal of Sociology*, 1938, pp. 38-83
2. Georg Simmel, "The Metropolis and Mental Life", in N. Leach, ed, *Rethinking Architecture,* New York: Routledge, pp.68-79
3. John Berger, *Ways of Seeing*, London: Penguin Books, 1977.
4. Nan Ellin, *Postmodern Urbanism*, New York: Princeton Architectural Press, 1996.
5. Ash Amin (ed). *Post-Fordism: A Reader*. Oxford: Basil Blackwell, 1994.
6. Michael Sorkin (ed). *Variation on a Theme Park*, New York: Hill and Wang, 1992.
7. Marshall Berman, *All That is Solid Melts into Air*, London: Penguin Books, 1982.
8. Paul Wilis, *Learning to Labor*. New York: Columbia University Press. 1977.
9. David Harvey, *The Condition of Postmodernity*, Oxford: Basil Blackwell, 1989.
10. S. Watson and Gibson (eds). Postmodern Cities and Spaces. Cambridge: Basil Blackwell, 1995.
11. Gold and J Burgess (eds).*Geography, the Media and the Popular Culture*. London: Croom Helm, 1985.
12. Alan Marcus, Dietrich Neumann (eds),*Visualizing the City (Architext)*, Routledge, 2008
13. Wolfgang Natter, "The City as Cinematic Space: Modernism and Place in Berlin, Symphony of a City" in S. Aitken and P Zonn (eds). *Place, Power and Spectacle*. London: Rowman and Littlefield Publishers, 1994, pp.203-227.
14. Scott Bukatman, *Terminal Identity: The Virtual Subject in Post-Modern Science Fiction*, Durham: Duke University Press, 1993.
15. J. Rutherford (ed). *Identity: Community, Culture, Difference*. London: Lawrence & Wishart. 1990.
16. Nezar AlSayyad, *Consuming Tradition, Manufacturing Heritage*. London: Routledge, 2001.
17. A. King (ed). *Culture, Globalization and the World System*. London: Macmillan. 1991
18. Dietrich Neumann, *Film Architecture: From Metropolis to Blade Runner*, Prestel Publishing, 1999.
19. Nezar AlSayyad, "The Cinematic City: Between Modernist Utopia and Postmodernist Dystopia" in *Built Environment* 26:4, 2000, pp.268-281.
20. Nezar AlSayyad, *Cinematic Urbanism: A History of the Modern from Reel to Real*. Routledge, 2006.
21. Katherine Shonfield, *Walls Have Feelings: Architecture, Film and the City*, London: Routledge, 2000.
22. D. Clarke (ed). *The Cinematic City*, London: Routledge, 1997.
23. F. Penz and T Thomas (eds). *Cinema and Architecture*, London: British Film Institute. 1997.
24. M. Lamster (ed). *Architecture and Film*, New York: Princeton Architectural Press, 2000.
25. M. Shiel and T. Fitzmaurice (eds), *Cinema and the City*, Oxford: Blackwell, 2001.

Films: Cinema Paradiso; It's a Wonderful Life; Berlin: Symphony of a City; Modern Times; Metropolis; Brazil; End of Violence, Rear Window, Manhattan, Taxi Driver, Blade

Runner, Do the Right Thing, My Beautiful Launderette, The Truman Show, Los Angeles Plays Itself, Eliana, Eliana and related films (determined in class).

ENAR800029
ARCHITECTURE AND TEXTS
3 CREDIT HOURS

Tujuan Pembelajaran: Introduces the architecture as a text that can be read and interpreted based on the relation between the text to its context, and provides tools (methods) to read a work of architecture as a text.

Syllabus:"*Il n'y a pas de hors-texte*" (there is nothing outside the text). Such a sentence ever given by the philosopher Jacques Derrida. Text is often associated with written communication. However, in the context of this course, the text is not limited to the written word. Facial expressions, advertising, traffic signs, painting, and so on, including works of architecture, the text also. The text says, the "brothers" with the word texture and context, comes from the Latin word texere, which means knitting. This course is an introduction to the work of architecture as a text. How do we read a work of architecture as a text? How do we read a work of architecture as an architectural masterpiece with a knitted between the experience of the architect, the condition of local people, places, and so on? Such questions is what we will try to answer together on this subject

Prasyarat: -

Buku ajar :

1. Barthes, Roland. *Mythologies*, Vintage Classics, London, 2000.
2. Caputo, John D. (ed.), *Deconstruction in a Nutshell: a Conversation with Jacques Derrida*, Fordham University Press, New York, 1997.
3. Eco, Umberto, *A Theory of Semiotics*, Indiana University Press, Bloomington, 1976.
4. Gilberthorpe, Joel, *What is a Text?: on the Limits of a Text as an Object of Knowledge*. Downloaded from *http://www.arts.mq.edu.au/documents/NEO_Article_5_2009_Joel_Gilberthorpe.pdf*

ENAR800030
ENERGY EFFICIENT BUILDING
3 CREDIT HOURS

Learning Objectives: Student understands technology theory principle of energy efficiency building and can apply that knowledge to designing building that reacted to climate and energy efficient.

Syllabus: Renewed energy, climate and site, sun geometry, pasif cooling, shading, natural and artificial lighting, and solar cell.

Prerequisites: -

References:

1. Donal Watson, *The Energy Design Handbook*, The American Institute of Architecture Press, 1993
2. Klaus Daniels, *The Technology of Ecological Building*, English translation by Elizabeth Schwaiger, Birkshauser Verlag, Berlin 1994
3. Norbert Lechner, *Heating Cooling Lighting*, Edisi kedua, terjemahan, PT Raja Grafindo Persada, 2007

ENAR800031
HIGH RISE BUILDING FACADES
3 CREDIT HOURS

Learning objectives: mastering the regulation of high rise building facades including aspects of aesthetic, technical, and environmentally

Syllabus:

• The essence of building facades of high-rise building (resistance to earthquakes, lateral-force / wind and water resistant)
• The design of the facade
• Material and technological detail of the facade
• Green façade

Prerequisites:-

References:

1. Wolfgang Schueller, *Struktur Bangunan Bertingkat Tinggi*, Bandung: PT Eresco. 1989
2. Mario Camp, *Skycrapers: An Architectural Type of Modern Urbanism*, Birkhauser – Basel ; Boston ; Berlin. 2000
3. Hart, Henn, and Sontag, Multi-*Storey Buildings in Steel*, Granada Publishing. 1978
4. *Details in Architecture 5: Creative Detailing by Some of The World's Leading Architects*, Mulgrave: The Images Publishing Group Pty Ltd. 2004

ENAR800032
GEOMETRY AND ARCHITECTURE
3 CREDIT HOURS

Learning objectives: This course introduces the role of geometry as a basis in shaping architecture;Able to perform exploration of various possible uses of geometry

as the critical tools of analysis of the existing architecture and in shaping architecture.
Syllabus: Development of the knowledge of geometry and its implications for the development ofarchitectural ideas and creativity;geometry and aesthetics of classical architecture; Euclidean geometry and non-Euclidean in architecture;geometry and the concept of ideal city;geometry,music and architecture;geometry and perception;topology in architecture; geometry in nature universe;exploration of the mechanism of shaping geometryinto design and the potential for further development.
Prerequisites:-
References:

1. Vitruvius, *Ten Books on Architecture*, New York, Dover Publications, 1960
2. Colin Rowe, *Mathematics of an Ideal Villa*, MIT Press, 1976
3. Peter Davidson & Donald L. Bates, *Architecture after Geometry, Architectural Design*, 1999
4. Irenee Scalbert, Archis, *Towards a Formless Architecture: The House of the Future by A+P Smithson*, Archis, 1999
5. D'Arcy Thompson, *On Growth and Form*, 1961
6. Jane Jacobs, *The Death and Life of Great American Cities*, 1967
7. Elizabeth Martin, *Architecture as a Translation of Music*, Pamphlet Architecture 16, Princeton Architectural Press, 1994

ENAR800033
EVERYDAY AND ARCHITECTURE
3 CREDIT HOURS
Learning objectives: This course introduces to the existence of phenomenon of everyday life as an approach to architecture; position the disciplines of architecture in response to various phenomena of everyday living space
Syllabus: Definition and historical background of the concept of 'everyday' in architecture;domestic space;aestheticsin architecture and the 'everyday', the concept of idealcity and its relation to the'everyday';cyberspaceand virtual space; the phenomenon of 'everyday' in urban space: a participatory approach in architecture
Prerequisites:
References:

1. Steven Harris & Deborah Berke (eds.), *Architecture of the Everyday*, Princeton Architectural Press, 1997
2. Sarah Wigglesworth & Jeremy Till (eds.), *The Everyday and Architecture*, Architectural Design, 1998
3. Michel de Certeau, *The Practice of Everyday Life*, University of California Press, 1998
4. Malcolm Miles, *The Uses of Decoration: Essays in the Architectural Everyday*, Wiley, 2000
5. Jonathan Hill (ed), *Occupying Architecture*, Routledge, 1998
6. Margaret Crawford, et.al, *Everyday Urbanism*, Monacelli, 1999
7. Arnstein, *Ladder of Citizen Participation*, 1969

ENAR800034
ADVANCED PROJECT MANAGEMENT
3 CREDIT HOURS
Learning objectives: Develop knowledge of the activities and Project Management Planning and Development Building, especially in technical and economicaspects of administration building at an early stage, design,construction, until the end of the project. Train the ability to critically discuss the content and administrative documentsin project management, the provisions of legislation and standards development. Train the ability to draft OR proposal, Auction Document, Administrative Design, Construction Administration, or the Guide Project (ProjectManual) construction services in a simple project, including working with real clients.
Syllabus: As a product, Project Management is the recording process of the project as a whole, both as aworkingguideline, means of coordination and control of a project.As a process, Project Management is also aseriesof activities that generate andrecord the quantity responsible for all phases of project managementactivities,in amulti-disciplinary functions. This course introduces the skills necessary for project managementthroughoutthe life cycle model with chronological.
Prerequisites: Students have taken Architectural Design 2
References:

1. PMI. *A Guide to the Project Management Body of Knowledge (PMBOK Guides)*. 3 ed. Project Management Institute, 2004.
2. *Hand-Outs mengenai proyek, komunikasi, presentasi dan keberhasilan usaha*
3. J.M Amos and B.R. Sarchet. *Management for Engineers*. Prentice-Hall, Inc., 1981
4. D. Sbarrie, *Professional Construction Management*. Mc. Graw Hill, NY, 1986

5. D. Cadman and L. Austin-Crowe. *Property Development*, EF & N Spon 1978 (1991)

ENAR800035
UNDERSTANDING PHENOMENON: PLATO TO DERRIDA
3 CREDIT HOURS
Learning Objectives:
Introduction of philosophy in architecture is given to student, especially the difference knowledge and empiric/physical verification and metaphysic explanation in understanding the architecture phenomena. Then, student can express and demonstrate thinking principle critically related to each different observation and thinking process of architectural phenomena especially in its principle application in a certain architectural problems form.
Syllabus:
Form and Shape in physical and metaphysical, ontology understanding about 'what' and 'matter' architectural form from empiric and metaphysic knowledge, Plato and Khora, Phenomena and Phemomenology Husserl (essensialism) and Heidegger (existentialism), Semiotic Sign, Myth, Simulacra and Deconstruction, Knowledge-Power.
References:
1. Barthes, R. *Mythologies*. Translated by Annette Lavers. Hill and Wang: New York, 1972
2. Caputo, J.D. (ed.), *Decosntruction in a Nutshell: Conversation with Derrida.* Fordham University Press, New York. 1997.
3. Deleuze, G. *Difference and Repetition.* Translated by Paul Patton. Columbia University Press. 1994.
4. Derrida, J. *On The Name.* Edited by Thomas Dutoit. Stanford University Press, Stanford, 1993. Khususnya Bab mengenai*Khōra*.
5. Derrida, J. *Of Grammotology.* Translated by GayatriSpivak. The John Hopkins University Press, Baltimore, London. 1974. Khususnyabagian*Translator's Note* oleh G. Spivak.
6. Heidegger, M. *Language, Poetry and Thinking.* Perennial Classic, 1971. Khususnya Bab mengenai*Dwelling, Building and Thinking.*
7. Moran, D. *Introduction to Phenomenology.* Routledge, London, New York, 2000
8. Popkin, R. H. danAvrum Stroll. *Philosophy Made Simple.* Doubleday Compay, Inc., Garden City, New York, 1956

ENAR800036
URBAN AND REGIONAL PLANNING
3 CREDIT HOURS
Learning objectives:
This course introduces students to the discourse of growth and development of urban areas. Because these courses are offered for architecture student, the discussion will focus on how to boost economic and social forms of urban physical environment. At the end of this course, students are expected to discuss a complex urban issues from different points of view of actors (planners, developers, landowners, the political, socio-profit institutions, and so on). Students are expected to not only understand the relationship between socio-economic factors on the physical environment, but the reverse is also growing criticality of the idea that a physical intervention can improve the quality of the environment in asociallyoreconomically.
Syllabus:
This course is divided into four major topics. The first section take the students tobeginobservingthe symptoms change (transformation) in the city. In this section,students are encouragedto not only see changes to the city only as a phenomenonbut also as well-planned steps to realize a future alternative for the town. In thesecond section students are introduced to the techniques of urban physical planning which includes: (a) allocation of resources (land, transportation, and public infrastructure), (b) widening of the city, the growth of suburban areas, growth areas, (c) planning of the old town area. The third section asked students to observe the relationship between social and physical environment,including introducing students to the concept of community-based development and poverty reductionplan is the main principles of urban. a critique ofurbanplanningtheories generated by Western countries andpropose how best to adapt those theories in the context of Asia and Indonesia.
Prerequisites:
References:
1. 1.John M. Levi, Contemporary *Urban Planning,* Englewood Cliffs, New York, Prentice Hall, 2003
2. 2. Stuart Chapin Jr & Edwatd J. Kaiser.

Urban Land Use Planning, Chicago, University of Illinois Press, 1995.
3. 3. Richard Register, *Ecocities : Building Cities in Balance with Nature*. Berkeley Hills Books, 2002.
4. 3.Peter Hall dan U.Pfeiffer, *Urban Future 21. A Global Agenda for Twenty - First Century Cities*. London, EF&N Spon, 2000.
5. 4. Soegiyoko, B.T.S. dan BS. Kusbiantoro, eds, *Bunga Rampai Perencanaan Pembangunan di Indonesia*. Grasindo, 1997.
6. 5. Nigel Taylor, *Urban Planning Theory since 1945*, Sage Publication, London, 1998.
7. 6. J. Abbott, *Sharing the City*, Earthscan, London, 1996.

ENAR800037
ADVANCED HISTORY OF ARCHITECTURE
3 CREDIT HOURS
Learning objectives: This course introduces to the art works of modern architecture in the past
Syllabus: Pre-Greek architecture in the Mediterranean, the artwork ofcivilization Minoan, Mycenae, the early Greek civilization sovereign cities, kingdoms of Greece and Hellenism
Prerequisites:
References:
Encyclopedia of Architecture, Academy Editions

ENAR800038
ADVANCED STRUCTURE AND CONSTRUCTION
3 CREDIT HOURS
Learning objectives: Able to follow the development of structure innovation and the latest construction that can be useful in architectural design
Syllabus:
• innovative structural system
• The technology and innovative building construction
• cutting-edge building materials
• The architectural design of innovative
Prerequisites:-
References:
1. Mario Savadori and Matthys Levy, *Structural Design in Architecture, Second Edition*, Prentice-Hall Inc, Englewood Cliffs. 1981
2. Heather Martienssen, *The Shapes of Structure*, Oxford University Press. 1976
3. Angus J. Macdonald, *Struktur& Arsitektur, Edisi Kedua*, Penerbit Erlangga. 2001
4. Sutherland Lyall, *Master of Structure: Bangunan dengan Struktur Inovatif Terkini*. Jakarta: PT Raja Grafindo Persada. 2006
5. Farshid Moussa, *The Function of Form*, Actar and The Harvard University Graduate School of Design. 2009
6. James B. Harris, Kevin Pui – K Li, *Masted Structures In Architecture*, Butterworth Architecture. 1996
7. Fuller Moore, *Understanding Structures*, WCB/McGraw-Hill
8. H. Werner Rosenthal, *Structure*, London and Basing Stoke: The MacMillan Press Ltd. 1974

ENAR800039
ADVANCED BUILDING UTILITY
3 CREDIT HOURS
Learning objectives: Able to explain the utilities systems in the high-rise building (widening and rising), so the building has well function in terms of safety and convenience of users
Syllabus: System of water supply and sewerage / waste, artificial aeration systems, artificial lighting systems, sound systems, CCTV, telephone, lightning rods, vertical transportation systems, building cleaning system.
Prerequisites: -
References:
1. Reynolds, John S and Stein, Benjamin;*Mechanical and Electrical Equipement for Buildings*, John Willey and Sons, 1999
2. Yeang, Ken;*The Skyscraper Bioclimatically Considered*, Academy Press, 1998
3. Reid, Esmond;*Understanding Building*. The MIT Press, 1984
4. Poerbo, Hartono; *Utilitas Bangunan: Buku Pintar untuk Mahasiswa Arsitektur-Sipil*, Djambatan, 1992

ENAR800041
CAPITA SELECTA
3 CREDIT HOURS
Learning objectives: this course introduces various aspects of design and management that learned and applied directly in real products
Syllabus: architecturally related design graphics, product; appropriate technology; business proposals.
Prerequisites:
References:

ENAR800042
TEACHING ASSISTANTSHIP
3 CREDIT HOURS

Learning objectives: With participation as fasilitator in one undergraduate course, student is expected can understand various approach in learning process, which will be a career development professionally in future, both in academic or non-academic.

Prerequisites: Students have passed 1st year evaluation

Syllabus: Fundamental of teaching/teaching and learning; class preparation, creating assignments, fascilitating discussion, assessing & evaluating (grading), use of teaching aids in classrooms, three main approaches of learning theory: behaviorism, cognitive construction and social construction in relation to knowledge, learning , motivation and the instructional methods.

References:

1. Barbara Davis's "Watching Yourself on Videotape," in *Tools for Teaching*, San Francisco: Jossey-Bass, 1993, pp. 355-61.
2. L. Vygotsky, L *Mind in Society*. London: Harvard University Press. 1978.
3. W. G. Perry, *Forms of Ethical and Intellectual Development in the College Years*. San Francisco: Jossey-Bass Publishers, 1999.
4. B.F Skinner, *About Behaviorism*, New York: Vintage Books, 1976.
5. J. Piaget. *Six Psychological Studies*, Anita Tenzer (Trans.), New York: Vintage Books. 1968

6.5. MASTER PROGRAM IN CHEMICAL ENGINEERING

Program Specification

1	Degree Donor Institution	Universitas Indonesia
2	Organized Instituion	Universitas Indonesia
3	Study Program Name	Chemical Engineering Master Program
4	Type of Class	Regular, Special
5	Degree given	Master Program in Chemical Engineering
6	Accreditation status	BAN-PT: Akreditasi A; AUN-QA
7	Medium Language	Indonesian and English
8	Study Scheme (Full time/Part time)	Full time
9	Entry requirement	S1 Graduate/equivalent
10	Study Duration	Designed for 2 years

	Type of Semester	Number of semester	Number of weeks /semester
	Regular	4	17
	Short (optional)	1	8

11 Option:
Master degree program in chemical engineering is offered at UI Depok campus for the regular class and at UI Salemba campus for the special class in gas management. In the chemical engineering master program there is no formal stream or option, instead students have flexibility to select a set of elective courses that suit their interest.

12 Graduate Profile:
A graduate of the Masters Program in Chemical Engineering, Faculty of Engineering University of Indonesia (PSTK-FTUI) should be able to solve problems in process system design and/or self-directed research activities based on scientific principles and be able to develop their professional performance as indicated by the appropriate level of problem analysis, scientific approach, and coherent problem-solving ability.

13 Graduate Competency List:
- Able to apply knowledge of mathematics and science in solving chemical engineering problems
- Able to use modern chemical engineering tools
- Able to analyze the chemical engineering transport phenomena problems
- Able to analyze chemical engineering thermodynamics problems
- Able to analyze chemical engineering reaction engineering problems
- Capable of conducting independent research based on scientific principles in a particular specialty area
- Able to design process systems and chemical products taking into account the engineering, management, economic, social, health, safety, and environmental aspects
- life-long learning attitude for continuous personal development and contribution to solve local and global problems

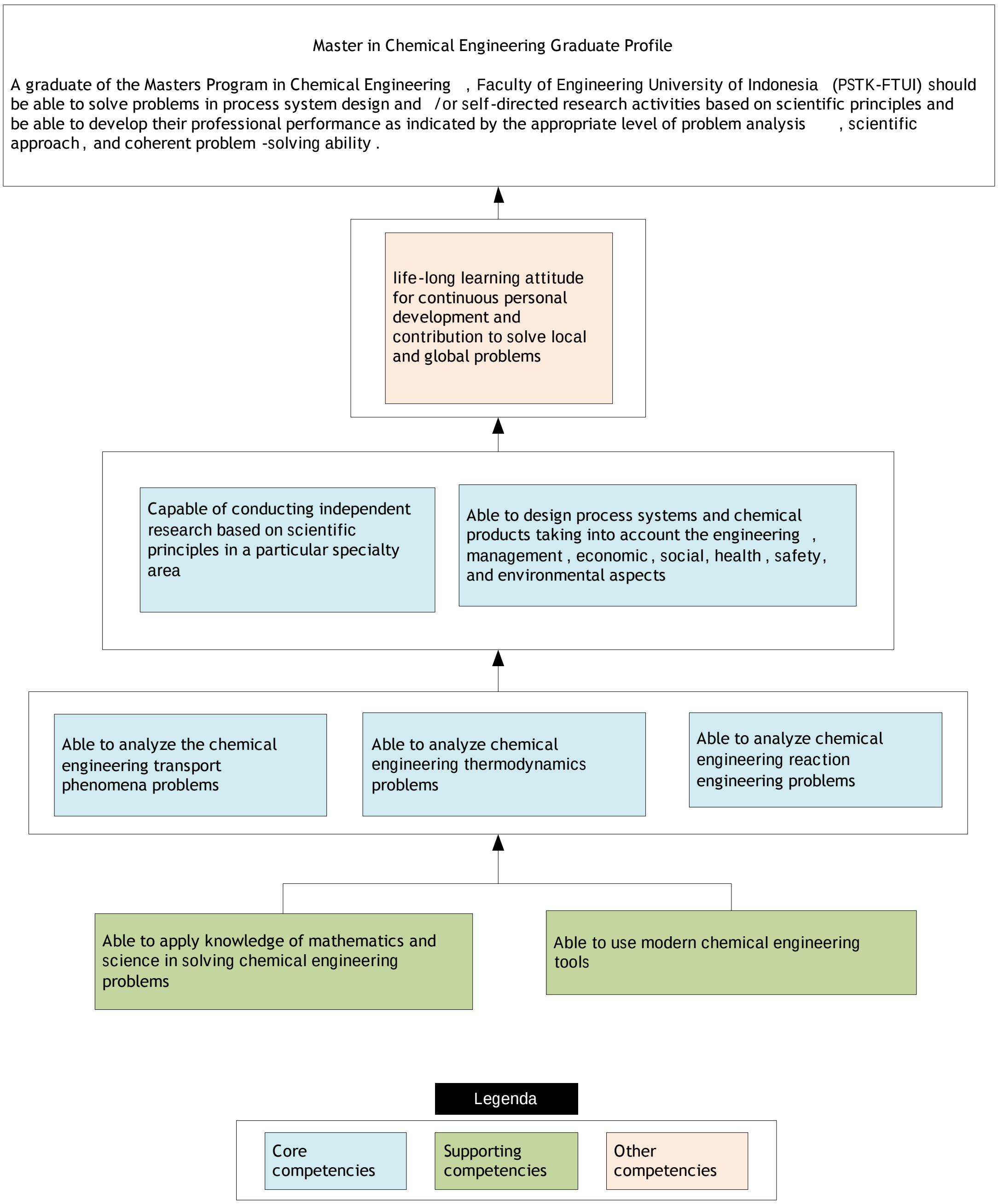
13 Classification of Subjects

No	Classification	Credit Hours (SKS)	Percentage
i	Compulsory Subjects	24	58.5 %
ii	Stream Subjects	6	14.6 %
iii	Elective Subjects	3	7.3 %
iv	Seminar, Thesis	8	19.6 %
	Total		100 %

14	**Total Credit Hours to Graduate**	**41 SKS**

Flow Diagram of Learning Outcomes

Targeted graduate competencies of the chemical engineering master program is shown as competence network in Figure 1. The main competencies (blue color) are general characteristics of master graduates in chemical engineering. Achievement of the main competencies is supported by the attainment of the supporting competencies (green color) whereas the other competencies (orange color) is a more general competence.



Curriculum Structure of Master Program in Chemical Engineering (Regular)

The curriculum structure of the master program is given in Table 1 and list of the elective courses is given in Table 2. Elective courses listed in Table 2 are also available for students participating in the undergraduate (regular, parallel, and fast-track) programs.

Table 1. Curriculum structure of the chemical engineering master program (Regular).

KODE	MATA AJARAN	SUBJECT	CREDIT
	Semester 1	**1st Semester**	
ENCH800001	Pemodelan Teknik Kimia Lanjut	Advanced Chemical Engineering Modeling	3
ENCH800002	Termodinamika Teknik Kimia Lanjut	Advanced Chemical Engineering Thermo-dynamics	3
	Pilihan 1	Elective 1	3
	Pilihan 2	Elective 2	3
		Sub Total	**12**
	Semester 2	**2nd Semester**	
ENCH800003	Peristiwa Perpindahan Lanjut	Advanced Transport Phenomena	3
ENCH800004	Teknik Reaksi Kimia Lanjut	Advanced Chemical Reaction Engineering	3
ENCH800005	Metodologi Penelitian	Research Methodhology	3
	Pilihan 3	Elective 3	3
		Sub Total	**12**
	Semester 3	**3rd Semester**	
ENCH800006	Seminar	Seminar	3
	Pilihan 4	Elective 4	3
	Pilihan 5	Elective 5	3
		Sub Total	**9**
	Semester 4	**4th Semester**	
ENCH800007	Tesis	Thesis	7
		Sub Total	**7**
		Total	**40**

Tabel 2. List of elective courses available for the chemical engineering master (reguler) program students.

Odd Semester			
KODE	**MATA AJARAN**	**SUBJECT**	**CREDIT**
ENCH801017	Material Komposit	Composite Material	3
ENCH801018	Termodinamika Terapan	Applied Termodynamics	3
ENCH801019	Sistem Dinamik	Dynamic System	3
ENCH801020	Sifat Termodinamika Hidrokarbon	Thermodynamic Properties of Hydrocar-bons	3
ENCH801021	Teknologi Pelumas	Lubricant Engineering	3
ENCH801022	Teknologi Bioproses	Bioprocees Engineering	3
ENCH801023	Teknologi Kriogenik	Cryogenic Engineering	3

ENCH801024	Teknologi Plasma Ozon	Plasma and Ozone Engineering	3
ENCH801025	Katalis Heterogen	Heterogeneous Catalyst	3
ENCH801026	Manajemen Resiko	Risk Management	3
ENCH801027	Topik Khusus 1	Special Topic 1	3
ENCH801028	Kecakapan Pemecahan Masalah	Problem-Solving Skills	3
ENCH801029	K3 dalam Industri Kimia	Health and Safety in Chemical Industry	3
ENBP601021	Industri Oleokimia	Oleochemical Industry	3
ENBP601022	Teknologi Pangan	Food Technology	3
ENBP601024	Rekayasa Protein	Protein Engineering	3
ENBP601025	Teknologi Herbal	Herbal Technology	3
Even Semester			
KODE	**MATA AJARAN**	**SUBJECT**	**CREDIT**
ENCH801030	Pengolahan Minyak Bumi	Petroleum Processing	3
ENCH801031	Proses Petrokimia	Petrochemical Processing	3
ENCH801032	Teknik Pembakaran	Combustion Engineering	3
ENCH801033	Teknologi Fotokatalis	Photocatalysis Technology	3
ENCH801034	Analisis dan Sintesis sistem Proses Kimia	Analysis and Synthesis of Chemical Pro-cesses	3
ENCH801035	Teknologi Polimer	Polymer Engineering	3
ENCH801036	Pencegahan Pencemaran	Pollution Prevention	3
ENCH801037	Eksplorasi dan Produksi Hidrokar-bon	Exploration and Production of Hydrocar-bons	3
ENCH801038	Utilitas dan Pemeliharaan Pabrik	Utilities and Plant Maintenance	3
ENCH801011	Transportasi dan Pemanfaatan Gas Bumi	Natural Gas Transportation and Utilization	3
ENBP601027	Teknologi Penyimpanan dan Penge-masan	Packaging and StorageTechnology	3
ENBP601028	Bioinformatika	Bioinformatics	3
ENBP611029	Teknologi Pelepasan Terkendali Obat	Drug Controlled Release Technology	3
ENBP601030	Teknologi Obat dan Kosmetik	Drugs and Cosmetics Technology	3
ENBP601031	Biomaterial	Biomaterial	3
ENCH801039	Topik Khusus 2	Special Topic 2	3

Curriculum Structure of Master Program in Chemical Engineering (Major in Gas Management – Special Class at Salemba

The curriculum structure of the gas management master program (Salemba campus) is given in Table 3.

Table 3. Curriculum structure of the gas management master program.

KODE	MATA AJARAN	SUBJECT	CREDIT
	Semester 1	**1st Semester**	
ENCH801008	Eksplorasi dan Produksi Hidrokar-bon	Hydrocarbon Exploration and Processing	3
ENCH600024	Pengolahan Gas Bumi	Natural Gas Processing	3
ENCH800009	Manajemen Proyek Gas Bumi	Natural Gas Project Management	3
ENCH800002	Termodinamika Teknik Kimia Lanjut	Advanced Chemical Eng. Thermodynam-ics	3
		Sub Total	**12**
	Semester 2	**2nd Semester**	
ENCH800010	Keekonomian Gas Bumi	Natural Gas Economics	3
ENCH801011	Transportasi & Pemanfaatan Gas Bumi	Natural Gas Transportation and Utiliza-tion	3
ENCH801012	Manajemen Resiko	Risk Management	3
ENCH800013	Manajemen Sistem Rekayasa	Engineering System Management	3
		Sub Total	**12**
	Semester 3	**3rd Semester**	
ENCH801014	Energi Berkelanjutan	Sustainable Energy	3
ENCH800015	Metodologi Penelitian dan Seminar	Research Methodhology and Seminar	3
ENCH800016	K3 dalam Industri Gas Bumi	Health and Safety in Natural Gas Industry	3
		Sub Total	**9**
	Semester 4	**4th Semester**	
ENCH800007	Tesis	Thesis	7
		Sub Total	**10**
		Total	**40**

Course Description

ENCH800001
ADVANCED MODELING OF CHEMICAL ENGINEERING
3 SKS
Learning Objectives: Students are able to solve the problems in engineering and design the system of chemical engineering with numerical application
Syllabus: The differential equation of the ordinary linear, the differential equation of the ordinary not linear – initial value problem; the differential equation of the ordinary not linear - boundary value problem; the partial differential equation: finite difference method.
Prerequisites: Modeling of Chemical Engineering
Textbook:
1. Constantinides, A. dan Mostouvi, N., Numerical Methods for Chemical Engineers with MATLAB Applications, Prentice Hall, 1999.
2. Davis, M.E., Numerical Methods and Modeling for Chemical Engineer, John Willey & Sons, New York, 1984.
3. Griffiths, D.F. dan Higham, D.J., Numerical Methods for Ordinary Differential Equations, Springer, 2010.
4. Hoffman, J.D., Numerical Methods for Engineers and Scientists, Marcel Dekker, Inc., 2001.

ENCH800002
ADVANCED CHEMICAL ENGINEERING TERMODYNAMICS
3 SKS
Learning Objectives: Students are able to understand the basics of thermodynamics, fluid properties, phase equilibrium and reaction and be able to apply it to solve problems of chemical engineering.
Syllabus: Analysis the system using the several forms of the first and second laws, the equation network of termodynamic for termodynamic properties, condition equation, fluid phase equilibrium, chemical reaction equilibrium
Prerequisites: Chemical Engineering Thermodynamics
Textbook:
1. Kyle, BG, Chemical and Process Thermodynamics, 2nd ed., Pretice Hall, 1992.
2. Hand-out lecture
3. Smith J.M. and van Ness, HC, Introduction to Chemical Engineering Therkodynamics, 4th ed., McGraw-Hill, 1985
4. Callen, HB, Thermodynamics and An Introduction to Thermostatics, 2nd ed., John Wiley and Sons, 1985.

ENCH800003
ADVANCED TRANSPORT PHENOMENA
3 SKS
Learning Objectives: Students are able to understand the transport phenomenom of momentum, mass and heat simultaneously and able to apply it at the unit processes that involve the flow of single phase or multiple phase
Syllabus: Review of the theory of transfer of momentum, mass and heat simultaneously; analysis and application of single-phase system: mixing and dispersion, mixer; analysis and application of a combination system of gas-liquid phase, gas-solid, liquid-liquid, liquid-solid, gas -liquid-solid: hydrodynamics, mass transfer / heat, appliances
Prerequisites: Transport Phenomena
Textbook:
1. Bird et al, Transport Phenomena, Wiley, 1960.
2. Gordon, RJ, Transport: Momentum Transport and Fluid Flows, AIChE Modular Instruction, AIChE, 1980.
3. Chereminisof, N.P., ed., Fluid Mechanics. Vol 1 s / d 6, Gulf Publishing Co., 1987.
4. Brodkey, Flersley, H.C., Transport Phenomeria. A Unified Approach, McGraw Hill, 1988.

ENCH800004
ADVANCED CHEMICAL REACTION ENGINEERING
3 SKS
Learning Objectives: Students are able to analyze the phenomenon of chemical kinetics, the kinetics reaction data to determine the equation mechanistic reaction rate; Ability to design and analyze the performance of chemical reactors is not ideal homogeneous phase and multi phase
Syllabus: Thermodynamics of the reaction; definitions and basic concepts: the rate of reaction, the reaction rate equation, the Arrhenius equation: reaction modeling and data analysis for the determination of reaction rate equations; the introduction of gas-solid heterogeneous catalysts: a reduction in reaction rate equations and data of heterogeneous catalytic reactions of solid-gas ; effects of diffusion and heat transfer in the catalytic reaction data interpretation. design of batch reactor and CSTR (isothermal, non-isothermal) reactor design PFR and PBR (isothermal, non-isothermal) sphere and the membrane reactor design; design-solid heterogeneous catalytic reactors with interstage gas cooler / heater;

design of reactors for multiple reactions and mss (multiple steady state). design of non-ideal reactor (residence time distribution).
Prerequisites: Chemical Reaction Engineering 2
Textbook:
1. Fogler, HS, Elements of Chemical Reaction Engineering, 3rd ed., 1999. Prentice-Hall,
2. Smith, JM, Chemical Engineering Kinetics, 3rd ed., 1981, McGraw-Hill
3. Thomas, JM, and WJ Thomas., Principles and Practice of heterogeneous Catalysis, VCH, Weinheim, 1997.

ENCH800005
RESEARCH METODOLOGY
2 SKS
Learning Objectives: Students are able to indentify the problem, determine the appropriate methods to solve the problem in the form of research activity, processes the data and present the scientific research results orally and in writing.
Syllabus: Introduction, techniques to identify problems and arrange hypotheses, think logically, the techniques of scientific writing, technical writing research proposals, designing research techniques, presentation techniques, techniques to collect data, analyze it and present it.
Prerequisites: -
Textbook:
1. Handout
2. Research Proposal Format The preparation of various agencies

ENCH800007
THESIS
3 SKS
Learning Objective: Students are able to design, perform, and analyze research in chemical engineering; present the result of the research in writings and orally.
Syllabus: the material in accordance with the thesis topic research are taken.
Prerequisite: In accordance with the regulations
Textbook: Guide the practical implementation of the Constitutional Court. Thesis, Depok, 1999.

ENCH800008
HYDROCARBON EXPLORATION AND PRODUCTION
3 SKS
Learning Objectives: Students are able to explain the economic concept of natural gas and analyze the economy 4e
Syllabus: Introduction of hydrocarbon, life cycle of field development, hydrocarbon form and hydrocarbon property and reservoir, hydrocarbon exploration: geology, geophysic, and drilling, field apparsial, reservoir development, drilling development, hydrocarbon production, HSE, hydrocarbon economy and lease, coal and hydrocarbon unconventional (CBM, Shale gas, and HYDRAT GAS)
Prerequisites:-
Textbook:
1. Frank Jahn et all, 2008, Hydrocarbon Exploration and Production, Developments in Petroleum Science, second edition
2. Babusiauz et al, 2004, Oil and Gas Exploration and Production. Reserves, Cost and Contracts, IFP-Technip,
3. M. Kelkar, 2008, Natural Gas Production Engineering, PennWell Publications
4. Norman J. Hyne, 2001, Nontechnical Guide to Petroleum Geology, Exploration, Drilling and Production, Pennwell Books, 2 edition.

ENCH800009
NATURAL GAS PROJECT MANAGEMENT
3 SKS
Learning Objectives: Students are able to explain the natural gas project management appropriately and structured and able to implement project management in an activity.
Syllabus: Concept Project - Production, Project Life Cycle, Project Selection, Project Planning, Project Implementation, Project Completion & Evaluation.
Prerequisites:-
Textbook: Suharto, Imam, Manajemen Proyek, 1990.

ENCH800010
THE NATURAL GAS ECONOMICS
3 SKS
Learning Objective: Students are able to explain the concept of the natural gas economic and analyze the supply chain natural gas as well as natural gas project.
Silabus: Introduction the structure of the natural gas industry, natural gas market, natural gas prices and tariff, natural gas contracts and sale agreement, economic cost of natural gas value chain, natural values in demand sectors, natural gas project development and finance.
Prerequisites: -
Textbook:
1. Tussing, Tippee, 1995, The natural Gas Industry. Evolution, Structure and Economics, Pennwell Books

2. Vivek Chandra, 2006, Fundamentals of Natural Gas. An international Perspective, Pennwell
3. Bob Shively and John Ferrare, 2007, Understanding Today's Natural Gas Business, Enerdynamics.
4. Julius D., Mashayekhi A., 1990, The Economics of Natural Gas: Pricing, Planning and Policy, Oxford Institute for Energy Studies.
5. Ole Gunnar Austvik, 2000, Economics of Natural Gas Transportation, Lillehammer College August. 64 pages, Research Report no. 53

ENCH800011
TRANSPORTATION AND UTILIZATION THE NATURAL GAS
3 SKS
Learning Objectives: Students are able to analyze several option of the natural gas utilization either energy or feedstocks
Syllabus: The general observation of natural gas: property and quality, the history of milestones, the aspect of the environment, international issue, and industrial structure of the natural gas; transportation and storage the natural gas in gas and liquid fase; the natural gas utilization: gas as fuels, gas to synfuels and chemicals, gas to wires/power.
Prerequisites: Chemical Engineering Termodynamics
Textbook:
1. Handbook of Natural Gas Engineering, Kartz D.
2. Handbook of Natural Gas Utilization, Pritchard G.
3. Combustion Engineering and gas utilization, Cornforth J.R.
4. Oil and Gas Pipeline Fundamentals by John L. Kennedy
5. Tussing A.R., Tippee B., The Natural Gas Industry, Evolution, Structure and Economics, Penwell Books, 1995
6. Bisio A., Boots S., Energy Technology and The Environmnet and Environmental, 1995.

ENCH800012
RISK MANAGEMENT
3 SKS
Learning Objectives: Students can explain and apply risk management in a risk assessment.
Syllabus: Introduction to the risk, the basic principles and guidelines concerning risk, risk management standards, risk assessment, risk analysis, risk analysis and simulation, simulation of the risk with Montecarlo method, the risk of using software simulation crystal ball.
Prerequisites:
Textbook: J. F. A. Stoner, Management, 1986

ENCH800013
ENGINEERING SYSTEM MANAGEMENT
3 SKS
Learning Objective: To give knowledge and comprehension about analysis system, simulation, and the processes concerned until become a technique product that appropriate with costumer requirement.
Syllabus: Design, manufactur, and complex system operation constitute a main challenge from the manager now. The system that in such a way, the heavy schedule, the financial constraint with the pressurre in technology development, require the new of auxiliary apparatus for project designing, organizing, and controlling. This curriculum also gives the market strategy principle briefly; determination the relationship in the superior value versus price. Strategic aspects from marketing and how this thing was attributed with the basic functions of marketing, such as: sale and promotion
Prerequisites:
Textbook:

ENCH800014
SUSTAINABLE ENERGY
3 SKS
Learning Objectives: Students are able to explain the relationship of energy with social aspect, economic and environmental and sustainability concepts, and able to analyze the performance of techno-economy and the continuity especially fossil energy system, new, and renewable.
Syllabus: Concept of sustainability and sustainable energy, energy hierarchy, energy linkages with economic, environmental and social, fossil energy / fuels and Impacts, global climate change and its mitigation, conversion, transportation / distribution and storage, analysis method of energy sustainability: LCA , sustainability index, hydrogen and fuel cells and nuclear energy, solar energy (PV and thermal), wind and ocean, hydropower, bioenergy, geothermal energy, energy efficiency and conservation, energy policy and international consensus.
Prerequisites: Chemical Engineering Thermodynamics or Biochemical Engineering
Textbook:
1. Jefferson W. Tester, et al., Sustainable Energy: Choosing Among Options, MIT Press, 2005.
2. Godfrey Boyle, et al., Energy Systems and

Sustainability: Power for a Sustainable Future, Oxford University Press, 2003.
3. E. Cassedy S, Prospects for Sustainable Energy: A critical assessment, Cambridge University Press, 2000.
4. DeSimone et al, Eco-Efficiency. The Business Link to Sustainable Development, MIT Press, 1997.
5. D. Elliot, enerfy, Society, and Environment, Technology for a sustainable future, Rouledge, 1997
6. Miller, G. T., Environment Science. Sustaining Earth, Wardworld Publish Co. 1993
7. Munashinge, Energy Policy Analysis and Modeling, Cambridge University Press; 1993

ENCH800015
RESEARCH METHODOLOGY AND SEMINAR
2 SKS
Learning Objectives: Students are able to indentify the pronlem, determine the appropriate methods to solve the problem in the form of research activity, processes and scientific research results orally and in writing.
Syllabus: Introduction, techniques to identify problems and arrange hypotheses, think logically, the techniques of scientific writing, technical writing research proposals, designing research techniques, presentation techniques, techniques to collect data, analyze it and present it.
Prerequisites: Students have to take a minimum of 90 credits (minimum value of D) with a GPA of 2.0
Textbook:
1. Handout
2. Research Proposal Format The preparation of various agencies

ENCH800016
HSE IN NATURAL GAS INDUSTRY
3 SKS
Learning Objectives: Students are able to identify the condition of health and safety in the gas industry and to propose ways of overcoming problems of HSE with due regard to safety laws and regulations relating to the work environment.
Syllabus: Laws and regulations relating to safety, national standards and international standards related to safety analysis, dual-function chemicals, Hazard Identification and Risk Assasment (Hira), Hazard Identification (HAZID) and Hazard Operatibility Study (HAZOPS).
Prerequisites: -
Textbook:
1. Undang-undang keselamatan kerja No.1 tahun 1970
2. Peraturan Menteri Tenaga Kerja, Pedoman Teknis Audit Sistem Manajeman Keselamatan dan Kesehatan Kerja, 1996.
3. International Labour Office, Prevention of Major Industrial Accidents, 1991.
4. Chemical Process Safety Modules

ENCH801017
COMPOSITE MATERIAL
3 SKS
Learning Objectives: Students are able to:
1. Explain the characteristics of composite materials and compare it with conventional materials.
2. Explain the manufacturing process, and research development of composite materials.

Syllabus: The position of composite materials in materials science in general, common characteristics of composite materials, the type of composite based on the composition, the types of polymer matrix and reinforcement, the role of surface treatment in the strength of composite materials, manufacturing processes, durability, the process of splicing and repair of composite materials, code and standards for application of composite materials, the development of composite materials research.
Prerequisites: Organic Chemistry
Textbook:
1. Fiber-reinforced Composites (Materials Engineering, Manufacturing and Design), P. K. Mallick, Marcel Dekker, Inc., 1993.
2. Handbook of Plastics, Elastomers, and Composites, 3rd ed., Charles A. Harper, McGraw-Hill, 1996.
3. Reinforced Plastics - Theory and Practice, 2nd ed., M. W. Gaylord, Chaners Books, 1974.

ENCH801018
APPLIED THERMODYNAMICS
3 SKS
Learning Objectives: Students are able to analyze problems of thermodynamics based on a thorough review including fundamental aspects of thermodynamics, experimental, and green chemistry, based on current information from scientific journals
Syllabus: The case study of industrial termodynamic, example cycle processes, fase equilibrium, and chemical reaction equilibrium to

process and product engineer; friendly solvents such as supercritical CO_2 and ionic liquid
Prerequisites: Chemical Engineering Thermodynamics
Textbook:
1. References relevant to a given problem.
2. Mulia, K and Wulan, PPDK, Textbook of Chemical Thermodynamics

ENCH801019
DYNAMIC SYSTEMS
3 SKS
Learning Objectives: Students are able to build dynamic models of process systems, biological, industrial, social and economic.
Syllabus: Introduction to dynamical systems, causal loops, model and validation, analysis, case study.
Prerequisites: Numerical Computation
Textbook:
1. Forrester, J. W., 2002, Principles of Systems, Productivity Press
2. Goodman, Michael R., 1998, Study Notes in System Dynamics, Productivity Press
3. Richardson, George P. and Pugh III, Alexander L., 1999, Introduction to System Dynamics Modeling, Pegasus Communications
4. Andersen, David, etc., Introduction to Computer Simulation - A System Dynamics: Systems Thinking and Modeling for a Complex World, McGraw-Hill

ENCH801020
THERMODYNAMIC PROPERTIES OF HYDROCARBONS
3 SKS
Learning Objectives: Students are able to predict the magnitude of the thermodynamic properties of hydrocarbons and the phase condition, either manually or using software calculations.
Syllabus: introduction to hydrocarbon thermodynamics properties, basic thermodynamic concepts, P-V-T data correlations, physical properties of hydrocarbon fluids, computing aided thermodynamics properties, the vapor-liquid behavior of two-phase systems, water-hydrocarbon system behavior, product specifications in the disposal lease of hydrocarbon
Prerequisites: Chemical Engineering Thermodynamics
Textbook:
1. Wayne C. Edmister, Byung Ik Lee, Applied hydrocarbon thermodynamics, Volume 1, Gulf Publishing Company (1988), Houston, Texas.
2. John M. Campbell, Gas Conditioning and Processing, Vol. 1, 8th Edition Campbell Petroleum Series 2001.

ENCH801021
LUBRICANT ENGINEERING
3 SKS
Learning Objectives: Students are able to explain the working principles of lubrication,lubricant function and several parameter of the quality and lubricant clasification, lubricant chemical, and its production technology either mineral lubricant, synthesis, and vegetal.
Syllabus: Principles of lubrication on friction and wear phenomena on the two surfaces of solid objects are moving together; mode lubrication: hydrodynamic and elastohydrodynamic; lubricants: mineral, synthetic, and vegetable; additives, formulations, degradation, contamination, and maintenance of lubricants; latest development of lubricant technology.
Prerequisites: Organic Chemistry
Textbook:
1. E. Richard Booster, Handbook of Lubricant: Theory and Practice of Tribology, Vol. I, Vol. II, Vol. III, CRC Press (1984), Inc., Boca Raton, Florida
2. Mervin H. Jones, Industrial Tribology: The Practical Aspect of Friction, Lubricant, and Wear. Elsevier Scientific Publishing Co., New York, 1983.
3. J. Halling, Principle of Tribology, Macmillan Press Ltd., London, 1978
4. Handout

ENCH801022
BIOPROCESS TECHNOLOGY
3 SKS
Learning Objectives: Students are able to explain the fundamentals of bioprocess engineering including systems, equipment and industrial applications.
Syllabus: Introduction to bioprocess technology, the design of fermentors, cell separation system, vessel for biotechnology, pipes, valves and pumps for biotech, cleaning, sterilization and water systems for pharmaceutical levels, heating, ventilation and air system, biowaste.
Prerequisites: Molecular Biology
Textbook:
1. J. Bailey E and D. F Ollis, Biochemical Engineering Fundamentals, McGraw-Hill Inc., New York, 1986
2. J. W. Dale and M. Von Schantz, From Gene to genomes: Concept and Application of DNA Technology, John Wiley & Sons, Ltd.., London, 2002
3. J. Matthews E., Handbook of Bioremedation, Lewis Publishers, London, 1994

4. Schrugerl K., and K. H. Belghardt (Eds.), Bioreaction Engineering: Modelling and Control, Verlaag Springer, Berlin Heidelberg, 2000

ENCH801023
CRYOGENIC ENGINEERING
3 SKS
Learning Objectives: Students are able to explain the various processes to liquefy gas in cryogenic technology
Syllabus: History and development of cryogenic, cryogenic scope of work. Refrigeration and liquefaction of natural gas, air, oxygen, nitrogen, helium, neon and argon.
Prerequisites: Chemical engineering thermodynamics
Textbook:
1. Timmerhaus, K.D., Cryogenic Process Engineering, Plenum Press 1989, New York.

ENCH801024
PLASMA AND OZONE ENGINEERING
3 SKS
Learning Objectives: Students are able to explain the physics and chemistry phenomena of plasma formation and release of electromagnetic energy and the use of plasma and ozone technology.
Syllabus: basic phenomena and physical-chemical processes of gases that are given an electrical charge (corona discharge), the generation process or formation of ozone, role and use of plasma technology and ozone in chemical engineering processes, the potential of ozone technology in control technology environmental pollution, the ozone generator module manufacturing equipment.
Prerequisite: Physics Electricity Magnetism
Textbook:
1. E. T. Protasevich: “Cold Non-Equilibrium Plasma”, Cambridge International science Publishing, Cambridge, 1999.
2. Rice, R. G., and M. E. Browning: “Ozone Treatment of Industrial Water wate”, Notes Data Corroraion, Park Ridyl, 1981.
3. Metcalf & Eddy, Inc. (Tchobano-glous, G., and FL Burton): “Wastewater Engineering: Treatment, Disposal, and Reuse”, McGraw-Hill Book. Co., Singapore, 1991.

ENCH801025
HETEROGENEOUS CATALYSIS
3 SKS
Learning Objectives: Students are able to explain the phenomenon of basic concepts heterogeneous catalysts and its application
Syllabus: The general property of catalyst, thermodynamic of the reaction with catalyst, the distribution of the catalyst based on the type of reaction, the core function is active, the method of selecting catalysts for certain reactions, characterization of the corresponding want to know the nature of the target, the catalyst test methods, methods of development of the catalyst, and reaction products.
Prerequisites: Chemical Reaction Engineering 1
Textbook:
1. Satterfield, C. N., heterogeneous Catalysis in Industrial Practice, McGraw-Hill Inc., New York, 1991.
2. Rase, F. R., Commercial Catalyst, CRC Press, New York, 1991
3. Richardson, T, J., Principles of Catalyst Development, Plenum Press, New York, 1989
4. Thomas J.M. And WJ Thomas, Principles and Practice of Heterogenous Catalysis, VCH, Weinhem, Germany, 1997
5. Emmet, R. H., Catalysis, Reinhold Publishing Corporation, New York, 1961

ENCH801026
RISK MANAGEMENT
3 SKS
Learning Objectives: Students can explain and apply risk management in a risk assessment.
Syllabus: Introduction to the risk, the basic principles and guidelines concerning risk, risk management standards, risk assessment, risk analysis, risk analysis and simulation, simulation of the risk with Montecarlo method, the risk of using software simulation crystal ball.
Prerequisites:
Textbook: J. F. A. Stoner, Management, 1986

ENCH801028
PROBLEM SOLVING SKILLS
3 SKS
Learning Objectives: Students are able to apply problem-solving strategies in a variety of real cases.
Syllabus: The awareness of thinking, creativity, problem-solving heuristics and techniques (problem-solving); techniques of defining the problem; situation analysis includes the analysis of Kepner-Tregoe problem by, decision analysis, and analysis of potential problems.
Prerequisites: -
Textbook:
1. Fogler, HS. and LeBlanc, SE., Strategies for Creative Problem Solving, Prentice Hall, 1995
2. Woods, DR, Problem-Based Learning: How to gain the Most from PBL, 1994.

ENCH801029
HEALTH AND SAFETY IN CHEMICAL INDUSTRY
3 SKS
Learning Objectives: Students are able to identify the condition of health and safety in the chemical industry and propose the ways of overcoming problems of health and safety with observe to safety laws and regulations relating to the work environment.
Syllabus: The law and regulations relating to safety, national standards and international standards related to safety analysis work, Dual-function chemicals, Hazard Identification and Risk Assasment (HIRA), Hazard Identification (HAZID) dan Hazard Operability Study (HAZOPS).
Prerequisites: -
Textbook:
1. Safety Act of 1970 1
2. Regulation of the Minister of Labour, Technical Guidelines for Safety Audit management system and Occupational Health, 1996.
3. International Labour Office, Prevention of Major Industrial Accidents, 1991.
4. Chemical Process Safety module

ENCH801030
PETROLEUM PROCESSING
3 SKS
Learning Objectives: Students are able to explain petroleum characteristic and its refine product and the stages of the process from various petroleum processing technologies.
Syllabus: Introduction terminology, oil composition, thermal properties of petroleum, chemical processing of petroleum processing, distillation, hydrogenation and dehydrogenation, cracking processes, the processes of reforming, gas processing and petroleum light products, product improvement.
Prerequisites: Fluid and Particle Mechanics, Termodynamics, Mass Transfer.
Textbook:
1. James G. Speight, The Chemistry and Technology of Petroleum, Marcel Dekker, 1991.
2. James H. Gary and Glenn E. Handwerk, Petroleum Refining, Marcel Dekker, 1974.
3. D. S. J. Jones, Elements of Petroleum Processing, John & Sons Woley

ENCH801031
PETROCHEMICAL PROCESSES
3 SKS
Learning Objectives: Students are able to explain the development of petrochemical products and raw material potential, upstream / downstream petrochemical production lines (olefin center, aromatic center, and the pathways of methane) and the major production processes of several petrochemical industry through methane, olefins and aromatics; able to analyze impact of industrial processes and petrochemical products to the environment.
Syllabus: History of the general petrochemical products development and raw material potential, the scope of the petrochemical industry, petrochemical classification process, the type and processing raw materials into petrochemical products, the details of various petrochemical industry: olefins center, aromatics and the center line of methane, industrial and environmental impact of products petrochemicals.
Prerequisites: Organic Chemistry
Textbook:
1. Martyn V. Twigg, “Catalyst Handbook”, 2nd Ed., Wolfe Pub. Ltd..
2. Lewis T. Hatch, Sami Matar, “From Hydrocarbon to Petrochemical”.
3. Wells, Margaret G., “Handbook of Petrochemicals and Processes”, Gower Publishing Company Ltd., 1991.
4. Pandjaitan Maraudin, Petrochemical Industry and The effect of environment, Gadjah Mada University Press, 2002

ENCH801032
COMBUSTION ENGINEERING
3 SKS
Learning Objectives: Students are able to explain the phenomenon of combustion and resolve the problems that rendered correctly.
Syllabus: chemical kinetics and combustion, the flame, premix flame, diffusion flame, the combustion process applications.
Prerequisite: Transport Phenomena, Chemical Reaction Engineering 1, Chemical Engineering Thermodynamics
Textbook:
1. Warnatz, J., Maas, U. dan Dibble, R.W., Combustion: Physical and Chemical Fundamentals, Modeling and Simulation, Experiments, Pollutant Formation, 2nd ed., Springer, Heidelberg, 1999.
2. Turns, S.R., An Introduction to Combustion: Concepts and Applications, 2nd ed, McGraw-Hill, 2000.
3. Glassman, I., Combustion, Academic Press, 1997.
4. el-Mahallawy dan el-Din Habik, S., Fundamental and Technology of Combustion, Elsevier, 2002.
5. Combustion, T. J. Poinsot and D. P. Veynante, in Encyclopedia of Computational Mechanics, edited by Erwin Stein, Ren´e de Borst and Thomas J.R. Hughes,

2004 John Wiley & Sons, Ltd.
6. Introduction to Combustion, Concepts and Applications, Stephen R. Turns, 2nd edition, McGraw Hill, 2000
7. Introduction to Combustion Phenomena, A. Murty Kanury, Gordon and Breach Science Publishers, 1975
8. Heat Transfer from Burners, Charles E. Baukal, in Industrial Burners Handbook, edited by Charles E. Baukal, CRC Press, 2004.

ENCH801033
PHOTOCATALYSIS TECHNOLOGY
3 SKS
Learning Objectives: Students are able to understand the basic concepts and photocatalysis and apply it in the various the simple daily problem, especially related with environment, health, and energy.
Syllabus: The basic concept photocatalytic processes, thermodynamics and kinetics of photocatlytic process, semiconductor photocatalyst materials, the basic parameters of photocatlytic process, Photocatalyst Nanomaterial Engineering, photocatlytic applications for degradation of organic pollutants and heavy metals, photocatlytic applications for self-cleaning and anti fogging, photocatlytic applications for anti-bacterial and cancer therapy, photocatlytic applications for engineering 'daily life tools', photocatlytic applications in renewable energy sector, solar detoxification engineering with photocatlytic, intensification of photocatlytic process.
Prerequisites: Chemical Reaction Engineering 1
Textbook:
1. M. Schiavello, *Heterogeneous Photocatalysis*, John Wiley & Sons, 1997.
2. A. Fujishima, K. Hashimoto, and T. Watanabe, *TiO_2 Photocatalysis: Fundamentals and Applications*, BKC Inc. Japan, 1999.
3. J.B. Galvez, et.al., *Solar Detoxification*, Natural Sciences, Basic and Engineering Sciences, UNESCO.
4. M. Kaneko, I. Okura, *Photacatalysis Science and Technology*, Springer USA, 2002.
5. C.A. Grimes, G.K. Mor, *TiO_2 Nanotube Arrays: Synthesis, Properties, and Applications*, Springer, New York, 2009.
6. Paper-paper dan bahan lain dari berbagai Jurnal Ilmiah dan website.

ENCH801034
ANALYSIS AND SYNTHESIS OF CHEMICAL PROCESS SYSTEMS
3 SKS
Learning Objectives: Students are able to analyze and synthesize the chemical processes in an integrated system of technical and economic aspects
Syllabus: The strategy of synthesis and analysis process, design concepts development and the determination of the best flowsheet, a preliminary optimization process, the retrofit process, the use of computer aided design system for simulation and analysis process.
Prerequisites: Simulation of Chemical Processes
Textbook:
1. James M Douglas, Conceptual Design of Chemical Process, McGraw-Hill International Edition, 1988.
2. Hartman, Klaus, and Kaplick, Klaus, Analysis and Synthesis of Chemical Process Systems
3. Lorenz T Biegler, Systematic Methods of Chemical Process Design, Prentice Hall Inc., 1997.

ENCH801035
POLYMER ENGINEERING
3 SKS
Learning Objectives: Students are able to explain the basic principles and characteristics of polymer manufacturing until being able to keep abreast of the latest technology.
Syllabus: The concept of polymer and polymer characteristics, synthesis / polymerization, kinetics of polymerization, the polymer solution, characterization, process of making plastics.
Prerequisites: Organic Chemistry
Textbook:
1. R. J. Lovell, Introduction to Polymers, P. A. Lovell, Chapman & Hall.
2. R. B., Seymour, Polymers for Engineering Applications, ASM International.
3. F. W. Billmeyer, Textbook of Polymer Science, Wiley.
4. R. J. Crawford, Plastic Engineering, Pergamon Press.
5. Donald R. Woods, Problem Based Learning: How to gain the most PBL, 1994, Mc-Master University, Hamilton, ON L8S 4L8.

ENCH801036
POLLUTION PREVENTION
3 SKS
Learning Objectives: Students are able to explain the concepts of pollution prevention and able to design the waste treatment system.
Syllabus: Introduction to the concept of pollution prevention, waste water treatment outline and preparation, waste water treatment in

physical, biological, and chemical as well as the operating unit, bioremediation, bioseparasi and biodegradation, advanced oxidation processes, the handling of waste gas, waste handling B3, solid waste handling , effluent treatment, gas, is unconventional.

Prerequisites: Chemical Reaction Engineering 1.

Textbook:

1. Freeman, H. M., Industrial Pollution Prevention Handbook, McGraw-Hill, New York, 1995.
2. Eckenfelder, W. W., Jr.., Industrial Water Pollution Control. 3rd ed. McGraw-Hill International Editions, New York, 2000.
3. Metcalf & Eddy. (Revised by Tchobanoglous, G. & F. L. Burton). Waste Water Engineering: Treatment, Disposal, Reuse, 3rd ed., McGraw-Hill, Singapore, 1991.
4. Heinson R. J. & R. L. Cable. Source and Control of Air Pollution. Prentice Hall. New Jersey. Of 1999.
5. Legislation on the prevention of pollution and waste management.
6. Journals, the Internet.

ENCH801037
HYDROCARBON EXPLORATION AND PRODUCTION
3 SKS

Learning Objectives: Students are able to explain the economic concept of natural gas and analyze the 4e economy.

Syllabus: Introduction of hydrocarbon, life cycle of field development, hydrocarbon form and hydrocarbon property and reservoir, hydrocarbon exploration: geology, geophysic, and drilling, field apparsial, reservoir development, drilling development, hydrocarbon production, HSE, hydrocarbon economy and lease, coal and hydrocarbon unconventional (CBM, Shale gas, and HYDRAT GAS)

Prerequisites:-

Textbook:

1. Frank Jahn et all, 2008, Hydrocarbon Exploration and Production, Developments in Petroleum Science, second edition
2. Babusiaux et al, 2004, Oil and Gas Exploration and Production. Reserves, Cost and Contracts, IFP-Technip,
3. M. Kelkar, 2008, Natural Gas Production Engineering, PennWell Publications
4. Norman J. Hyne, 2001, Nontechnical Guide to Petroleum Geology, Exploration, Drilling and Production, Pennwell Books, 2 edition.

6.7. MASTER PROGRAM IN INDUSTRIAL ENGINEERING

Program Specification

1	**Awarding Institution**		Universitas Indonesia Double Degree: Universitas Indonesia and National Taiwan University of Science and Technology (NTUST)
2	**Teaching Institution**		Universitas Indonesia Double Degree: Universitas Indonesia and National Taiwan University of Science and Technology (NTUST)
3	**Programme Title**		Master Program in Industrial Engineering
4	**Class**		Regular
5	**Final Award**		Magister Teknik (M.T) Double Degree: Magister Teknik (M.T) and MBA (Master of Business Administration)
6	**Accreditation / Recognition**		BAN-PT: Accredited B
7	**Language(s) of Instruction**		Bahasa Indonesia and English
8	**Study Scheme (Full Time / Part Time)**		Full Time
9	**Entry Requirements**		Bachelor (S1) Graduate from Science and Engineering field, AND pass the entrance exam
10	**Study Duration**		Designed for 2 years
	Type of Semester	Number of semester	Number of weeks /semester
	Regular	4	17
	Short (optional)	1	8
11	**Graduate Profiles:** *An Industrial engineer who has the capabilities of designing, improving, operating and maintaining integrated and multi-level manufacturing and service systems by analyzing and synthesizing processes within research and scientific framework in order to increase the productivity and quality.*		
	Expected Learning Outcomes: 1. Be able to design and conduct researches, analyze and interpret data. 2. Be able to design a system, component, or process to fulfill the needs within realistic boundary such as economics, environment, social, politics, ethics, health and safety, feasibility, and continuity. 3. Be able to identify, formulate, and solve engineering problems by using skills and modern tools. 4. Understanding of professionalism and ethical responsibility. 5. Broad education to understand the influence of engineering problem-solving within global, economical, environmental, and social contexts. 6. Be able to conduct a long-life learning continuously. 7. Knowledge on contemporary and future issues that will be faced by community within local, global, social and business environmental scale, that are related to engineering, including ability to identify entrepreneurship efforts based on innovation and independence within ethics (UI competence).		

12	8. Be able to think critically, creative, innovative, and possess an intellectual curiosity to solve problems within individual and group scale (UI competence). 9. Be able to give alternative solutions that rise among the society, nation and country /of Indonesia (UI competence). 10. Be able to identify standards of engineering, law, and work safety within process design, development, and implementation of integrated system. 11. Be able to design experimental process (scenario development, result testing, result analysis) effectively and efficiently. 12. Be able to design and improve the performance of manufacture and service system by considering sustainability aspect. 13. Be able to design and improve the quality of product, process, work station, and organization by considering human factors.

13	**Classification of Subjects**		
No	Classification	Credit Hours (SKS)	Percentage
i	Compulsory Subjects	24	58.5 %
ii	Stream Subjects	6	14.6 %
iii	Elective Subjects	3	7.3 %
iv	Seminar, Thesis	8	19.6 %
	Total		100 %
14	**Total Credit Hours to Graduate**		**41 SKS**

Course Structure Master Program in Industrial Engineering

KODE	MATA AJARAN	SUBJECT	SKS
	Semester 1	**1st Semester**	
ENIE800001	Faktor Manusia dalam Perancangan Industri	Human Factors in Industrial Design	3
ENIE800002	Manajemen Kualitas Terpadu	Total Quality Management	3
ENIE800003	Penelitian Operasi Lanjut	Advanced Operations Research	3
ENIE800004	Statistik Lanjut	Advanced Statistics	3
		Sub Total	**12**
	Semester 2	**2nd Semester**	
ENIE800005	Manajemen Operasi	Operations Management	3
ENIE800006	Perancangan Strategi Industri	Industrial Strategic Planning	3
ENIE800007	Metodologi Penelitian	Research Methodology	3
ENIE800008	Berpikir Sistem	System Thinking	3
		Sub Total	**12**
	Semester 3	**3rd Semester**	
ENIE800009	Perancangan Sistem Industri	Industrial System Design	3
	Pilihan 1	Elective 1	3
	Pilihan 2	Elective 2	3
		Sub Total	**9**
	Semester 4	**4th Semester**	
ENIE800010	Tesis	Thesis	5
	Pilihan 3	Elective 3	3
		Sub Total	**8**
		Total	**41**

MATA AJAR PILIHAN

Semester Gasal

KODE	MATA AJARAN	SUBJECT	SKS
ENIE801101	Rekayasa Jasa	Service Engineering	3
ENIE801202	Kebijakan Industri	Industrial Policy	3
ENIE801203	Pemodelan Lanjut	Advanced Modelling	3
ENIE801302	Manajemen Pengetahuan	Knowledge Management	3
ENIE801103	Sistem Dinamis	System Dynamics	3
ENIE801303	Ergonomi Kognitif	Cognitive Ergonomics	3

Semester Genap

ENIE801304	Manajemen dan Rekayasa Keselamatan Kerja	Safety Engineering and Management	3
ENIE801201	Kebijakan Teknologi	Technology Policy	3
ENIE801301	Manajemen Aset Manusia	Human Capital Management	3
ENIE801102	Sistem Manufaktur	Manufacturing System	3

Course Structure of Master Program in Industrial Engineering

ENIE800001
HUMAN FACTORS IN INDUSTRIAL DESIGN (3 SKS)
Learning Objective(s): Course participants are able to design and analyze work system based on human factors and ergonomics methods in practical and comprehensive way. Students are also expected to apply various methods of human factors and ergonomics in workplace.
Syllabus: General introduction of human factors in industrial engineering, general application of human factors in industrial engineering, Physical methods, Psycho-physiological methods, Behavioral–Cognitive methods, Team methods, Environmental methods, Macroergonomics methods, Human in work system environment.
Prerequisite(s):-
Textbooks:
1. Stanton Neville., Hedge Allan., et.al., Handbook of Human Factors and Ergonomics Methods, CRC Press., United States. 2005
2. Marras S William., Karwowski Waldermar., Fundamental and Assesstment Tools for Occupational Ergonomics, Taylor & Francis Group. 2006

ENIE800002
TOTAL QUALITY MANAGEMENT (3 SKS)
Learning Objective(s): Course participants are able to use concepts and application of TQM as the basis for analysis and evaluation of quality improvement system.
Syllabus: TQM Studies vs Principles. MBNQA. Statistical QC. Cost of Quality. Organizing for Quality. QFD. Capability Process. Six Sigma. Pre-
Prequisite(s): Quality System.
Text Book(s):
1. Rao, et al. TQM : A Cross Functional Perspective, Prentice Hall.
2. Quality Management; Goetsch & Davis, 2000, Prentice Hall

ENIE800003
ADVANCED OPERATIONS RESEARCH (3 SKS)
Learning Objective(s): Course participants are able to understand and implement mathematical model to optimize problem-solving within industrial management and technical issues, which later can be modeled quantitatively, deterministically and stochastically.
Syllabus: Dynamic Programming. Markov Analysis. Decision Tree. Game Theory. Non Linear Programming. Queue. Simulation.
Pre-requisite(s): Linear Programming
Text Book(s):
1. Hamdy A. Taha, Operations Research, 7th ed., Prentice-Hall, Inc. 2006.
2. Hellier, Liebermen, Introduction to Operations Research, McGraw-Hill, 2005.

ENIE800004
ADVANCED STATISTICS (3 SKS)
Learning Objective(s): Course participants are able to organize the collection, process, and analysis of data using statistics and engineering principles to support decision making process, within DOE - Design of Experiment.
Syllabus: Review of Basic Statistical Concepts. Single Factor Experiment (Fixed Effect Model). Single Factor Experiment (Random Effect Model). Randomized Complete Block Design. Latin Square Design. General Factorial Design. 2k Factorial Design. Blocking in Factorial Design. Factorial Experiments with Random Factors. Fractional Factorial Design. Nested Design. Response Surface Model.
Pre-requisite(s): Statistics and Probability
Text Book(s):
1. Design and Analysis of Experiments, Douglas C. Montgomery. John Wiley & Sons, 2000
2. Design and Analysis of Experiments, Angela Dean and Daniel Voss, Springer-Verlag, 2000
3. Experimental Design with Applications in Management, Engineering, and the Sciences, Paul D. Barger and Robert E. Maurer, Thomson Learning, 2002

ENIE800005
OPERATIONS MANAGEMENT (3 SKS)
Learning Objective(s): Course participants are able to analyze, design, and operate productive systems in order to create competitive products and services.
Sylllabus: Introduction: transformation processes. Aggregate planning & optimization. MPS & MRP. Process analysis & performances. Production processes. Little's Law, process & queing models. Supply chain processes & performances. Location. Distribution system & logistics. Inventory policy decision. Theory of costraints (TOC). Service process selection. Case study.
Prerequisite(s): -
Textboks:
1. Operations & Supply Chain Management; Jacobs, Chase; Irwin McGraw-Hill; 13th Ed., 2011.
2. Operations Management; Nigel Slack, Stuart Chambers, Robert Johnston; Prentice Hall; 2010.
3. Operations Management – Along the Supply Chain; Roberta S. Russel; Bernard W. Taylor; John Wiley & Sons, Inc.; 6th Ed., 2009.

ENIE800006
INDUSTRIAL STRATEGIC PLANNING (3 SKS)
Learning Objective(s): Course participants are able to formulate and implement competitive strategies in various kinds of industries either within local or international context.
Syllabus: Introduction. Preparation and development of company strategies and its units. Analyzing the competitive internal and external surrounding. Analyzing business portfolio. Analyzing and selecting alternatives for a competitive strategy. Case study to analyze actual strategic issues. Strategy implementation and elaboration of several aspects (management, finance, marketing, R&D, operation, technology and information system). Development of strategic map and implementation of BSC in case study in order to translate strategies into actions. Evaluation and Strategic Control.
Pre-requisite(s): -
Text Book(s):
1. Strategic Management, Concept & Cases; Fred R. David; Pearson International Edition, 11th Edition.
2. Strategic Management and Business Policy; Wheelen and Hunger; Pearson International Edition; 10th Ed.

ENIE800007
RESEARCH METHODOLOGY (3 SKS)
Learning Objective(s): Course participants are able to understand the basic steps necessary for a scientific research and publications and prepare themselves for the upcoming Thesis as part of the pre-requisites on receiving the master degree
Pre-requisite(s): Please Read Thesis SOP
Text Book(s): Manual Penyusunan Tesis Universitas Indonesia dan Departemen Teknik Industri, 2008.

ENIE800008
SYSTEM THINKING (3 SKS)
Learning Objective(s) : Course participants are able to implement soft OR concept which is SSM (Soft System Methodology) as a thinking pattern to understand a systemic problem.
Syllabus: System Thinking Concept. Concept of Learning. Organization Hard OR vs Soft OR. Causal Loop Diagram. System Archetypes. Behavior Overtime Graph (BoT). SSM (Soft System Methodology): Entering the problem situation, Expressing the problem situation, Formulating root definitions of relevant systems, Building Conceptual Models of Human Activity Systems, Comparing the models with the real world, Defining changes that are desirable and feasible and Taking action to improve the real world situation.
Pre-requisite(s): -
Text Book(s):
1. The Fifth Discipline Fieldbook: Strategies and Tools for Building a Learning Organization, Peter M. Senge, Crown Business, 1994
2. Soft Systems Methodology in Action, Peter Checkland, Wiley, 1999

ENIE800009
INDUSTRIAL SYSTEM DESIGN (3 SKS)
Learning Objective(s): Course participants are able to analyze implementation of NPD Process in an organization and know the approaches, tools and techniques used in each steps of the process according to the needs and characteristics of the organization in order to achieve competitive advantage.
Syllabus: Introduction to NPD Process, Models of NPD Process, Detail Design of of Stage-Gate Model dan Concurrent Engineering, Value Engineerng, Spiral NPD Model, Case Studies Implementation NPD.
Prerequisite(s): Product Design, Industrial Feasibility Analysis, Industrial Engineering Design
Textbook(s):
1. Trott, P. (2008). *Innovation Management and New Product Development*, 4th Edition.
2. Cooper, R.G. (2011), *Winning at New Products: Creating Value Through Innovation*, 4th Edition.
3. Park, R.J.(1998), Value Engineering: A Plan for Invention, St.LuciePress.
4. Morgan, R.M, Liker,J.K (2006). *The Toyota Product Development System: Integrating People, Process and Technology.*

ENIE800010
THESIS (5 SKS)
Learning Objective(s): Course participants are able to systematically present his/her problems and idea during scientific forum with concise and correct.
Pre-requisite(s): Please Read Thesis SOP
Text Book(s): Manual Penyusunan Tesis Universitas Indonesia dan Departemen Teknik Industri, 2008.

ENIE821001
SERVICE ENGINEERING (3 SKS)
Learning Objective(s): Course participants gather the knowledge about service management and engineering and are able to analyze the problems in service industry and provide the alternative solutions
Syllabus: Definition of Service Engineering, The Functions of Engineering Management, Risk Analysis in Service Industry
Pre-requisite(s): -
Text Book(s):
1. Chang M. C (2010). *Service Systems Management and Engineering: Creating Strategic Differentiation and Operational Excellence*, John Wiley & Sons.

ENIE822002
INDUSTRIAL POLICY (3 SKS)
Learning Objective(s): Course participants have the knowledge about the supply side of the economy: business who makes and sells product or services and to give understanding about the role of an industry
Syllabus: Consumer theory. Corporate Theory. Price Teori Konsumen. Price Theory. Competition. Monopoli, Duopoly dan Oligopoli. Market Structure and Corporation. Merger. Innovation and Technology.
Pre-requisite(s): Introduction to Economics and Business
Text Book(s):
1. Microeconomics Theory, A Mathematical Approach; Henderson, James M and Richard E. Quandt; Mc Graw Hill Book Co; New York
2. Industrial Economics, Analysis and Public Policy; Martin, Stephen; Englewood Cliffs; Prentice Hall.

ENIE822003
ADVANCED MODELLING (3 SKS)
Learning Objective(s): Course participants are able to develop computer model from a complex system according to research needs.
Syllabus: Introduction to Modeling Topology, Methodology of Simulation and Modeling, Agent-Based Modeling, Object-Based Modeling, Advanced Mathematical Modeling, Group Model Building, GIS-Based Model, Financial Modeling. *(This course includes working in the designated laboratory)*
Pre-requisite(s): System Thinking/System Modeling
Text Book(s):
1. Scenarios, Stories and Use Cases: Through the Systems Development Life-Cycle, Ian Alexander and Neil Maiden, John Wiley & Sons. 2004
2. Excel® Dashboards & Reports, Michael Alexander and John Walkenbach, Wiley Publishing, Inc. 2010
3. Information Dashboard Design, Stephen Few, O'Reilly, 2006.

ENIE823002
KNOWLEDGE MANAGEMENT (3 SKS)
Learning Objective(s): Course participants are able to comprehend the concept of knowledge starting from creation, use, transfer, retention and disposal of knowledge to broaden the understanding about the importance of KM for achieving organizations objective.
Syllabus: Introduction to KM, Definition and Concept of KM, SECI Model, Information Management Body of Knowledge (IMBOK), Capitalization of Knowledge, Learning Organization, Implementation of KM in Organization , KM and Innovation, Knowledge Transfer and Open Innovation, Best Practices of KM Implementation.
Pre-requisite(s): -
Textbook(s):
1. Nonaka I., Takeuchi H. The Knowledge Creating Company: How Japanese Companies Create The Dynamics of Innovation, 1995.
2. Ackermann, M.S. etal. Sharing Expertise: Beyond Knowledge Management, MIT Press, 2003
3. Amrit Tiwana, The Knowledge Management Toolkit: Practical Techniques for Building A Knowledge Management System, Prentice-Hall, New Jersey, 2000.
4. Madanmohan Rao, Knowledge Management Tools and Techniques: Practitioners and Experts Evaluate KM Solutions, Elsevier Inc. Oxford – UK. 2005.
5. Murray Jennex, Case Studies in Knowledge Management, Idea Group Publishing, 2005.

ENIE821003
SYSTEM DYNAMICS (3 SKS)
Learning Objective(s): Course participants are able to develop a continuous model of dynamic system to answer complex problems, analyze results and display it professionally.
Syllabus: Concept and methodology of continuous modeling, Model Conceptualization, over-time behavior concept, dynamic hypothesis, CLD (Causal Loop Diagram), SFD (Stock and Flow Diagram), Methodology of Dynamic System Modeling, Model Validation, Scenario Development, Analyzing and Displaying the results *(This course includes working in the designated laboratory)*
Pre-requisite(s): System Thinking/System Modeling
Text Book(s):
1. Business Dynamics: System Thinking and modeling for a ComplexWorld. John D. Sterman, McGraw-Hill, USA, 2000
2. Scenarios, Stories and Use Cases: Through the Systems Development Life-Cycle, Ian Alexander and Neil Maiden, John Wiley & Sons. 2004
3. Excel® Dashboards & Reports, Michael Alexander and John Walkenbach, Wiley Publishing, Inc. 2010
4. Information Dashboard Design, Stephen Few, O'Reilly, 2006.
5. Courses Module Powersim Studio, Lab SEMS UI, 2010

ENIE823002
COGNITIVE ERGONOMICS (3 SKS)
Learning Objective(s): Course participants are able to understand about basic principles of ergonomics and human factors in cognitive perspective. Students are expected to implement

knowledge of cognitive ergonomics in workplace, and also be expected to measure, evaluate, and analyze performance and behavior of various fields and the relation to technology development and engineering. Students are also are expected to design Hierarchical Task Analysis (HTA) as a part of task design based on cognitive.

Syllabus: General introduction to ergonomics and human factors, cognitive aspect in human-machine/machine-environment interaction, cognitive aspect in industry, cognitive aspect in transportation, information technology and cognitive performance, behavior aspect and human cognitive performance in designing Hierarchical Task Analysis (HTA).

Prerequisite(s):-

Text book(s):

1. Don Harris, Engineering Psychology and Cognitive Ergonomics,Springer, 2011
2. Erik Hollnagel, Handbook of Coqnitive Task Design,Lawrence Erlbaum Associates Publisher, 2003, New Jersey London
3. Candida Castro, Human factors of visual and cognitive performance in driving, CRC Press, 2009

ENIE823004

SAFETY ENGINEERING AND MANAGEMENT (3 SKS)

Learning Objective(s): Course participants are expected to understand about the importance of work safety in various work fields. Students are also able to do observation, evaluation, and analysis of work safety program to enhance the benefit, in order to achieve effective and efficient work safety program and human-centered focus. Students also are able to understand about management and engineering design concept which is related to occupational safety in an industrial organization through suppression in control of hazardous materials, safety consideration in production facility and maintenance, and operation of effective safety program.

Syllabus: General introduction about work safety in various fields, performance and human error, work safety management program, human reliability assessment, risk management (for human/worker), work safety management engineering in various work fields. Basic Safety, OSHA Standards, hazard identification and elimination, accident causes and prevention, hazard communication, safe work practice and description, function, and scope of safety engineering and management that are relevant with industry, especially that are related to safe production facility design and operation.

Prerequisite(s): Human Factors in Industrial Design

Textbook(s):

1. Brauer. (2006). Safety and Health for Engineers, 2nd edition, John Wiley & Sons, Inc.
2. Thompson, Dan Hopwood., Workplace Safety : a Guide for Small and Midsized Companies, John Wiley & Sons, Inc., 2006
3. A. Ian Glendonet. al, Human Safety and Risk Management,CRC Press, 2006
4. George A. Peters, Barbara J. Peters, Human Error Causes and Control, CRC Press, 2006

ENIE822001

TECHNOLOGY POLICY (3 SKS)

Learning Objective(s): Course participants are able to analyze the relationship between technology development and socioeconomic aspects and capable of proposing national technology and innovation policy alternatives based on those aspects.

Syllabus: Definition of socioeconomic aspects of technology development, National system and policy of technology and innovation, Innovation and Technology Clusters: National, Regional and International Analysis, Best Practices Technology and Innovation Policy Implementation

Prerequisite(s): -

Textbooks

1. Van Genhuizeen, M. (2008). Value Added Partnering and Innovation in a Changing World, Purdue Press.
2. Worldbank (2010). Innovation Policy: A Guide for Developing Countries.

ENIE823001

HUMAN CAPITAL MANAGEMENT (3 SKS)

Learning Objective(s): Course participants are able to organize, manage and measure the value of human capital in organization for achieving competitive advantage

Syllabus: Strategic Role of HRM & Effective Management of People. Ability Motivation & Opportunity. Job Analysis & Planning & Recruitment. Testing, Selection & Interview. Training & Development. Appraising & Managing Performance. Managing Careers & Fair Treatment. Establishing Strategic Pay Plans. Pay for Performance & Incentives. Benefits and Services. Labor Relations & Collective Bargaining. Employee Safety & Health. Linking to Organisational Outcomes. Human Resource Capital Management. Human Resource System for TQM.

Prerequisite(s): -

Textbooks:

1. Strategic Human Resource Management, Mike Millmore, Philip Lewis, Prentice Hall 2007
2. Human Resource Management, Gary Dessler, Prentice Hall, 10th edition, 2007
3. Human Resource Strategy, Dreher & Dougherty, Mc Graw Hill, 2001

ENIE821002
MANUFACTURING SYSTEM (3 SKS)
Learning Objective(s): Course participants are able to understand manufacturing system concept that converts raw material into valuable products and its implementation, including product design activities, process and facilities, and technology used to create competitive products.
Syllabus: Introduction to Manufacturing System. Processes. Manufacturing Facility & Technology. Product Design & Development. Green Manufacturing. Resource planning & ERP. Simulation. Introduction to Plant Simulation for Manufacturing System. JIT & Lean Production. Value Stream Mapping. Optimization Model and its application in production. Case study.
Prerequisite(s): -
Textbooks:
1. Operations Management-An Asian Perspective; William J. Stevenson, and Sum Chee Chuong ; McGraw-Hill; 2010
2. Manufacturing Planning and Control for Supply Chain Management; F. Robert Jacobs, William Berry, D. Clay Whybark, and Thomas Vollmann; McGraw-Hill; 2011.
3. The Fundamentals of Production Planning and Control; Stephen N. Chapman; Pearson - Prentice Hall, 2006.

ENIE810001
MULTIVARIATE ANALYSIS
(3 CREDITS)
Learning Objective(s): Course participants are able to organize the extraction, process & analysis of multivariate data in a right way to make decisions.
Syllabus: of Basic Statistical Concepts, Multiple Regression. Manova. Principal Component Analysis. Factor Analysis. Cluster Analysis. Discriminant Analysis. Logit Analysis. Canonical Correlation. Multidimensional Scaling. Structural Equation Modeling.
Pre-requisite(s): Statistics and Probability, Industrial Statistics
Text Book(s):
1. Hair,J.F.,B. Black, B. Babin, and R.E. Anderson (2005) Multivariate Data Analysis, Sixth Edition, Prentice Hall.
2. Richard Johnson and Winchern (1998) Applied Multivariate Statistical Analysis, Fourth Edition, Prentice Hall.
3. W.R. Dillon and M. Goldstein (1984) Multivariate Analysis: Methods and Applications, John Wiley & Sons.

ENIE810002
INTERPERSONAL SKILLS
(3 CREDITS)
Learning Objective(s): Course participants are able to implement the principles of effective communication and behavior standard according to ethics and habits in a professional level of organization.
Syllabus: Basics of Communication Science. Reading and Controlling Body Language. Listening and Inquiring Skill to Facilitate, Development of Presentation Materials, Presentation Preparation, Processing the Question and Answer Session, Formal Writing Skill (Proposal, Report, Letter, Correspondence, Manner), and Effective Reading.
Pre-requisite(s): -
Text Book(s): *Interpersonal Skills in Organizations*, 3rd Edition, De Janasz, Suzanne C, Karen O. Dowd and Beth Z. Schneider, McGraw-Hill International Edition. New York. 2009.

ENIE810003
PRODUCT LIFECYCLE MANAGEMENT (3 CREDITS)
Learning Objective(s): Course participants are able to understand the product life cycle and its role in creating company's innovation strategy.
Syllabus: Product Life Cycle Concept, Product Life Cycle Phase Management, PLM and Innovation Strategy, Product Development Strategy in Enterprise.
Pre-requisite(s): Product Design
Text Book(s):
1. Stark, J, (2011). *Product Life Cycle Management, 21th Century Paradigm for Product Realisation*, 2nd Edition. Springer.
2. Grieves, M. (2005). *Product Lifecycle Management. Driving the Next Generation of Lean Thinking*, McGrawHill.

ENIE810004
MACRO ERGONOMICS (3 CREDITS)
Learning Objective(s): Course participants are able to understand comprehensively about work system design that consists of interacting variables such as hardware and software within internal and external physical environment, organization structure and process in order to make it better. Ability to understand how to implement ergonomic science.
Syllabus: Introduction to macroergonomics, method and tools that are used in work system design and analysis, introduction to organization integration in productivity, safety, health and quality of work life context
Pre-requisite(s): Human Factors in Engineering and Design
Text Book(s):
1. Hendrick, W.H,. Kleiner, Brian, (2002). *Macroergonomics: Theory, Methods, and Applications (Human Factors and Ergonomics)*
2. Stanton, N,. Hedge, A, (2005). *Handbook of Human Factors and Ergonomics Methods*, CRC Press LLC.

ENIE810005
FINANCE AND INVESTMENTS (3 CREDITS)
Learning Objective(s): Course participants posses the knowledge about industrial finance and investments in general and multinational including international trading and finance.
Syllabus: International Trade Theory, Trade Policies, Monetary and Payment System, Market and Exchange Mechanism, International Investment, Multinational Finance,Foreign Investment Analysis.
Pre-requisite(s):
Text Book(s):
1. Root, Franklin R. 1978. International Trade Investment. Cincinnati: South-Western Publishing Co.
2. Grubel, Herbert G. 1981. International Economics, Homewood: Richard D. Irwin Co.
3. Shapiro, Alan C. 2003. Multinational Financial Management. Hoboken: John Wiley & Sons Inc.

ENIE810006
INNOVATION MANAGEMENT (3 CREDITS)
Learning Objective(s): Course participants are able to understand the concept and steps in developing innovation within organization.
Syllabus: State of the art 'Innovation', Innovation Development Strategy, Country Innovation, Process Innovation, Innovation Development Procedure, Technology Empowerment to Develop Innovation.
Pre-requisite(s): -
Text Book(s):
1. Cooper, R.G. (2007), *Winning at New Products*, 3rd Edition.
2. Schilling, M.A. (2010). *Strategic Management of Technological innovation*, 3rd Edition, McGrawHill.
3. Trott, P. (2008). *Innovation Management and New Product Development*, 4th Edition.
4. Tidd, J., Bessant, J., Pavitt, K. (2001). *Managing Innovation – Integrating Technological, Market and Organisational Change*, Second Edition, John Wiley & Sons Ltd., West Sussex, England.

ENIE810007
CUSTOMER RELATIONSHIP MANAGEMENT (3 CREDITS)
Learning Objective(s): Course participants are able to understand the role and function of customer relationship management in improving organization's/company's competitiveness.
Syllabus: Concept and Procedure of CRM Implementation in Organization, CRM Process Management, Managing Networks for CRM performance CRM Success Measurement, Best Practices of CRM Implementation, Managing supplier partner relationships, IT for CRM
Pre-requisite(s): Information System
Textbooks:
1. Peppers, D. (2011). *Managing Customer Relationships: A Strategic Framework*, John Wiley & Sons.
2. Francis Buttle (2009). Customer Relationship Management, Elsevier.

ENIE810008
LEAN OPERATIONS (3 CREDITS)
Learning Objective(s): Course participants are able to understand the concept of effective manufacturing process.
Syllabus: History and Concept of Lean Operations and Manufacturing, Strategy and Procedure of Lean Manufacturing Implementation, Toyota Production System
Pre-requisite(s): Production System
Text Book(s):
1. Wilson, L. (2009). *How to Implement Lean Manufacturing*, McGrawHill.
2. Askin, R.G., (2002). *Design and Analysis of Lean Production System*, John Wiley & Sons.
3. Pascal, D. (2007). *Lean Production Simplified*, Productivity Press.

ENIE810009
MANUFACTURING FACILITIES PLANNING AND ANALYSIS (3 CREDITS)
Learning Objective(s): Course participants are able to understand the concept of manufacturing facility analysis and planning and the differences compared to models of manufacturing system and supported with laboratory work.
Syllabus: General RMS Characteristics, Enabling Technologies and Reconfigurable Characteristics, Reconfigurable Machines.
Pre-requisite(s): Production System
Text Book(s):
1. Meyers, F.E., Stephens, M.P. (2005). *Manufacturing Facilities Design and material Handling*, 3rd Ed. Prentice-Hall.

ENIE810010
DATA MINING (3 CREDITS)
Learning Objective(s): Course participants are able to organize the extraction, process, and data analysis in a right way to make decisions.
Syllabus: Concept and Process of Data Mining, Algorithm in Data Mining, Data Mining Application in Organization.
Pre-requisite(s): Statistics and Probability, Industrial Statistics.
Text Book(s):
1. Nisbet, R. (2009). Handbook of Statistical Analysis and Data Mining Applications, Elsevier.

ENIE810011

SYSTEM ENGINEERING (3 CREDITS)

Learning Objective(s): Course participants are able to understand the basics of system engineering management in industries to be able to cultivate a design process, installation, management and termination of a complex system.

Syllabus: Concept and methodology of industrial system engineering. System Life-Cycle: Concept – Development – Production – Benefit and Support – End of System. Vee-Model. Processes in System Life Cycle: Technical Process. Project Process. Organization Process and Acquisition Process of Goods and Services. System Value and Life Cycle Costing. The Role of Modeling and Simulation in System Engineering.

Pre-requisite(s): System Modeling

Text Book(s):

1. Cecilia Haskins, CSEP, Kevin Forsberg, CSEP and Michael Krueger, CSEP. *SYSTEMS ENGINEERING HANDBOOK: A GUIDE FOR SYSTEM LIFE CYCLE PROCESSES AND ACTIVITIES*, version 3.1, 2007
2. Kossiakoff, Alexander and William N. Sweet. *Systems Engineering Principles and Practice*. John Wiley & Sons. Hoboken – New Jersey, 2003.
3. ISO/IEC 15288 Standard for Systems Engineering. International Organization Standard (ISO).

ENIE810012

ENTERPRISE COMPETITIVENESS ANALYSIS (3 CREDITS)

Learning Objective(s): Course participants are able to analyze company's internal and external factors for setting up company strategy for achieving competitive advantage through value innovation and strategic position and capabilities development.

Syllabus: Understanding Industry Profitability, The Vertical Boundaries of the Firm, Strategic Positioning for Competitive Advantage, Leveraging Market Power to Grow, Risk Management, Competitor and Competition, Competitive Intelligence

Pre-requisite(s): Cost Accounting

Text books:

1. Besanko, David. 2007. Economics of Strategy, Willey, 4th edition.
2. Sharp, S. 2009. How to minimize risk, avoid surprise, and grow your business in a changing world. John Willey.
3. Porter, M. 2008. The Five Competitive Forces That Shape Strategy. Harvard Business Review
4. Porter, M. 1998. Competitive Strategy: Techniques for Analyzing Industries and Competitors. Free Press.
5. Carbal, Luis. 2000. Introduction to Industrial Organization, MIT Press

ENIE810013

ADVANCED OPTIMIZATION (3 CREDITS)

Learning Objective(s): Course participants are able to design and implement various heuristic and meta-heuristic optimization algorithms to solve problems in industrial engineering field.

Syllabus: Introduction to Optimization. Complexity Theory. Basics of Heuristic. Hill Climbing Algorithm. Greedy Algorithm, Simulated Annealing, Tabu Search, Genetic Algorithm, Challenge Counter Techniques , Multi-destinations metaheuristic.

Pre-requisite(s): Operation Research

Text Book(s):

1. Zbigniew Michalewicz,. David B. Fogel (2004). *How to Solve It: Modern Heuristics*, Springer.
2. Essentials of Metaheuristics, Sean Luke (2009). *Essentials of Metaheuristics,* Lulu, available at http://cs.gmu.edu/~sean/book/metaheuristics/
3. Andries P. Engelbrecht (2007) *Computational Intelligence, An introduction*, John Wiley & Sons, England.

ENIE810014

SUSTAINABLE MANUFACTURING AND INNOVATION (3SKS)

Learning Objective(s): Course participants are able to understand the environmental and sustainability aspects of manufacturing process and their roles in increasing the competitiveness of enterprise and innovation development.

Syllabus: Concept and Sustainability Process in manufacturing process. Green Manufacturing (Remanufacturing, Reuse, Recycling), Renewables and Resource Utilizations, Green Logistics and SCM, Eco-Innovation, Best Practices in Sustainable Manufacturing.

Pre-requisite(s): Production System

Text Book(s):

1. Seliger, G. (2011). *Advances in Sustainable Manufacturing*, Springer.
2. Jovane, F. (2010). *The Manufuture Road: Towards Competitive and Sustainable High-Adding-Value Manufacturing*, Springer.
3. Allen, D.T. (2012). *Sustainable Engineering: Concepts, Design and Case Studies*, Prentice-Hall.
4. Hermosilla, J.C. (2009). *Eco-Innovation: When Sustainability and Competitiveness Shake Hands*.

ENIE810015

HUMAN DIGITAL MODELLING AND SIMULATION (3 CREDITS)

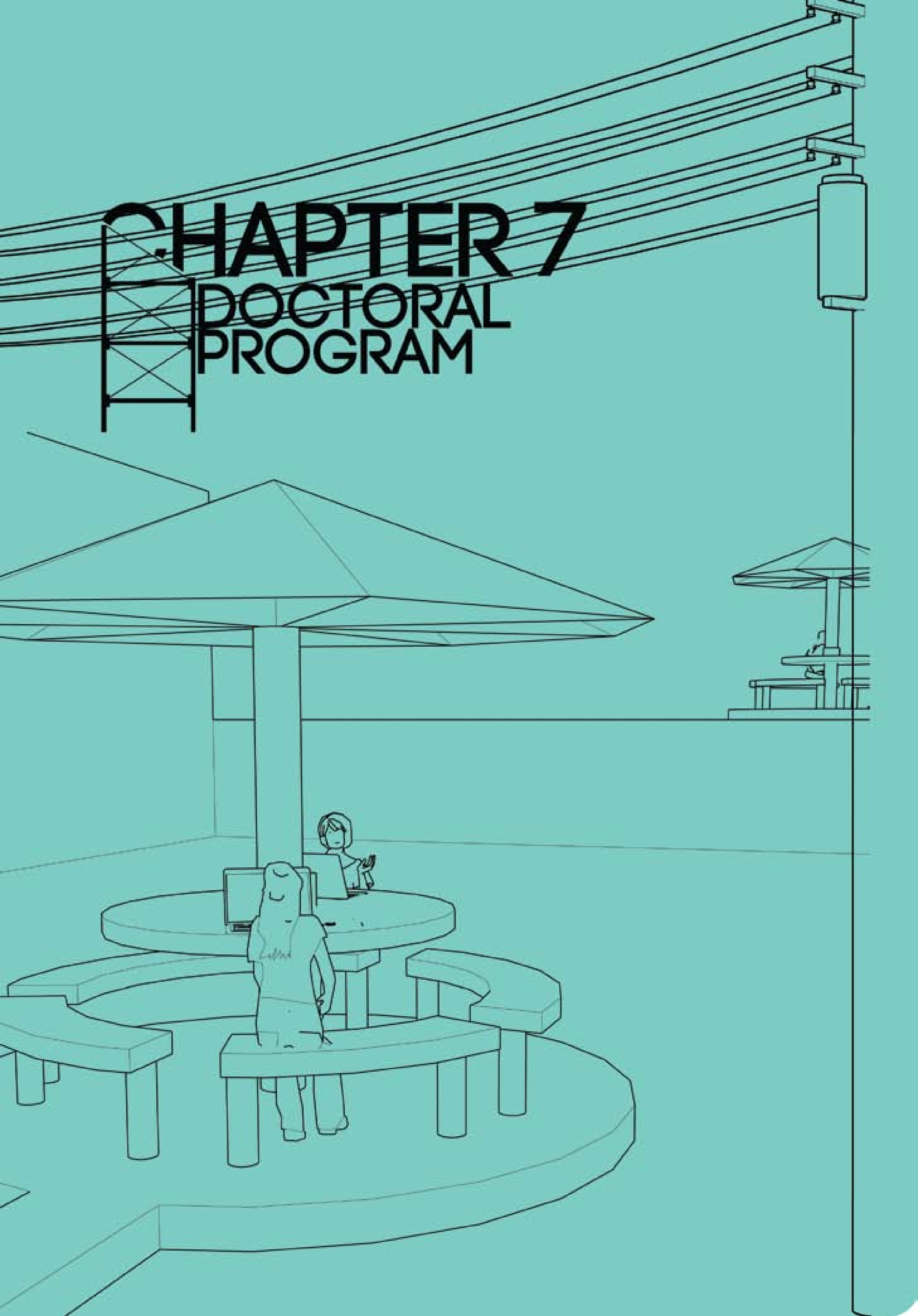
Learning objective(s): Course participants are able to model digital human and simulate it to obtain more effective and efficient work design

Syllabus: Anthropometry, Human Factors and

Ergonomics in Healthcare, Ergonomics Modelling & Usability Evaluation, Human Factors, Ergonomics and Safety in Manufacturing and Service Industries. Introduction to Jack Software and Motion Capture.
Prerequisite(s): Human Factors in Engineering and Design
Text books:-
1. Duffy, G V. 2010. Advances in Applied Digital Human Modelling. CRC Press.
2. Jack Software Module dari Ergonomic Centre

ENIE810016
DECISION, UNCERTAINTIES AND RISKS (3 CREDITS)
Learning objective(s): Course participants are able to analyze risks and uncertainties based on statistical tools accurately to make decision
Syllabus: Concept and Decision Making Process, Uncertainty Theory, Risks Analysis Prerequisites: Statistics and Probability, Industrial Statistics
Prerequisite(s): Statistics and Probability
Text books:
1. Parmigiani, G. (2009). *Decision Theory: Principles and Approaches* , John Wiley.

CHAPTER 7
DOCTORAL PROGRAM



7. DOCTORAL PROGRAM

FTUI holds Doctoral Program for the six following study programs:
1. Civil Engineering
2. Mechanical Engineering
3. Electrical Engineering
4. Metallurgy & Material Engineering
5. Chemical Engineering
6. Architecture

FTUI Doctoral program was officially opened in 2000 with the opening of the Civil Engineering and Electrical Engineering Doctoral program followed by the emersion of the Opto-electrotechnique and Laser Application study program into the Postgraduate Program of FTUI. The Mechanical Engineering study program was officially opened in 2006 while the Metallurgy & Material Engineering and Chemical Engineering followed in 2007. And In 2009, respectively Department of Architecture opened the Architecture Doctoral Program. In 2001, the Opto-electrotechnique and Laser Application was closed and was emerged into the Electrical Engineering study program. Each Doctoral study program is headed by the Head of Study Program which is held ex-officio by the Head of Department in the Faculty of Engineering UI. The Doctoral study programs have one or more focus subjects to give a more specific knowledge on engineering field to all students of the program.

New Students Selection

Selection process for new students for the FTUI Doctoral Program is as follow:

1. Pre-admission stage: future student is encouraged to informally contact their prospective Promotor or the Head of Department to further discuss his/her desired dissertation topic. This is important to make sure the availability of Promotor in accordance to said research topic. Communication may be done through email or face to face. The Head of Department and future Promotor then would discuss the student's proposal internally.
2. Future student should register online via http://penerimaan.ui.ac.id and complete the required documents and prerequisites.
3. Future student will then take the entrance examination (SIMAK UI) which consists of: (i) Academic Potential Examination and (ii) English Proficiency Test.
4. The results of the Entrance Examination will then be sent to FTUI by the UI Entrance Examination Committee. These results will then be discussed in a Department Committee Meeting headed by the Head of Department to determine which students accepted, and the proposed research topic approved, and the availability of future Promotor. An interview have to be arrange with the future student to determine the suitability of research topic, with previous study field, and the student's commitment to participate in the Doctoral program full time. Interview may be done directly or through email or messanger application.
5. The outcome of the Department Committee Meeting will then be submitted to the UI Entrance Examination Committee to be announced.

Academic Counseling

Since the day a student is registered as student for the Doctoral program until the time that he/she passes qualification examination, the student will be under the guidance of an academic advisor who the student expected to be their Promotor or Co-Promotor. Head of Department accepts a proposal of future Promotor/Academic Advisor from a committee in the Department. Once the student pass the qualification examination, the student will earn status as Doctor Candidate and the Academic Advisor's status will revert to Promotor/Co-Promotor.

Promotor and Co-Promotor

Promotor and Co-Promotor for Doctoral Program are lecturers or experts from related field and are assigned by Head of Department based on a Rector's Decree to guide and advise a Doctor candidate in conducting research and dissertation writing. Academic Advisor consist of 1 Promotor and a maximum of 2 (two) Co-Promotors. Promotor is a first chair Advisor who holds an academic degree of Professor or Doctor and a minimum of Senior Lecture academic position; has a relevant expertise in the field which the student's dissertation topic is; and is acknowledge as a full time faculty at the Universitas Indonesia.

Co-Promotors are the Promotor's companions who act as second and/or third chair advisor who hold academic degree of Doctor or Senior Lecturer. Co-Promotor from outside of the Faculty of Engineering UI must have the approval from the Promotor. Promotor and Co-Promotors are appointed by the Rector based on the proposal submitted by the Dean which are also based on suggestions from the Head of Department after the student has pass the qualification examination. The appointment must be done at the latest 1 (one) semester after the qualification examination. A change of Promotor/Co-Promotor must be proposed by the Dean to the Rector based on a proposal from the Head of Department.

Program Specification

1	**Awarding Institution**		Universitas Indonesia
2	**Teaching Institution**		Universitas Indonesia
3	**Programme Title**		Doctoral Program in Civil Engineering Doctoral Program in Mechanical Engineering Doctoral Program in Electrical Engineering Doctoral Program in Metallurgy & Material Engineering Doctoral Program in Chemical Engineering Engineering Doctoral Program in Architecture Doctoral Program in Industrial Engineering
4	**Class**		Regular
5	**Final Award**		Doctor (Dr.)
6	**Accreditation / Recognition**		Civil Engineering Doctoral Program: Accreditation A from BAN-PT Mechanical Engineering Doctoral Program: A Accreditation A from BAN-PT Electrical Engineering Doctoral Program: Accreditation A from BAN-PT Metallurgy & Material Engineering Doctoral Program: Accreditation A from BAN-PT Chemical Engineering Engineering Doctoral Program: Accreditation A from BAN-PT Architecture Doctoral Program: Accreditation B from BAN-PT Industrial Engineering Doctoral Program: On Accreditation Process
7	**Language(s) of Instruction**		Indonesia
8	**Study Scheme (Full Time / Part Time)**		Full Time
9	**Entry Requirements**		Master graduate from study programs in line with study program chosen and pass the entrance examination
10	**Study Duration**		Designed for 3 years
	Type of Semester	Number of semester	Number of weeks /semester
	Regular	6	14 - 17
	Short (optional)	none	none

11	**Streams:** *The Civil Engineering Doctoral Program has six streams as follow:* • *Structure* • *Construction Management* • *Transportation* • *Water Resource Management* • *Project Management* • *Geotechnique* *The Mechanical Engineering Doctoral Program has four streams as follow:* • *Energy Conversion* • *Engineering Design and Product Development* • *Manufacture Engineering* • *Fire Safety Engineering and Management* *The Electrical Engineering Doctoral Program has eight streams as follow:* • *Telecommunication Engineering* • *Electrical Power and Energy Engineering* • *Photonic and Electronic Engineering* • *Control Engineering* • *Multimedia and Information Engineering* • *Security of Information Network Engineering* • *Telecommunication Management* • *Electrical Power and Energy Management* *The Metallurgy & Material Engineering Doctoral Program has two streams as follow:* • *Corrosion and Protection* • *Material Engineering and Manufacture Process* *The Chemical Engineering Doctoral Program has five streams as follow:* • *Industry Catalist* • *Gas Management* • *Product Design and Chemical Process* • *Environmental Protection and Work Safety* • *Gas Technology* *The Industrial Engineering Doctoral Program has two streams as follow:* • *Rekayasa Kualitas Manufaktur* • *Rekayasa Sistem Jasa*
12	**Graduate Profiles:** FTUI Doctoral Program Graduates haves the capabilities of demonstrating expansion, novelty breakthrough in research in the engineering or architecture field in accordance to certain stream or sub-stream. Graduates are able to posess the following skill: • Be able to show expertise in the engineering or architecture discipline; • Be able to uphold the academic and research ethics; • Be able to work collaboratively in research; • Be able to position themselves as leader in their community; • Be able to communicate well in their community and build networks; • Be able to demonstrate individual live skill in connection to human relationship; • Be able to demonstrate attitude, behavior and way of thinking which support their success in society.

13	**Graduates Competence:** 1. Have highly academic integrity; 2. Implement the code of ethics in his related field of study; 3. Have an open mind and perceptive towards the development of science, technology, art, and culture; 4. Have a broad knowledge, basic sciences skill, and technical ability needed to adapt and to further develop science; 5. Master the theoretical, conceptual and paradigm approaches best suited to their related field of study; 6. Able to use their expertise and skill within their related field of study to: • Find answers and/or solution to complex problems, included those which need an inter-disciplinary approach; • Discovere new state of the art developments of a particular research arena. 7. Able to communicate their thoughts, ideas and work to experts of related field of study and to broader community; 8. Able to participate and play a role in the development of science, technology, art, and culture at national and international level.
14	**Classification of Subjects**

No	Classification	Credit Hours (SKS)	Percentage
i	Compulsory Subjects	8	16 %
ii	Research	40	84 %
	Total	48	100 %
15	**Total Credit Hours to Graduate**		48 SKS

Curriculum Structure for FTUI Doctoral Program

The curriculum structure for the Doctoral Program in all study programs are the same, they are only differentiated by their codes for the research component. The code “xx” for each study programs are as follow:
ENCV for Civil Engineering, ENME for Mechanical Engineering, ENEE for Electrical Engineering, ENMT for Metallurgy & Material Engineering, ENAR for Architecture, and ENCH for Chemical Engineering.

KODE/CODE	MATA AJARAN	SUBJECT	SKS
	Semester 1	**1st Semester**	
ENGE900001	Metode Penelitian Lanjut	Advanced Research Method	4
ENxx900001	Pra Penelitian 1	Pre-Research 1	2
ENxx900002	Kekhususan 1	Special Subject 1	4
		Sub Total	**10**
	Semester 2	**2nd Semester**	
ENGE900002	Analisis Kualitatif & Kuantitatif	Qualitative & Quantitative Analysis	4
ENxx900003	Pra Penelitian II dan Ujian Kualifikasi	Pre-Research II and Qualification Exam	2
ENxx900004	Kekhususan 2	Special Subject 2	4
		Sub Total	**10**
	Semester 3	**3rd Semester**	
ENxx900005	Penelitian 1	Research 1	5
		Sub Total	**5**
	Semester 4	**4th Semester**	
ENxx900006	Penelitian 2	Research 2	7
		Sub Total	**7**
	Semester 5	**5th Semester**	
ENxx900007	Penelitian 3 dan Ujian Pra Promosi	Research 3 and Pre-Promotion Exam	10
		Sub Total	**10**
	Semester 6	**6th Semester**	
ENxx900008	Penelitian 4 dan Ujian Promosi	Research 4 and Promotion Exam	6
		Sub Total	**6**
Total			**48**

Description of Subjects

ENGE900001
ADVANCED RESEARCH METHOD
4 SKS

Learning Objective(s): Course participants are expected to: (a) master the scientific work process based on science philosophy, which is the scientific justification aspects, innovative aspects and scientific ethics aspects, (b) able to write a research proposal and or draft of scientific writing related to the student's doctoral topic.

Syllabus: (1) Relationship between philosophy and engineering science; (2) Science Philosophy; (3) Epystemology in Engineering Science; (4) Research Method; (5) Problem formulation and hypothesis; (6) Research and state of the art; (7) Research Evaluation; (8) Design Evaluation and research Stages; (9) Introduction to the analysis of the data processing method; (10) Benchmark on research output and conclusion formulation; (11) Various citation method; (12) Finalization of research proposal draft and /or scientific article draft.

Prerequisite(s): None

Textbooks:

1. Haryono Imam R dan C. Verhaak, Filsafat Ilmu Pengetahuan, Gramedia, Jakarta, 1995
2. Willie Tan, "Practical Research Methods", Prentice Hall, 2002.
3. R. Kumar, *Research Methodology, A Step-by-step Guide for Beginner*, 3rd ed., Sage Pub, 2012

ENGE900002
QUALITATIVE AND QUANTITATIVE ANALYSIS
4 SKS

Learning Objective(s): Discuss the qualitative and quantitative in data analysis and exploring specific data analysis areas. After taking this subject, course participants are expected to have the following subject outcomes: (1) awareness to situations requiring qualitative data analysis in the inductive paradigm; (2) awareness to situations requiring quantitative data analysis in the deductive paradigm; (3) appreciation toward various approaches; (4) possessing skills in giving critical appraisal; (5) possessing skills in performing qualitative and quantitative data analysis.

Syllabus: Introduction; Qualitative Analysis; Quantitative Analysis; Non-Parametric Analysis; Uncertainty Analysis; Critical Appraisal; Design of Experiment; ANOVA revisit; Multivariate Techniques.

Prerequisite(s): None

Textbooks:

1. Miles M & Huberman M, Qualitative Data Analysis, London Sage Publications, (1994)
2. Montgomery, D.C., & Runger, G.C, Applied Statistics and Probability for Engineers 3rd Ed., John Wiley and Sons, Inc., New York, (2003)
3. Kirkup, L, Experimental Method: An Introduction to the Analysis and Presentation, John Wiley and Sons, Australia, Ltd., Queensland, (1994)
4. Montgomery, D.C, Design and Analysis of Experiments 6th Ed., John Wiley and Sons, Inc., New York, (2005)
5. Hair, J.F., B.Black, B.Babin and R.E Anderson, Multivariate Data Analysis 6th Ed., Pearson Education Inc., New Jersey, (2006)

ENxx900001
Special Subject 1
4 SKS

ENxx900003
Special Subject 2
4 SKS

Special Subject 1 in the 1st first semester (4 SKS) and Special Subject 2 in the 2nd semester (4 SKS) are determined together with the student's Academic Advisor to support the student's research and/or to develop the student's knowledge with information and knowledge from unrelated field. Academic Advisor is also allowed to propose a special content for the student to Head of Department.

The following are the requirements for the implementation of Special Subject 1 and 2:

- For students who do not have in line Master degree educational background from the Faculty of Engineering Universitas Indonesia, they are allowed to take the similar courses of the related field of study available at the Master Program in FTUI during the running semester.
- Students are also allowed to take courses from other study programs within the Faculty of Engineering Universitas Indonesia or courses from other faculties in UI as stated in the Guidance Book or the Master/Doctoral Program Catalog.
- In the event where neither conditions is viable for the students, the Academic Advisor is allowed to conduct a class of said course.

ENxx900002
Pre-Research I (2 SKS)

Pre-Research I is initial activities in a research with a 2 sks load where students are required to do literature study in connection to his/her research materials. Literature study must be done intensively by mapping the latest research results from international journals on related subjects. The final objective for Pre-Research I is that students have a state of the art understanding of his research topic, and be able to determine the unexplored knowledge gap in the international level for further study and research during his

Doctoral program. The result of Pre-Research I is written into a literature study report which later will be examined by a panel, consisting of Future Promotor/ Academic Advisor or other examiners. A student will be considered passing the Pre-Research I if acquiring a minimum B grade.

ENxx900004
Pre-Research II and Qualification Examination (2 SKS)
Pre-Research II is a continuance activity of Pre-Research I, where after the student has a clear state of the art understanding of his topic research, student can formulate the scope of his Doctoral research and determine his research method. The result from the student's Pre-Research I is in the form of an comprehensive research proposal which includes objective, background and data analysis from experiment and early research done. Included in the research proposal is the work plan for each semester and publication target. It is very advisable for the student, in the Pre-Research II stage, to start conducting experiment or initial study which can show that the research direction taken is feasible and recent in his field. Thus, it is expected that by the end of the semester the student can write a scientific article which is viable to be presented in a **National Seminar**. The result of the experiment or the initial study, the literature study and the complete research plan is concluded in a Pre-Research II Report which will be examined in a Qualification Examination. Pre-Research II Appraisal is given after the Qualification Examination. The students of the Doctoral Program will be considered passing the Pre-Research II if acquiring a minimum B grade at the Qualification Exam. The Qualification Examination is conducted by the Qualification Examination Committee. The comitee is pointed through a Dean's Decree based on a proposal from the Head of Department. The committee consists of a minimum of 3 (three) people and maximum of 5 (five) people. The committee consists of candidate promotor and co-promotor, head of department and other examiners.

ENxx900005
Research I (5 SKS)
Research I is a continuance of the Pre-Research II activity. At this stage, student is expected to have an experiment output or study to enhance his research topic and clarify his research direction. The research output must also show an innovation or breakthrough, mastery of knowledge on the related science discipline to the research topic, in depth research material, state of the art knowledge and mastery of the latest development of the field of research interest, originality and contribution to the field of science and / or its application. To make sure that the original contribution is made, during the Research I Examination, the student must present a research/experiment/ early study result that deserves to be publicized. The entire sequence of research results in the Pre-Research I, Pre-Research II and Research I stages are expected to viable for publication on a **National Journal**.

Requirements and prerequisite of Research I Examination:

- Research I Examination can be held if the student has passed the qualification examination.
- Research I Examination can be held if the supervisor team, consisting of promoter and co-promotor, has been appointed by a Rector's Decree.
- Research I Examination can be held by an examination committee appointed by the Dean based on the Study Program's proposal.
- Student of the Doctoral program will be considered passing the Research I Examination if said student acquiring a minimum B grade at the Research I Examination.

ENxx900006
Research II (7 SKS)
Research II is a continuance of research activity in accordance to the research designed planned. During this stage, Doctor Candidate is expected to start producing research results which are the main part of the planned original contribution. The research result at this stage is expected to be viable for publication in an International Conference. Once in every two years, FTUI held the **International Conference** on Quality in Research which all Doctor Candidate may utilize to publicize his Doctoral Research which he has completed until the Research II stage.

The results for Research II activities are measured through an examination or a Research Result Seminar which is held publicly. The Research II Examination Committee is appointed by the Dean through a Dean's Decree based on a proposal from the Head of Department. If deemed necessary, the Head of Department may invite an external examiner from outside of the Universitas Indonesia as part of the Research II Examination Committee. The date of the examination is determined by the Head of Department with the Promotor. A Doctor candidate is considered passing the Research II if said student acquiring a minimum B grade.

ENxx900007
Research III and Pre-Promotion Examination

(10 SKS)
Research III is a research activity which its evaluation appraisal is finalized by a Pre-Promotion Examination. During this Research III stage, a Doctor Candidate is expected to have the main results which is deemed feasible as part of his original contribution to the science world. The entire research results up until this stage are required to written by the Doctor Candidate in a dissertation paper to be examined in a Pre-Promotion Examination. Thus, it is to be expected that within this stage, the Doctor Candidate has written an article draft to be publicized in an International Journal and has determined which International Journal he/she intends to submit the article to. FTUI published an international journal, the International Journal of Technology (IJTech), which the student may utilize as one of International Journal which he can publicize his Doctoral research.

Pre-Promotion Examination is a scheduled academic activity in order to give an appraisal to a Doctor Candidate's dissertation paper which is compiled based on his research results that have been approved by his promoter and co-promotor.

The requirements and prerequisites for Pra-Promotion Examination are:

- Promotor and Co-Promotor have given a written approval on the page of the dissertation paper that the student is considered qualified for Pre-Promotion Examination.
- Pre-Promotion Examination is held by the Pre Promotion Examination Committee. The committee for the Pre-Promotion Examination is appointed through a Dean of the Faculty of Engineering UI's Decree based on a proposal from the Head of Department. The committee consists of (a) The dissertation advisor team, that is the Promotor and Co-Promotor, and (b) the rebuttals team, consisting of a minimum of five people and a maximum of seven people where one of them is from an outside institution of the Universitas Indonesia.
- Rebuttal team consists of experts in related field to the one which the Doctor Candidate is studying.
- The Pre-Promotion Examination is held in a closed session for around 3 (three) hours and divided into two steps: the dissertation presentation by the Doctor Candidate for 15-30 minutes and a Question and Answer session for 120-165 minutes.
    - The Doctor Candidate will be considered passing the Pre-Promotion Examination if said student acquire a minimum B grade and GPA of a minimum 3.00.

ENxx900008
Research IV and Promotion Examination (6 SKS)
Research IV is a research activity which its appraisal is finalized by completing the Dissertation and Promotion Examination. During the Research IV stage, the Doctor Candidate is requiried to conduct additional research as a follow up on his Pre-Promotion Examination. Suggestions and critics given during the Pre-Promotion Examination must be answered and compelted through a series of final research. During this stage, the Doctor Candidate must also be able to prove the authenticity and originality of his research results as new contribution to the science world. **Therefore, during this state the Doctor Candidate is required to have received the status of "Accepted" for International Journal publication.** The Doctor Candidate must also have completed his dissertation paper and must be ready for the Promotion Examination.

The Promotion Examination is a scheduled academic activity to appraise a Doctor Candidate dissertation in order to award him the highest degree in the academic world, Doctor. The requirements and prerequisites for Promotion Examination are as follow:

- The Promotion Examination can only be held if the student has fulfilled the scientific publication as required, in accordance to the Dean's Decree Number 010/D/SK/FTUI/I/2012 dated 18 January 2010 where a Doctor Candidate must have a minimum of 1 (one) International Science Journal publication (or "Accepted status) and 1 (one) National Science Journal publication in line with his dissertation research. The publication must also state the Faculty of Engineering Universitas Indonesia as one of its affiliation.
- The Promotor and Co-Promotor have given a written approval on the page of the dissertation paper that the student is considered qualified for Promotion Examination.
- The Head of Department submit a report to the Dean stating that the Doctor Candidate has finished his Research IV and is ready for examination in a Promotion Examination.
- The Promotion examination is conducted by the Promotion Examination Committee. The committee for the Promotion Examination is appointed through a Rector's Decree based on a proposal from the Head of Department made through the Dean of Faculty of Engin-

ering Universitas Indonesia. The committee consists of a minimum of 7 (seven) people and a maximum of 9 (nine) people.

- The Promotion Examination Committee consists of (a) Promotor and Co-Promotor, (b) Examiners, (c) a minimum of one person within the committee is from an outside institution of the Universitas Indonesia.
- The examiners consist of experts in related field to the one which the Doctor Candidate is studying. In special circumstances, an examiner from outside of the Academic society may be invited.
- Promotion Examination is lead by the Examination Committee Head who is also a committee member aside from the Promotor/ Co-Promotor and outside examiners.
- If the Examination Committee Head is unable to attend, the Head of Committee position may be filled by one of the examiners committee member.
- The Promotion Examination is held in a public session examination for around 3 (three) hours and divided into two steps: the dissertation presentation by the Doctor Candidate for 15-30 minutes and a Question and Answer session for 120-165 minutes.
- The Doctor Candidate will be considered passing the Promotion Examination if said student acquiring a minimum B grade and GPA of a minimum 3.00

Dissertation is an academic paper based on study result and/or in-depth research done independently which contains new contribution to issues or problems which have been answered temporary or rise new questions about things that are considered to have been confirmed and established in the field of science and technology; conducted by the Doctor Candidate under the supervision of his Academic Advisor. Doctor candidate who has finished his dissertation correction is obligated to submit five copies of his dissertation (in hard cover) with original letter of approvals which have been signed by all advisors to the FTUI Center of Administration signifying the end of his study in FTUI. The Dissertation writing format and binding must follow the Dissertation Writing and Binding Guidelines in accordance to the Technical Guidelines of Final Project Writing of Universitas Indonesia Students which can be downloaded from *http://www.ui.ac.id/download*.

Scientific Publication

Scientific Publication is an inseperable part of a research activity and is a prerequisite for a Promotion Examination. This requirement and prerequisite in accordance to the Dean's Decree Number 010/D/SK/FTUI/I/2010 dated 18 January 2010 as follow:

1. The number of publication required is one publication in International Journal and one publication in National Journal.
2. International Journal stated in the requirement is English-language journal which the Board of editors came from three different countries or more.
3. The Doctor Candidate's publication status must be stated as "Accepted" befor the Promotion Examination.

Facilities for Doctoral Program Students

To make sure that student of FTUI Doctoral Program are able to conduct full time research and produce excellent publications as required, FTUI provides the following facilities:

Doctoral Program Students' Workstation

Compact cubicles in comfortable rooms are available as Doctoral program students' workstation. The locations for these workstations are located on the 2nd and 3rd floor of the Engineering Center Building. Access to these workstations requires a swipe card to guarantee security. A round the clock wi-fi service is also available. To procure a workstation and access card, students are requested to register to the Associate Dean for General Affairs in the Dean's building, 2nd floor, FTUI Depok.

International Journal Article Writing Training

These free of charge trainings for the FTUI Doctoral program students are held several times each year. The information regarding these trainings are communicated through an announcement in SIAK-NG, posters at each Department, Doctoral program mailing list and FTUI website (www.eng.ui.ac.id).

Research Proposal Writing Training

These free of charge trainings for the FTUI Doctoral program students are held several times each year. The information regarding these trainings are communicated through an announcement in SIAK-NG, posters at each Department, Doctoral program mailing list and FTUI website (www.eng.ui.ac.id).

Line Editing Draft for International Journal Article

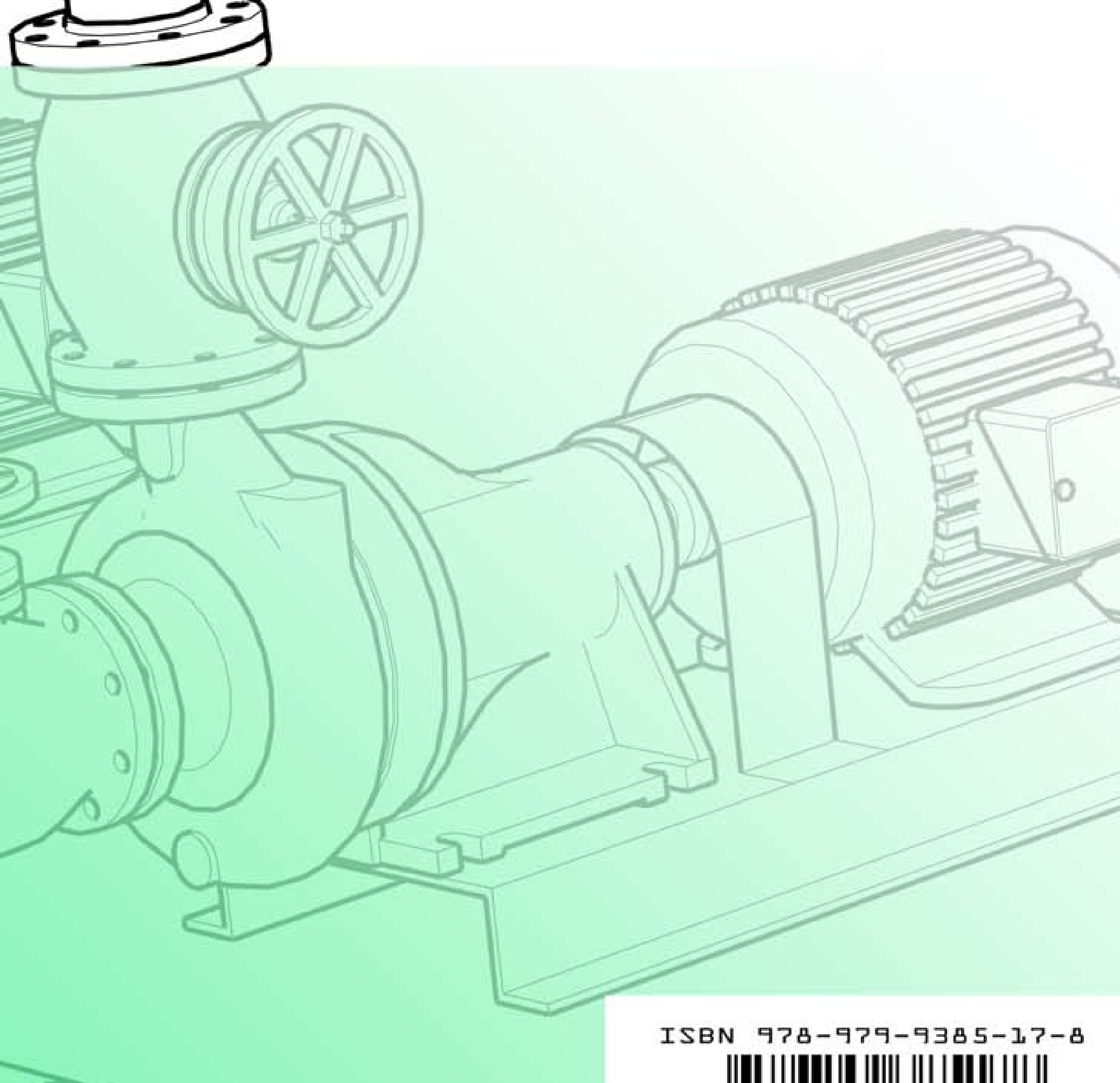
FTUI provides funds for line editing drafts for International Journal Articles. Requirement for applying for this funds are: the article must include the promoter name as part of the writing team and state FTUI as the main affiliation. To be grant this facility, students only needs to send a draft of their article through email to the FTUI Associate Dean of Academic and Research (risetft@eng.ui.ac.id). The time required for line editing is 2-4 weeks.

Doctoral Program Mailing-List

The Doctoral Program mailing list is used as a communication tool between the Dean's Faculty Heads, the Faculty Center Administration staff and all Doctoral program students in FTUI. Information regarding trainings, seminars, grants or other academic matters is announced through this mailing list. Complaints and suggestions are also accommodated by this mailing list. The mailing list address is: programdoktorft@group.eng.ui.ac.id

Research and Incentive Grants for Doctoral Program Research

Research funds including consumables and tests for research as part of the Doctoral dissertation writing is the responsibility of the student. There are a number of competitive research grants, incentive research grant schemes available from which Doctoral program students may propose to finance his/her research. Complete guidance and research proposal examples are available at the Associate Dean for Academic and Research secretary at the Dean's Building, 2nd floor or through research.ui.ac.id. Among these grants and incentives are:



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