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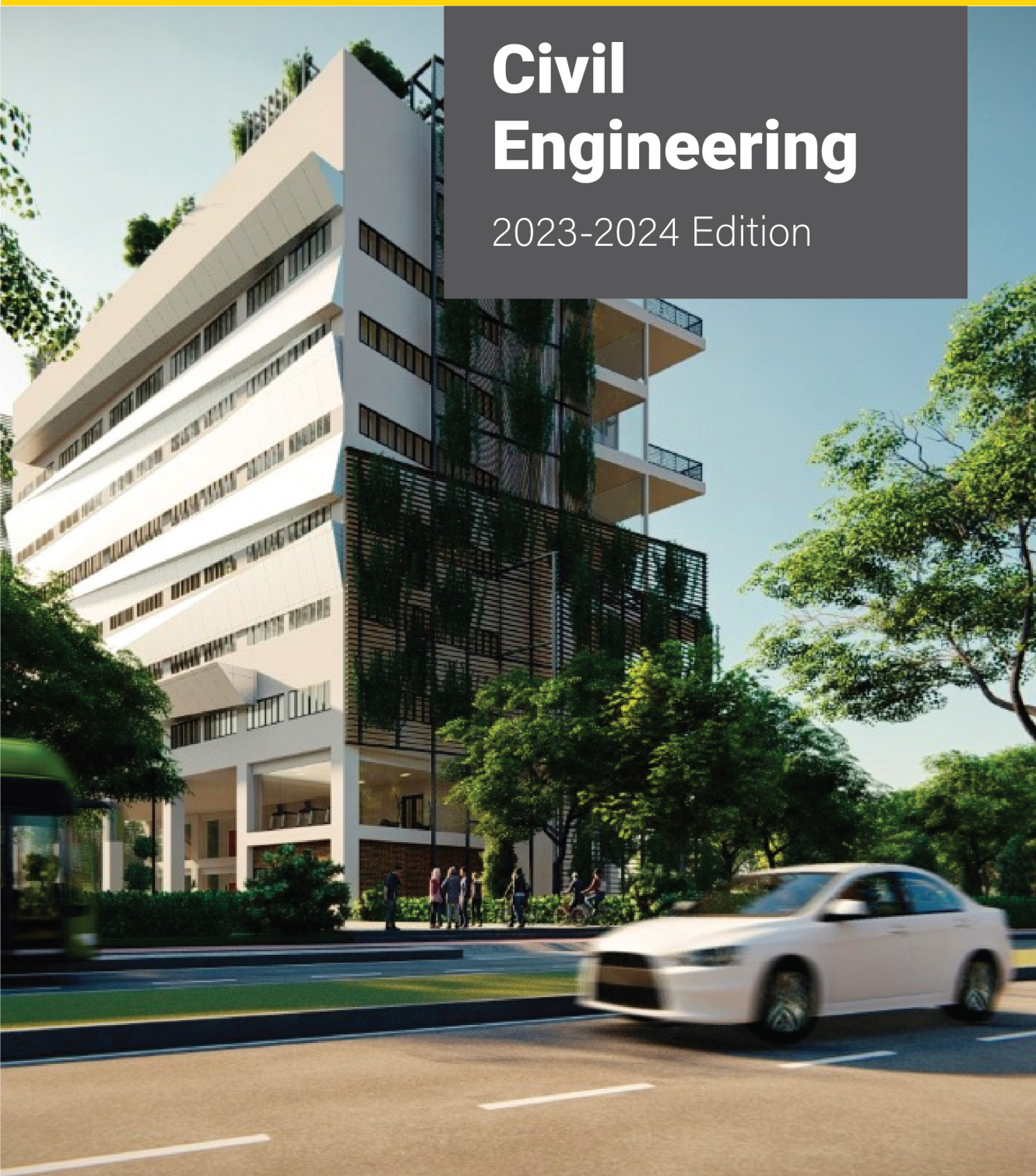
Civil Engineering

2023-2024 Edition



FACULTY OF ENGINEERING

UNIVERSITAS INDONESIA

ACADEMIC GUIDEBOOK

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CIVIL ENGINEERING GUIDEBOOK

2020 - 2024

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PREFACE

Welcome to FTUI !

On behalf of the Faculty of Engineering Universitas Indonesia (FTUI). I would like to extend our warmest welcome to all students joining us this year. Our faculty is one of the largest faculty in the Universitas Indonesia and is proud to call ourselves one of Indonesia's leading education and research institutions. With the support of our faculty members, we provide an excellent learning and research environment for our students.

This 2023 Academic Guidebook is intended for all students of the Undergraduate Program (Regular, Parallel, International), Master Program, Professional Program, and Doctoral Program, to be used during their study at the Faculty of Engineering Universitas Indonesia. The curriculum, syllabus, and academic staff are listed, as well as all support information provided for you. The information contained within this book is also helpful for those considering continuing their study in the engineering field at the Universitas Indonesia.

Continuing the previous Academic Guidebook, we have refined the curriculum design based on the spirit of the Industrial Revolution 4.0 and the concept of "Merdeka Belajar Kampus Merdeka". The curriculum was designed based on the Outcome Based Education (OBE) system. The international standard engineering education outcome has been set in intended to prepare our graduates to be able to compete not only at the national or regional level but also in the global labor market.

In this guidebook, you will also find general information on FTUI and our Department/Study Program. It contains the education system, the academic regulations, the curriculum, and the syllabus of the subject taught in all our programs. In this guidebook, we are also proud to inform that starting the Academic Year 2023/2024, we opened the Professional Engineer Program (PPI) for the Recognition of Past Learning (RPL). This is a formal education program that uses work experience as the basis for continuing education for equality with certain qualifications. In addition, starting the Academic Year 2023/2024, FTUI will open the Master Program by Research. This program is a development of the existing Master Program by Course. This program is opened to provide learning opportunities for the community broad range, both from graduate students, and academics, to practitioners who already have research experience.

Lastly, I would like to convey my gratitude and appreciation to our stakeholders and the curriculum team for their contributions to the renewal curriculum. My sincere thank goes to all faculty members who have helped with the compilation of this academic guidebook, especially the Vice Dean for Academic, Research, and Student Affairs, the Vice Dean for Resources, Venture, and General Administration, the Associate Dean for Academic, the Heads and Vice Heads of Department, the Head of Study Programs, and the committee members. With the spirit of FTUI Entrepreneur Vision #ExcellentImpactful, let us deliver our graduates to be the best engineers in their field wherever they are.

Depok, November 2023
Faculty of Engineering Universitas Indonesia

Prof. Dr. Heri Hermansyah, ST., M.Eng., IPU

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CHAPTER 1

PROFILE OF DEPARTMENT

Profile of Departments

Department of Civil Engineering

General

The Department of Civil Engineering Universitas Indonesia has several study programs in the goal to become a center of knowledge and technology in Civil Engineering and Environmental Engineering and to play an important role in global market. Civil Engineering is the oldest engineering discipline and encompasses many specific areas. Civil engineering can be described as the application of engineering to civil society. It applies the principles of engineering to meet society's fundamental needs for housing, building, transportation, sanitation, and other necessities of a modern society. The engineers deal with the design, construction, and maintenance of the physical and naturally built environment, including works like roads, bridges, canals, dams, and buildings. 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 to national governments, and in the private sector from individual homeowners to multinational companies in responding to current challenges such as construction and maintenance of facilities and infrastructure, climate change, natural disasters, traffic congestion and urban development.

Environmental engineering is defined as the branch of engineering concerned with the application of scientific and engineering principles for protection of human populations from the effects of adverse environmental factors; protection of environments, both local and global, from the potentially deleterious effects of natural and human activities; and improvement of environmental quality. Tasks of environmental engineers include evaluation of environmental quality of water, air, and soil by developing strategies and methods, design of facilities or programs, evaluation of results and assessment of the economics and efficiency of processes. The Environmental Engineering Study Program provides graduates with professional and 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, and environmental impact assessment.

The Civil Engineering Department, previously known as the Civil Engineering Study Program, was established together with the Faculty of Engineering of Universitas Indonesia (FTUI) on July 17th, 1964. During its initial stage of development, the Civil Engineering Department of FTUI offered only one study program, i.e. Civil Engineering, with two majors: structural engineering and water resources engineering. In response to the demand and development of science and technology, the study program was then expanded to cover four additional majors, i.e. transportation engineering, geotechnical engineering, sanitary engineering, and construction management. With the improvement of human resources and facilities, the two-level Postgraduate Programs of Master's Degree (S2) and Doctoral Degree (S3) were established in 1992 and 2001, respectively. In 2006, the Department established the undergraduate program of Environmental Engineering. Previously, Environmental Engineering is one of the majors in Civil Engineering. There are eight specializations for Master's Degree Program and Doctoral Program in Civil Engineering, consisting of structural engineering, geotechnical engineering, water resources management, transportation system and engineering, construction management, environmental engineering, project management, and infrastructure management.

To maintain its quality, the Department has been regularly accredited by the National Accreditation Board (Badan Akreditasi Nasional Pendidikan Tinggi or BAN-PT) since 1998. Civil Engineering Study Programme and Environmental Engineering Study Programme, both have reached the highest grade of "Unggul" and Civil Engineering Magister Study Programme and Civil Engineering Doctoral Study Programme have reached grade "Unggul". The Environmental Engineering Study Program was accredited nationally in 2010. The undergraduate program of Civil Engineering was accredited internationally in 2001 by the Joint Board of Moderators of the Engineering Council consisting of the 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, reaccreditation was discontinued. In 2008, the undergraduate program of Civil Engineering was assessed by the ASEAN University Network – Quality Assurance Program (AUN-QA). In order to maintain the quality of education in the Department, AUN-QA reassessment was conducted in 2015. The Environmental Engineering S1 program assessment was performed by the ASEAN University Network (AUN) in 2018, and the formal results are being processed by AUN. In 2019, Civil Engineering and Environmental Engineering undergraduate programs are accredited with general accreditation by IABEE (Accreditation Board for Engineering Education).

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Vision

"To become a center of knowledge and technology in Civil Engineering and Environmental Engineering and to play an important role in global market"

Missions

- To improve the quality of graduates in mastering Civil and Environmental Engineering knowledge with solid foundation, and to provide them with internationally standardized environmental insight
- To actively contribute ideas through research including direct involvement in community service that is oriented to the development of facilities and infrastructure in the Civil and Environmental Engineering discipline, as well as reflecting upon the balanced relationships between human beings and nature.
- To shape and build students that can demonstrate strong leadership and independent personality, along with the ability to socialize, communication effectively and uphold profession ethics.

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CHAPTER 2

ACADEMICS SYSTEM AND REGULATION

Academic System and Regulation

General

Teaching and Learning Activities

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

Semester Credits Units (SKS)

Education in FTUI is provided in a variety of ways, including lectures, assignments (e.g., calculation tasks, planning, designs), practical work, seminars, lab, studio, and research for thesis writing. All educational activities that must be undertaken by a student to earn a bachelor's degree are contained within the academic loads and measured in semester credit units (SKS).

- Semester Credit is the measurement of the learning experience obtained by students in each semester.
- One Semester Credit in lecture, responses, and tutorials includes face-to-face study time for 50 (fifty) minutes per week per semester; structured learning activities with structured assignments for 60 (sixty) minutes per week per semester; and independent study session for 60 (sixty) minutes per week per semester.
- One Semester Credit of seminar or other similar subjects includes face-to-face study time for 100 (one hundred) minutes per week per semester, independent study session of 70 (seventy) minutes per week per semester.
- One Semester Credit in practical training, studio, workshop, on the field training, research and community services, and/or other similar subjects for 170 (one hundred and seventy) minutes per week per semester.
- One Semester Credit of online learning is 170 (one hundred seventy) minutes per week per semester.
- One semester is an effective learning process for at least 16 weeks of lectures or other scheduled activities and additional activities. Also included in the schedule is one week of midterm examination and another one or two weeks of final examination.
- To earn a bachelor's degree, a student must complete all educational activities with a total academic load of 144 credits spread 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 a minimum of 18-20 hours of scheduled interactions 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 (6,25%), Basic Engineering Subjects (15-20%), Basic Skills Subjects (30-35%), Core Subjects (35-40%). Subjects are categorized as either compulsory subjects and electives. They can be taken across departments or faculties.

Grade Point Average

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

The calculation is made by multiplying the number of credits and the letter grade for each course, divided by the number of credits.

$$IP = \left(\frac{\sum_{MA} (\text{Bobotnilai} \times \text{sks})}{\sum_{MA} \text{sks}} \right)$$

Semester Grade Point Average (SGPA)

Grade Point Average (GPA/IPK)

If the calculation involves the grade point values of all subjects taken during the educational program period, the result is called the Cumulative Grade Point Average (CGPA), which is used as a basis for study evaluation. Courses taken into account are the ones listed in the Study Plan Form (FRS). CGPA is obtained from the summation of all subjects having a grade of 'C' or higher, from the first semester until the last semester, with the exception of subjects with a letter grade of 'BS', 'I', or 'TK'.

Academic Performance Evaluation

Assessment of academic ability is performed on an ongoing basis by CLO (Course Learning Outcomes). There is at least one CLO derived from the Expected Learning Outcome (ELO) for each subject. Each CLO might be derived into several sub-CLO where each sub-CLO consists of several lecture materials and types of learning evaluations. A student will be assessed on their academic ability if they meet 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 every semester, students can download Semester Grade Record as a report of their academic performance from SIAK NG (https://academic.ui.ac.id/). Assessment of study efficacy is carried out using letters and grade points according to Table 2.1.

The highest grade is 'A' with a grade point of 4.00, and the minimum passing grade of a course is 'C' with a grade point of 2.00. A lecturer may assign an 'Incomplete' (I) grade if a student has not made a reasonable attempt to complete major session assignments or laboratory projects. The lecturer should make a reasonable effort to inform the student as early as possible that an essential part of the session work is incomplete. The 'I' mark should be changed to another

grade within one month; otherwise, it will automatically change to 'E' grade. The 'T' mark is given for no attendance in the exam. The 'BS' mark is given for special lecture (such as internship, seminar, and final project) that has not been completed. These 'BS' courses are not taken into account in the calculation of Semester Study Unit, SGPA, and CGPA.

Table 2.1. Grade Value and Point

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

Length of Study and Academic Load

Undergraduate Program

The academic load students can take proposed by the students for the approval of the Academic Counselor based on their previous Semester Grade Point Average (SGPA) as stated in the Study Plan (FRS). Students must take the entire allocated credits and courses during their first semesters. The minimum academic load for the Undergraduate Program is 144 (one hundred and forty-four) credits, while the maximum academic load is 160 (one hundred and sixty) credits, including the final project. The entire academic load can be completed in a minimum of 7 (seven) semesters and maximum of 12 (twelve) semesters.

As for the second semester, these following rules apply:

- Students can take all credits load allocated for the second semester according to the structure of the applicable curriculum.
- Students can take more credits from the credit load allocated for the second semester if the SGPA obtain in the 1st semester is in accordance with the provision of the maximum credit load amounts shall follow the provision in the Maximum Credit Load Table.

From the third semester onward, the maximum credit load allowed to be taken is determined by the SGPA of the previous Semester (not including the short semester). It follows the provision of Maximum Credit Load as shown in Table 2.2 with respect to course prerequisites (if any). If necessary, the Academic Advisor (PA) can add a maximum of 2 extra credits upon the approval of the Vice Dean.

Master Program

The academic load in the FTUI's Master Program curriculum is set at 40-44 credits after finishing

the Undergraduate Program. The length of study is scheduled for 4 (four) semesters and can be completed in minimum 2 (two) semesters and a maximum of 6 (six) semesters; exclude short semester.

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

SGPA	Maximum Credit
< 2,00	12
2,00 – 2,49	15
2,50 – 2,99	18
3,00 – 3,49	21
3,50 – 4,00	24

The student's academic load is proposed by the students for the Academic Counselor (PA) approval based on their last semester SGPA as stated in the Semester Grade List (DNS). Provisions on the academic load are as follows:

- AA semester's academic load is registered by a student as they carry out online registration according to the predetermined schedule. Students are required to take all subjects as allocated in the first-semester curriculum.
- For students with SGPA less than 2.50, a provision stating that the number of credits taken for the following semester does not exceed nine credits is applicable.
- The maximum number of credits that can be taken on the Master Program is 18 (eighteen) credits (for Regular Master Program) per semester.
- Any Exemption from the provisions of academic load should be with the permission of the Vice Dean.

Matriculation for Master

The Matriculation Program is aimed at synchronizing the students' ability to achieve the minimum requirements for continuing education in the Master Program of FTUI. The program is compulsory for students coming from a four-year diploma program (D4) or graduates from a non-linear undergraduate study program.

Matriculation is achieved by taking classes of subjects required by each Faculty/Study Program within the Undergraduate Program curriculum. The maximum allowed credit load for this Matriculation Program is 12 (twelve) credits, which can be completed in 2 (two) semesters (6 credits in the first semester and 6 credits in the second semester). Students are allowed to continue their study in the Master Program only if they pass all matriculation subjects in a maximum 2 (two) semesters with a matriculation GPA of 3.00 (three points zero).

Fast Track (Master – Doctoral Program)

Fast Track (Master – Doctoral Program) is an educational program organized to accelerate students who have excellent academic ability to complete their studies in the Master Program and Doctoral Program in the same field of science within a maximum of 10 (ten) semesters.

To take part in the Master-Doctoral Fast-Track Program, students must fulfill the following requirement:

a. have obtained 18 (eighteen) credits with a minimum GPA of 3.50 (three point five zero) at the end of the second semester.

b. The study period for the Master-Doctoral Fast-Track Program is a maximum of 10 (ten) semesters.

c. Study Load on the curriculum of the Master-Doctoral Fast-Track Program, as follows:

1. For the Master program, that is according to the total credits in the master study program including 12 - 16 (twelve to sixteen) the credits include elective courses taken from the compulsory doctoral program;

2. For the Doctoral program, a minimum of 50 (fifty) credits, including 12 - 16 (twelve to sixteen) credits, are courses that are recognized through credit transfers.

Students who cannot complete their education within 10 (ten) semesters only get a Master's Degree.

Doctoral Program

The academic load in the FTUI's Doctoral Program curriculum is set at 50 credits after finishing the Master Program. The students register a semester's academic load through online academic registration during the predetermined schedule. New students are required to take all subjects as allocated in the curriculum for the first and second semesters. Students must retake any research courses with a 'BS' grade from previous semesters. The students propose students' academic load for each semester for the approval of the Academic Counselor (PA) or the Doctorate Promoter.

The length of study is scheduled for 6 (six) semesters and can be completed in a minimum of 4 (four) semesters and a maximum of 10 (ten) semesters. Students in the Doctoral Program may be granted an extension of maximum 2 (two) semesters if they have never received an extension before, have

achieved a minimum grade of 'B' for research result examination, and have obtained a recommendation from their Promoter and a guarantee that they will complete their study within the granted extension period. The proposal for such extension is regulated in a Rector's Decree based on the proposal of the Dean.

Undergraduate Final Project (Skripsi)

Undergraduate Final Project (Skripsi) is a compulsory course for undergraduate students of FTUI taken to complete their study and earn a degree in engineering. The course is the application of science that has been obtained student has studied, in the form of a scientific paper, engineering design, assembly or models and accessories. It is equivalent to other skills courses and tailored to the scope of each Study Program. The following requirements, both academic and administrative, must be met before students are allowed to start writing their undergraduate thesis:

- The Undergraduate final project has been registered in the Study Plan Form [FRS]
- Students have obtained a minimum of 114 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 Final Project can be taken in both odd and even semesters in the running academic year. On SIAK NG, students must fill out the name of their Skripsi Supervisor and the title of their Skripsi to be verified by the Vice Head of Department. At the end of the semester, the supervisor will announce the Skripsi grade on SIAK NG and change the title of the thesis (if necessary). The completed undergraduate final project must be submitted in the form of a hardcover book, and students must upload their final revision in a pdf file to UI-ana (lib.ui.ac. id/ unggah). The undergraduate's final project must be assessed in an undergraduate thesis examination by the Supervisor and examiners assigned by the Head of Department.

Thesis (Master Program)

The thesis is a report of research findings 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 theory using a certain method. The thesis should be written in Bahasa Indonesia with English abstract. For Master Program students who are given the opportunity to conduct research and thesis preparation abroad, they are allowed to write the thesis in English with a Bahasa Indonesia abstract while still following the appropriate format stated in the Final Project Writing Guidelines of Universitas Indonesia. Exemption from this rule applies only to Study Programs in collaboration with universities abroad, as stated in the cooperation charter.

Requirements for a student to start writing a Thesis are:

- The student's thesis has been registered in the Study Plan Form (FRS) every semester.
- The Head of Study Program has designated a lecturer to be the student's Thesis Supervisor.

Students are responsible for all thesis research costs. Students can actively meet with any of their lecturers as potential supervisors to request a thesis topic. In addition, in the middle of the second semester, the Head of Study Program can start announcing thesis topics from which the students of the Master Program can choose to prepare their thesis proposal in the form of a seminar. The Head of Study Program will also announce a list of Thesis Supervisors assigned to guide the students in writing and finish the approved topic. The thesis examination committee consists of a committee chair and a minimum of 3 or a maximum of 5 examiners, including the Thesis Supervisor. Responsible for the implementation of the thesis writing is the Thesis Coordinator in each Department. Thesis counseling should be provided by a maximum of two people, the main Supervisor and the second Supervisor. The main Supervisor should be the permanent university lecture holding a Ph.D degree. The second Supervisor is the university permanent lecture or temporary lecturer or expert from national or international institutions holding a Ph.D. or Master's Degree with professional certifications and qualifications equal to level nine (9) of the Indonesian Qualifications Framework (KKNI).

A thesis can be submitted for a thesis examination when it has met the following academic requirements:

- The thesis has been registered in Study Plan Form [FRS] in the said semester
- The thesis has been declared eligible for examination by the Thesis Advisor
- The thesis that 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

Dissertation

Dissertation preparation is carried out under the guidance and evaluation of a Promoter with the following qualifications: a full-time university lecturer; a Professor or Doctor with an academic title of Associate Professor; have expertise relevant to the dissertation topic, and within the last 5 (five) years have written at least 1 (one) scientific paper published in an accredited national journal or a reputable international journal or 1 (one) other similar scientific work acknowledged by a team of experts appointed by the Academic Senate of Universitas Indonesia. The Promoter may be assisted by a maximum of 2 (two) Co-promoters from within the University, partner universities, or other institutions in cooperation with the Promoter Team. The Co-promoter must have the following qualifications: a full-time or a part-time lecturer or an expert from another institution; hold a minimum title of Doctor/ Ph.D with an academic title of at least Senior Lecturer, and have expertise relevant to the dissertation topic.

Internship for Undergraduate Student

The internship is an out-of-campus activity that encourages students to apply their scientific knowledge in a real work situation. The requirements for internship are set by each Department, and it accounts for part of the total 144 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 Double Degree Undergraduate Program, students are required to complete internships when they are in partner universities (except in UDE, Germany). For example, in Australia, the internship is one of the requirements set by the Institution of Engineers Australia (IEAust) to obtain an accredited B.E. (Bachelor of Engineering) Degree. The internship is a good opportunity for students to apply their skills and build networks in the industry. It is strongly suggested that students do their internships in partner universities. However, if they cannot do so, they are allowed to have their internship in Indonesia with prior permission from the partner universities.

Supplementary Exam

Students are allowed to take a supplementary examination for midterm and final examinations on the following conditions: sick, grievance, or representing Universitas Indonesia in a competition. Students with a sickness excuse are obliged to submit an application for supplementary exam signed by their parents/guardian and a medical certificate from a doctor or hospital that treats them; students with grievance or death in the family (death of the father, mother, older or younger siblings) are obliged to submit an application for supplementary exam signed by their parents/guardian; students representing Universitas Indonesia in the competition are obliged to submit a Letter of Assignment/Letter of Reference stating the competition in which they represent UI. The supplementary exam can only be taken with written consent from the Vice Dean for Academic, Research, and Student Affairs of Faculty of Engineering Universitas Indonesia.

Credit Transfer

Credit transfer is a recognition process of the number of credits a student may obtain from a university after an evaluation process by a Credit Transfer Team in each Faculty/ Department in the University. Students who have registered and studied at an undergraduate study program or other equivalent education programs, whether in Universitas Indonesia or any other universities or through a student exchange or study abroad program, may apply for a credit transfer, provided that: (i) the transferred credits contain the same material as the courses listed in the curriculum for the Undergraduate Program in FTUI, (ii) the academic record must date back not more than 5 years from the credit transfer application date, (iii) if the academic record is obtained from a university other than 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 maximum academic load that can be transferred in the Undergraduate Program is 50% of the total academic load that a student is required to complete in accordance with the curriculum of the Study Program he/ she is currently studying in. The courses transferred will be indicated with a 'TK' mark in the academic transcript.

The credit transfer procedures are as follows: (i) The student submits a letter requesting credit transfer to the Head of the designated Department; (ii) The Head of Department will form a team to recommend which courses the student has previously taken can be transferred; (iii) The recommendation will be sent to the Dean of FTUI; (iv) The Dean of FTUI will issue a Credit Transfer Decree; and (v) The Faculty's Center of Administration will assign a 'TK' mark to all the relevant courses in the student's SIAK NG account.

Credit Transfer for Parallel Class Students of Diploma Graduates

As of 2011, all Extension Programs in FTUI are merged into Parallel Classes in the Undergraduate Program. For diploma graduates registered as students in these Parallel Classes, credits obtained from the previous diploma program will be transferred in blocks of credits equivalent to the number of the first

and second semester credits in their study program. Students begin their study in the third semester by taking a full academic load according to the package provided for the third semester. Afterward, they can take credits according to their SGPA 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 programs abroad, such as in Japan, Korea, Taiwan, Singapore, and many other countries. Student exchange programs generally last for 1-2 semesters and are 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. Students participating in classes outside of the university (in the form of Student Exchange, International Undergraduate Dual Degree Program, Sandwich Program, Joint Degree Program, or other university acknowledge program) for at least one semester will be given an "overseas" or study outside of the university status. Before leaving to continue their study overseas, students must ensure that their status in SIAK NG has been change to "overseas", and they are obliged to make payment to Universitas Indonesia in the amount stated in the applied Rector's Decree of "overseas" academic fee. Period of study abroad, either on the Student Exchange program and the Double Degree, is counted as part of the whole study period. The result or grades obtained from this program will not be calculated in determining their GPA and will be given a letter grade of TK in their transcript.

Fast Track (Undergraduate – Master Program)

FTUI students, Regular, Parallel, or International Undergraduate Program, 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's 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 a 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 or 10 (ten) semesters.

The Academic load for the Fast Track Program curriculum is as follow:

1. For the undergraduate program is 144 (one hundred and forty four) credits, including 16-22 credits of elective subjects taken from the main competence subjects of the Master Program.
2. For the Master Program is 40-44 credits including the 16-22 credits from subjects mentioned in point an above and are acknowledge through credit transfer.

If a student is unable to complete his/her Undergraduate Program in 8 (eight) semesters, then the student will be deemed as unable to complete the Fast Track program, making all the subjects of the Master Program he/she has taken will be considered as elective subjects in their completion of the Undergraduate Program and cannot be acknowledged as part of their credit towards continuing to the Master Program.

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. Have a minimum GPA of 3.50 with a total of 120 credits (until 6th semester).
2. Have a minimum Institutional TOEFL/EPT score of 500 (students may use the score from the EPT test they took as a new student in FTUI)
3. Have 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.
3. The Fast Track Registration Forms will be evaluated by a team headed by the Head of Department.
4. 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 Form. The student's Study Plan Form 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.

5. Undergraduate thesis and thesis of the student are expected to be of continuous research to maximize knowledge, experience and quality research result.
6. The funds for the Fast Track Program will be borne entirely by the student.

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.

Fast Track (Undergraduate – Doctoral Program)

Fast Track (Undergraduate – Doctoral Program) is an educational program organized by the University to accelerate students who have an excellent academic performance to complete their studies in the Undergraduate Program and Doctoral program in the same study field at the maximum of 12 (twelve) semesters.

Merdeka Belajar Kampus Merdeka Program

Merdeka Belajar Kampus Merdeka Program is a policy of the Minister of Education and Culture, which aims to encourage students to master various sciences useful for entering the world of work. Merdeka Campus provides an opportunity for students to choose freely several courses they will take. The implementation of Merdeka Belajar – Kampus Merdeka Program in the curriculum starting on 2O2O/2021 Academic Year. The Merdeka Belajar – Kampus Merdeka Program is the right for all undergraduate study programs.

Fulfillment of time and study load for undergraduate students or applied undergraduate programs can be implemented by:

a. follow the entire learning process in the study program to the period and study load; or
b. follow the study program's learning process to fulfill part of the time and learning load, and perform the rest learning process outside the study program.

The student may apply for the following elective courses scheme:

a. Fast-Tack program with a minimum of 24 (twenty-four) and a maximum of 54 (fifty-four) credits of choice focused on elective courses and postgraduate level courses at the same field of science as the field of science at the bachelor level.
b. Major-Minor Program with a minimum of 24 (twenty-four) and a maximum of 54 (fifty-four) credits the choice is focused on one different Study Program (across Study Programs/cross faculties/cross clumps of knowledge).
c. Double Major Program with a minimum of 24 (twenty-four) and a maximum of 54 (fifty-four) credits the choice is focused on one different Study Program (across Study Programs/cross faculties/cross disciplines) plus the rest of the Mandatory courses in the second Study Program to fulfill the minimum Expected Learning Outcome of the second study program.
d. Independent study Choice with a maximum of 54 (fifty-four) Optional credits are used for outside learning activities study program as stated in the Policy Merdeka Learning - Merdeka Campus.
e. The selection of the selected subject application scheme is consulted with the Study Program.

The form of learning activities that can be carried out outside the Study program include:

a. Student Exchange
b. Internship/Work Practice
c. Teaching assistant in education unit
d. Research
e. Humanity project Proyek
f. Entrepreneurial activities
g. Independent Study/Project
h. Building a Thematic Real Work Village/Lecture

The number of hours of learning activities is 45 Hours per week for one credit. Implementation of activities must be accompanied by lecturers advisor. The conversion of activities to credits will be carried out by faculty evaluators and verifiers, based on the number of hours and type/form of activities. The evaluator is a lecturer in the study program from the student or other Study Programs in the Faculty assigned to assist and monitor student activities. Verificators are officials at the Faculty level who are responsible for Education and/or Student Affairs in

charge of perform verification, assign weighting, and propose assessment of student performance in student activities.

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

- **Administrative registration in Universitas Indonesia**
  July - August
- **Academic registration in Universitas Indonesia**
  August
- **Course period**
  August – January
- **Mid-semester examination**
  October
- **End of Semester Examination**
  December - January
- **Deadline for grade assignment in SIAK-NG**
  January
- **Departmental Judicium**
  1st: October
  2nd: January
- **Faculty Yudicium**
  1st: November
  2nd: January
- **Graduation**
  February

Term 2

- **Administrative registration in FTUI**
  January - February
- **Academic registration in FTUI**
  January - February
- **Course Period and examination**
  February - May
- **Mid-semester examination**
  March - April
- **End of Semester Examination**
  May
- **Graduation**
  August

Short Semester

- **Administrative Registration**
  June
- **Academic Registration**
  May - June
- **Course period**
  June - August
- **Mid-semester Examination**
  July
- **End of Semester Examination**
  August

Note:

*) Schedules are subject to change

Note:

1. Short Semester course period is held for 8 weeks, including mid-semester and final semester examinations.
2. 2 credit courses consist of two 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.
3. 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.
4. A student can take up to a maximum of 12 credits during the short semester.
5. Courses offered are determined by the Department.
6. 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.
7. 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.
8. 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. A 50% penalty will be imposed to students who do not make payment on time. Administrative registration are done by paying the tuition fee through the host-to-host system by the ATM (Automated Teller Machine) or bank teller of banks in cooperation with the Universitas Indonesia.

Academic Registration

Students should do online academic registration; consult with his/her Academic Advisor for approval and signing the Study 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 Form particularly in selecting courses and in solving their academic problems
- Monitoring and evaluating student's academic performance during their period of study.

Students should login to https://academic.ui.ac.id using username and password provided by the Office of Direktorat Sistem & Teknologi Informasi (DSTI) 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 are not followed to take part in the academic activities in the relevant semester, which is counted towards their length of study
3. Students who are not active as referred to in points (1) are not charged with tuition.
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.

Exception Administrative Registration

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

- The students are required to obtain the approval of 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 relevant semester.
- The approval will be used by the students for paying the tuition fee manually.
- The 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 the minimum GPA as required at the end fourth semester for the 2+2 program;
2. Have passed all required subjects as listed in the Study Program curriculum with minimum C with a total of passed credits consistent with the total number of credits listed in the Study
3. Program curriculum for semester 1-4.
4. Achieve the minimum IELTS or TOEFL scores as

required.

5. If their GPA is less than required, the students must stay at UI and repeat some subjects to improve their GPA, while administratively and academically registered at FTUI.

6. If their 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
Queensland Univ. of Technology	3.0	IELTS minimum 6.5 with no band lower than 6
Curtin University		
The Univ. of Queensland		
The Univ. of Sydney		TOEFL iBT in accordance to partner university's requirement
Monash University	3.2	

English Language Requirements for Undergraduate International Program Single Degree

Students of the Undergraduate International Program Single Degree are required to obtain an English certificate in IELTS (International English Language Testing System) or TOEFL iBT (Test of English as a Foreign Language – internet Based Test) with the following minimum score:

Type of Test	Overall Minimum Score	Additional Requirements
IELTS	6.0	No bands lower than 5.5
TOEFL iBT	75	No bands lower than 17

This English Language Certificate is one of the requirements before they may proceed to have their Undergraduate Thesis/ Final Project Exam.

1. Student choose a Partner University
   - Find out list of UI's Partner Universities
   - Information on Study Abroad/ Student Exchange Information from International Office UI through http:// international.ui.ac.id

2. Student contacted the selected partner University for Information on:
   - List of subjects offered and course description
   - List of requirements/documents needed.
   - Application and Tuition Fees.
   - Other Documents needed.

3. Student consulted their Academic Guidance Counselor or the Vice Head of Department to determine the subjects they will take in Partner University that can be credit transferred upon their return.

4. The Head of Department issued a Letter addressed to the Vice Dean stating:
   - Name and Student ID of student participating in the Study Abroad/Student Exchange Program
   - Name of Partner University and length of study of said program
   - List of subjects that the students will take at Partner University.

5. The Vice Dean will assigned the Associate Dean for Academic and Head of PAF to process the student's status to "overseas" or "student exchange and issued a Reference Letter and Academic Transcript for the student.

6. Student prepare the documents needed for their Study Abroad/ Student Exchange:
   - Application Form
   - IELTS/TOEFL iBT
   - Other language requirement
   - Reference Letter and Academic Transcript from the Faculty.

7. Student sends their application documents to Partnery University.

8. Student receives Letter of Offer dan Letter of Acceptance from Partner University.

9. Student makes payment and signed the Letter of Offer

10. Student applies for Student Visa to the Country where the Partner University is located.

11. Departure to Partner University

Procedure for Study Abroad/ Student Exchange to Partner University for Undergraduate International Program Single Degree.

Graduate Predicate

Students are considered to have passed the Undergraduate Program and will earn a Bachelor's Degree (S.T. or S.Ars.) if they are registered as an active student in Universitas Indonesia during said semester, both administratively and academically; have passed all the compulsory courses and acquired a minimum of 144 credits in accordance with the applicable curriculum with 'C' as the lowest grade and completed all 8-semester scheduled academic load within 8-12 semesters; have completed all administrative obligations, including returning all borrowed library and laboratory collections; and have completed all obligations within their study period and/or all assignments given in accordance with the curriculum of the Study Program (including revising Final Project) with a GPA of ≥ 2.00 (two point zero). Honors predicate for a graduate is determined by the student's CGPA as follows: Summa cum laude (3.90-4.00), Cum Laude (3.61-3.89), Very Satisfactory (3.25-3.60), Satisfactory (2.76-3.24). For an undergraduate student to graduate Cum Laude, he/she must finish his/her study within 8 (eight) semesters with minimum GPA 3,51 and without retaking any courses.

Students are considered to have passed the Master Program and will earn a Master of Engineering or Master of Architecture Degree if they have passed all the required 40–44 credits; achieve a ≥ 3.00 GPA with 'C' as the lowest grade; do not exceed the maximum study period; and have met all administrative requirements. The honors predicate for a graduate is determined by the student's CGPA as follows: Summa cum laude (3.95-4.00), Cum Laude (3.76-3.94), Very Satisfactory (3.51-3.75), Satisfactory (3.00-3.50). For a Master Program student to graduate Cum Laude, his/her length of study must not exceed 4 (four) semesters with minimum GPA 3,76 and without retaking any courses.

Students are considered to have passed the Doctoral Program and will earn a Doctoral Degree if they have passed all the required 50 credits; achieve a minimum GPA of 3.00 with minimum 'C' for in-class courses and minimum 'B' for research courses; do not exceed the maximum study period; and have met all administrative requirements. Honors predicate for a graduate is determined by the student's CGPA as follows: Summa cum laude (3.95-4.00), Cum Laude (3.76-3.94), Very Satisfactory (3.51-3.75), Satisfactory (3.00-3.50). For a Doctoral Program student to graduate Cum Laude, his/her length of study must not exceed 8 (eight) semesters without retaking any courses or academic leave (except for a student with outstanding achievement based on the Promoter and examiner team's judgment, the length of his/her study must not exceed 10 (ten) semesters). The mark 'BS' is not counted as course repetition. If a student's GPA is within the 3.76–4.00 range but he/she fails to meet the other requirements, he/she will be awarded a 'Very Satisfactory' predicate.

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 credits with a minimum of C at the end of their second semester;
- Attain at least 48 credits with a minimum of C at the end of their fourth semester;
- Attain at least 72 credits with a minimum of C at the end of their sixth semester;
- Attain at least 96 credits with a minimum of C at the end of their eight semester;
- Attain at least 120 credits with a minimum of C at the end of their tenth semester;
- Attain all required credit with a minimum of C at the end of their twelfth semester;

Or:

- Have the following issues: have an inactive status (empty) for two semesters in a row, thus being declared as "resign" automatically from the status of Universitas Indonesia's student by the Rector's decree on Status Determination.
- It was proven to be in violation of rules or regulations that caused the student to lose his right as FTUI student.
- Deemed unfit to continue their study based on consideration from a team of Medical Doctors appointed by the Head of the University.

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

Master's 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:

- Students fail to achieve a 3.00 GPA of at least 9 passed credits (for regular Master Program student) or 12-14 passed credits (for non-regular Master Program student) at the end of the second semesters;
- In the end of the study period evaluation, students fail to achieve the following graduation requirements: registered as an active student in Universitas Indonesia during said semester both administratively and academically; not exceeding the maximum length of study; completed all administrative obligation including the return of all borrowed library and laboratory collection; and complete all obligation of their study period and/or all assignments given in accordance to the curriculum of the Study Program (including revised Final Project) with a GPA ≥ 3,00 (three point zero).
- Students who do not register academically and administratively for two consecutive semesters.
- Proven to be in violation of rules or regulations that caused the student to lose his right as FTUI students.
- Deemed unfit to continue their study based on consideration from a team of Doctors appointed by the Head of the University.

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 Vice Dean with a copy to the Head of the Department.

Doctoral Program

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

- Students do not register academically and administratively for two consecutive semesters, thus automatically being considered to have resigned from UI.
- Students fail to obtain a minimum of 'B' for their research proposal examination or a similar exam at the end of their fourth semester.
- Students fail to complete a minimum of 50% of their research based on the judgment of the Promoter Team by the end of their sixth semester.
- Students fail to complete a minimum of 75% of their research based on the judgment of the Promoter Team by the end of their eighth semester.
- At the end of the study period (ten semesters), students fail to complete 4 points above.
- Students fail to do the following by the end of their study period of ten semesters: producing 1 (one) scientific paper based on research for their dissertation as the main author with an option to work with the Promoter Team as their co-writer that has been accepted to be published in an indexed international journal (8 credits); submitting proof of compliance with the foregoing requirement as part of the requirements for promotion exam, and submitting 1 (one) dissertation and participating in a promotion exam as the final step of the Doctoral Program (6-8 credits).
- Students exceed the maximum length of study (10 semesters).
- Students are proven to be in violation of rules or regulations that causes the students to lose their rights as an FTUI student.

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.

Students of the Doctoral Program (Research) will lose their right to continue to study (dropping out) if:

- Students do not register academically and administratively for two consecutive semesters, thus automatically being considered to have resigned from UI.
- Students fail to obtain a minimum of 'B' for their research proposal examination or a similar exam at the end of their fourth semester.
- Students fail to complete a minimum of 50% of their research based on the judgment of the Promoter Team by the end of their sixth semester.
- Students fail to complete a minimum of 75% of their research based on the judgment of the Promoter Team by the end of their eighth semester.
- At the end of the study period (ten semesters), students fail to complete 4 points above.
- Students fail to do the following by the end of their study period of ten semesters: producing 1 (one) scientific paper based on research for their dissertation as the main writer that is presented at an international scientific conference and published in the proceedings as a full paper (6 credits); producing 1 (one) scientific paper based on research for their

dissertation as the main writer with an option to work with the Promoter Team as their co-writer that has been accepted to be published in an indexed international journal (8 credits); submitting 1 (one) scientific paper that has been accepted to be published in a nationally accredited journal; submitting proof of compliance with the foregoing requirement as part of the requirements for promotion exam; and submitting 1 (one) dissertation and participating in a promotion exam as the final step of the Doctoral Program (6-8 credits).

- Students exceed the maximum length of study (10 semesters).
- Students are proven to be in violation of rules or regulations that causes the students to lose their rights as an FTUI student.

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.

Academic Leave

Students who wish to be away from their academic endeavors at FTUI for one to two semesters, but intend to return to FTUI are eligible for an academic leave of absence. Leave of absence can only be given to a student who has studied at FTUI for at least two semesters, unless under specific circumstances. Academic leave for special circumstances is an academic leave that is given to a student for unavoidable reasons, such as: carrying out state task, undertaking university task, or undergoing medical treatment, which prohibit the said student from participating in academic activities. Academic leave is not counted as part of the length of study.

Procedures of Academic Leave

1. To apply for academic leave, a student must write a letter requesting for academic leave to the Head of Department. Head of Department will give recommendation to Vice Dean based on the student request before the beginning of the administrative registration period of the relevant semester.
2. If the academic leave is approved by the Vice Dean, PAF will change the status of the student to 'academic leave' before the beginning of the administrative registration period of the relevant semester, and the amount of tuition will be automatically changed.
3. The student must pay 25% of tuition during the period of administrative registration of the intended semester.
4. If the student has been granted an academic leave but fails to pay the required tuition during the registration period, the academic leave will be canceled, and the student's status will change to 'inactive' (empty).
5. In the situation as stated above, if the student still insists on making payment after the registration period has passed, the student will be charged a late administrative registration fee in the amount stated in the Rector's Regulation on Academic Fees.
6. If the student fails to pay during the prescribed period of administrative registration, Exceptional Administrative Registration will apply.
7. If the academic leave is proposed not in accordance with point (1) above, or proposed after the semester starts, the student must pay the full amount (100%) of tuition.

Faculty and Department Judiciums

Judicium 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.

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 on student's request, while the diploma and academic transcripts are issued only once at the time of the student's graduation. Student Academic History and Academic Transcript contain the names, course codes and grades of all courses that the student have taken 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.

The Semester Academic Transcript (DNS) gives the information on the student's identity (name, student ID and highest education level), Academic Advisor, Faculty, Study Program, Specialty, Education Level, Subject Code, Subject Title, Credit, Letter Grade, Semester GPA, and GPA. The Semester Academic Transcript can be issued in hard copy form on a student request as required. A valid DNS is signed by

the academic administration official in the Faculty level.

Academic Record chronologically lists all academic activities of a student since the FRS time registered as a student until no longer registered, either due to graduation, expulsion, or resignation. The academic status of a student for each semester is recorded in the Academic Record. The Academic Record is also used as a source of information for the student, Academic Advisor, and Study Program to help the student to achieve success in their study and is issued as required on the student's request and validated by the Vice Dean of the Faculty.

Academic Transcript is given to students that have been declared to fulfill all requirements to graduate from a Study Program in a faculty meeting and contains information on a student identity (name, student ID, place and date of birth), previous education, education level, study program, specialty, list and code number of subjects, letter grade, number of required credits, number of obtained credits, GPA, title of the student's Final Project, diploma number and year of graduation. All subjects taken by the student, including repeated subjects and transfer credit subjects, are included in the Academic Transcript which is issued in two languages, Bahasa Indonesia and English. The Academic Transcript will be given to students with no outstanding tuition fees.

Diploma is given to a student who has been verified in a faculty members meeting to complete all requirements to graduate from a Study Program. Diploma contains information on the personal identity of the diploma holder (name, place and date of birth), academic title, name and signature of the Rector and Dean, issuance date of diploma, date of graduation, student ID, diploma number and signature and photo of the diploma holder. In the event that the diploma is lost or damaged, the diploma holder may request another copy of the diploma. Dean/ Vice Dean/ Director of Academic on behalf of the Rector may signed to validate a copy of diploma. Diploma will be given to students with no outstanding tuition fees.

Offenses and Sanctions

In any courses, no student shall engage in any form of unethical or improper conducts, including but not limited to examination offenses, such as:

1. Utilizing unauthorized materials/notes to enhance performance during on examination.
2. Attempting to observe the work of another student.
3. Taking an examination for another person, or permitting someone else to do so.
4. Collaborating improperly by joint effort on discussion in anyway expressly prohibited by lecturer.
5. 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.

Academic Sanction for Perpetrators of Academic Cheating In Exams

1. Academic sanction in the form of the revocation of the said exam (E grade) for the student caught or proven committing academic offence in the examination process, such as working with any other student, copying any other student's work or giving answer to any other student;
2. Academic sanction in the form of study period revocation (for all subjects) for the said semester for the student caught or proven committing academic offence in examination process such as opening books, notes or any other equipment prepared beforehand;
3. Academic sanction in the form of revocation of study period for the said semester and one semester suspension for the student caught or proven committing academic offence in the examination process due to collaborating with any third party outside of the examination room;
4. Academic sanction in the form of expulsion from the Faculty of Engineering, Universitas Indonesia, for the student caught or proven committing academic offence in the examination process by substituting any other examinee or by having someone else to take their place;
5. Academic sanction in the form of expulsion from the Faculty of Engineering, Universitas Indonesia, for the student

caught or proven committing academic offence in the examination process for planning and carrying out the plan to help any other examinee;

6. Other academic offence will be handled through a hearing by the Offence Settlement Committee (Panitia Penyelesaian Pelanggaran Tata Tertib (P3T2)), Faculty of Engineering, Universitas Indonesia;

7. Student is entitled to submit an appeal to the Faculty Academic Senate with the help of their Academic Advisor and the Vice Dean for Academic, Research, and Student Affairs, Faculty of Engineering, Universitas Indonesia..

Academic Sanction on Plagiarism and Act of Fraud in the Completion of Final Project

Plagiarism is an act of stealing ideas or thought already available in written and/or someone else's writing and used them as if it is our own ideas, thoughts and/ or writing thus causing harm/loss to the original owner both material or non material, this plagiarism can be in the form of using a word, phrase, sentence, paragraph, or even a chapter of someone else's writing or book, without stating the source. Included in this is the auto plagiarism.

Auto Plagiarisme is an act of using an idea or thought repeatedly in writing or using someone's own writing in parts or whole without stating the origin published source as if those ideas or thoughts are a new idea, thought and/or writing.

Plagiarism criteria used as a based to decide a sanction focuses on the amount of idea or phrase stolen and how similar the writing in phrase, sentence, paragraph, section, chapter, and the writing as a whole. A work can be considered plagiarism if based on the verification result on the writing contained a similarity level of 35% or more with the original work. To prevent plagiarism, student is obligated to check their final work using software of anti plagiarism provided by the Faculty or University before submitting their work to their advisor/promoter/co-promoter. If such software is unavailable, student is required to check existing list of research in connection to the topic of their research and state such research in their reference of research. Student caught and proven of committing plagiarism is entitled to an appeal tried in the Study Program level to the Faculty which the Faculty will later passed on to the university through the P3T2 to be verified and processed.

In case of an active student, early sanction can be in the form of delaying the final project examination or delaying the graduation status for student who has been declared passing the final project examination. Student that has been declared as a graduate but have not received their diploma, with the approval of the Rector, the Dean may hold said student diploma while await the Rector's final decision. Academic sanction on plagiarism for active student is established through the Dean's decree based on the proposal by the Head of the Study Program or recommendation from the Faculty in one month at the latest since the date of the proposal letter was accepted by the Dean. For graduate student is established through the Rector's Decree based on the P3T2 recommendation. The heaviest academic sanction given can be in the form of cancellation of the student final project (for active student) with the obligation to write a new final project with new topic, while for graduate student the sanction is in the form of revocation of academic titles.

The act of fraud in the writing of Final Project, Essay as Exam Substitute, or Assignment, includes the usage of other person's service/ replacement/ consultant/ or other service to complete assignments in the name of said student and other manipulative act of fraud. This act does not include the usage of service for data collecting, survey, and data processing for the completion of final project of student. Sanction given to the perpetrator of said act of fraud in the completion of final project is established throught the Dean's decree issued in one month at the latest since the proposal letter from the Head of Study Program is received by the Dean. The heaviest academic sanction given can be in the form of cancellation of the student final project (for active student) with the obligation to write a new final project with new topic, while for graduate student the sanction is in the form of revocation of academic titles. Active students who consciously act as a ghost writer in writing the final works for other students will be given the equivalent of student academic sanction given to the perpetrators of acts of fraud.

Academic Regulation Of The Universitas Indonesia

List of Academic Regulations at Universitas Indonesia can be accessed via http://respository.ui.ac. id. Below is a list of Decrees that functioned as reference for education program at Universitas Indonesia

General:

1. 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

Education

1. Decree of the Rector Universitas Indonesia Number: 285/SK/R/UI/2003 on the Implementation Guidelines for Cross-Faculty Lectures in Universitas Indonesia
2. Decree of the Board of Trustees Universitas Indonesia Number: 006/MWA-UI/2004 on the Universitas Indonesia's Academic Curriculum
3. Decree of the Rector of Universitas Indonesia Number: 491/SK/R/UI/2004 on Universitas Indonesia Education Activities Conclusion Regulations
4. Decree of the Board of Trustees Universitas Indonesia Number: 001/TAP/MWA-UI/2005 on the Establishment of Academic Degrees in the Universitas Indonesia.
5. 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
6. Regulation of the Board of Trustees Universitas Indonesia Number: 006/Peraturan/MWA-UI/2005 on Student Learning Outcomes Evaluation at Universitas Indonesia
7. Regulation of the Board of Trustees Universitas Indonesia Number: 007/Peraturan/MWA-UI/2005 on Academic Education Implementation Norms in Universitas Indonesia
8. Regulation of the Board of Trustees Universitas Indonesia Number: 008/Peraturan/MWA-UI/2005 on Professional Education Curriculum Norms in Universitas Indonesia
9. Decree of the Rector of Universitas Indonesia Number: 838/SK/R/UI/2006 on Administration of Universitas Indonesia Student's Learning Outcomes
10. Decree of the Rector of Universitas Indonesia Number: 012/SK/R/UI/2007 on Implementation of the of Students Learning Activity in Universitas Indonesia
11. Decree of the Rector of Universitas Indonesia Number: 450/SK/R/UI/2008 on the Implementation of E-Learning in the University Indonesia
12. Decree of the Dean of Faculty of Engineering Universitas Indonesia Number: 3 year 2019 on the English Requirements for Undergraduate International Program Single Degree and Double Degree Faculty of Engineering Universitas Indonesia.
13. Decree of the Rector of Universitas Indonesia Number : 24 year 2022 on the Implementation of Undergraduate Program in Universitas Indonesia
14. Decree of the Rector of Universitas Indonesia Number : 25 year 2022 on the Implementation of Master Program in Universitas Indonesia
15. Decree of the Rector of Universitas Indonesia Number : 26 year 2022 on the Implementation of Doctoral Program in Universitas Indonesia
16. Decree of the Rector of Universitas Indonesia Number : 29 year 2022 on the Implementation of Professional Education Programs in Universitas Indonesia
17. Decree of the Dean of Faculty of Engineering Universitas Indonesia Number: 622/D/SK/FTUI/IX/2016 on Academic Sanction for Academic Fraud Perpetrator in Faculty of Engineering Universitas Indonesia.
18. Decree of the Dean of Faculty of Engineering Universitas Indonesia Number: 623/D/SK/FTUI/IX/2016 on General Regulation on Supplementary Exam for Mid Term and Final Examination in Faculty of Engineering Universitas Indonesia.
19. Decree of the Dean of Faculty of Engineering Universitas Indonesia Number: 624/D/SK/FTUI/IX/2016 on Academic Sanction for Plagiarism and Act of Fraud in the Completion of Final Project in Faculty of Engineering Universitas Indonesia.
20. Decree of the Dean of Faculty of Engineering Universitas Indonesia Number : 2 year 2022 on the Scientific Publication Assessment Guide for Master Program and Doctoral Program in Faculty of Engineering Universitas Indonesia.
21. Decree of the Dean of Faculty of Engineering Universitas Indonesia Number : 703 year 2016 ont the Credit Transfer

Research

1. Decree of the Board of Trustees Universitas Indonesia Number 002/SK/MWA-UI/2008 on University's Research Norms
2. Decree of the Board of Trustees Universitas Indonesia Number 003/SK/MWA-UI/2008 on Research Policy at Universitas Indonesia
3. Decree of the Board of Trustees Universitas Indonesia Number 009/SK/MWA-UI/2008 on

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

CHAPTER 3

LABORATORY FACILITIES

LIST OF NAMES OF HEADS OF LABORATORY AND CIVIL ENGINEERING DEPARTMENT YEAR 2023

No	Head of Laboratory	Laboratory	Laboratory Assistant	Subjects Related to Lab
1	Lab. Struktur dan Material	Dr-Ing. Josia Irwan Rastandi, S.T., M.T.	Farah Dini Sofyani	1. Praktikum Property Material 2. Praktikum Perkerasan Jalan
2	Lab. Mekanika Tanah	Dr. Ir. Wiwik Rahayu, DEA.	1. Ria Dany Eviliana, S.T. 2. Riyanto 3. Sunarto 4. Fahruroji 5. Saprudin	1. Mekanika Tanah
3	Lab. Hidrolika, Hidrologi dan Sungai	Dr. Raden Rara Dwinanti Rika Marthanty, S.T., M.T.	Subagyo	1. Mekanika Fluida 2. Hidrolika, 3. Teknik Pantai 4. Teknik Sungai 5. Hidrolika Air Tanah 6. Hidrologi Teknik
4	Lab. Transportasi	Ir. R. Jachrizal Sumabrata, M.Sc. (Eng)., Ph.D	-	1. Teknik Transportasi 2. Rekayasa Lalu Lintas 3. Kebijakan Transportasi 4. Perancangan Jalan Raya 1 5. Perancangan Jalan Raya 2 6. Ekonomi Transportasi
5	Lab. Rekayasa dan Kualitas Air	Dr. RM. Sandyanto Adityosulindro, S.T., M.T., M.Sc.	Licka Kamadewi	1. Kimia Lingkungan 2. Laboratorium Lingkungan 3. Kimia Dasar 4. Mikrobiologi Lingkungan
6	Lab. Manajemen Udara dan Limbah Padat	Dr. Eng. Mochamad Adhiraga Pratama, S.T., M.T.	Pipit Fitriah	1. mikrobiologi lingkungan modul Bioaerosol 2. laboratorium lingkungan modul sampling sampah
7	Lab. Konstruksi dan Pemetaan	Leni Sagita Riantini S.T., M.T., Ph.D.	Audy Christian Rayvano Kalalo, S.T	1. Gambar Konstruksi dan SMK3L 2. Ilmu Ukur Tanah

CHAPTER 4

UNDERGRADUATE PROGRAM

Undergraduate Program in Civil Engineering

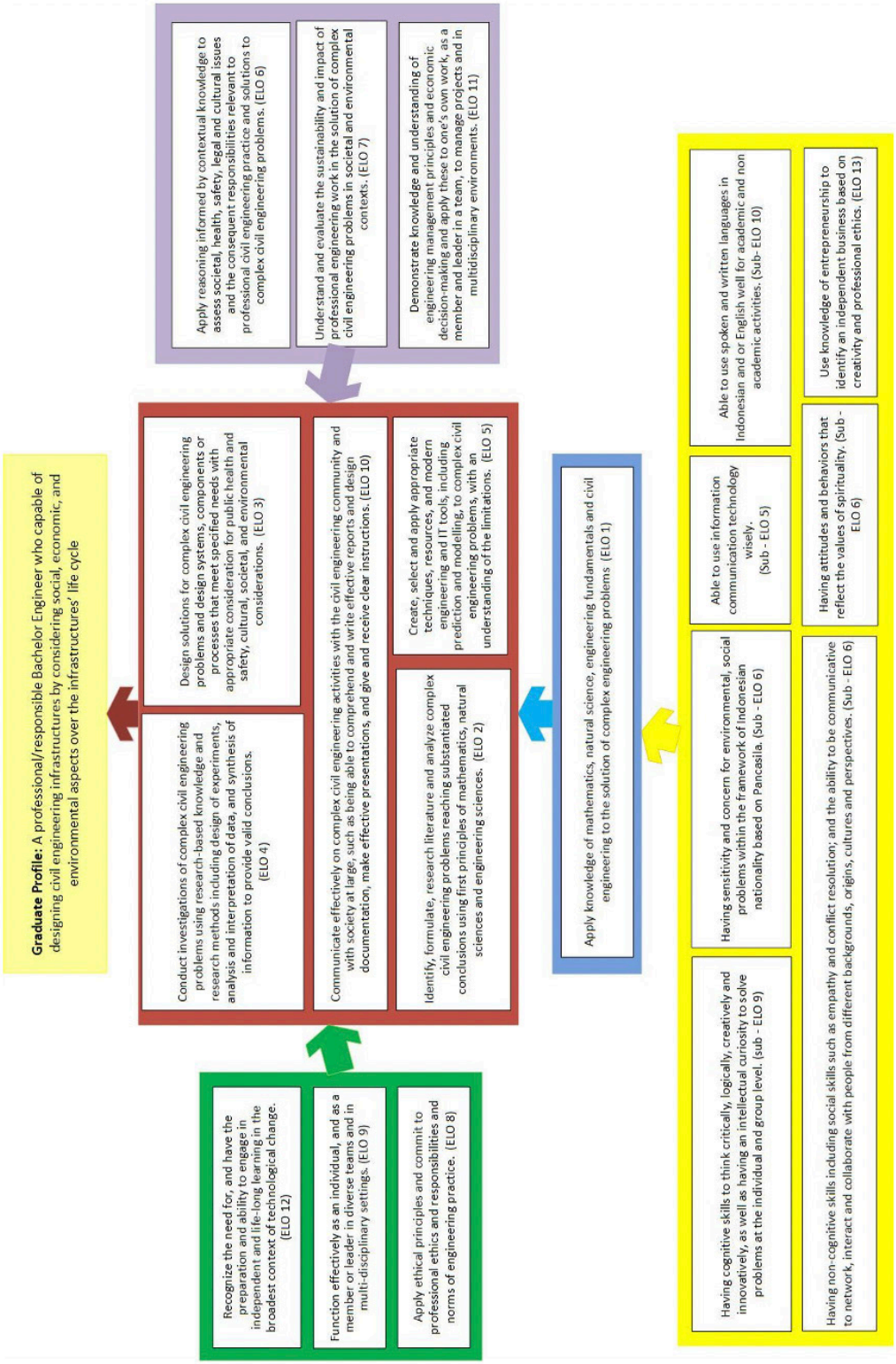
Program Specification

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.	**Faculty**	Engineering	
4.	**Programme Tittle**	Undergraduate Program in Civil Engineering	
5.	**Vision and Misson**	Vision of Civil Engineering Study Programme To become a center of knowledge and technology in Civil Engineering and Environmental Engineering and to play an important role in global market Mission of Civil Engineering Study Programme 1. To improve the quality of graduates in mastering Civil and Environmental Engineering knowledge with solid foundation, and to provide them with internationally standardized environmental insight 2. To actively contribute ideas through research including direct involvement in community service that is oriented to the development of facilities and infrastructure in the Civil and Environmental Engineering discipline, as well as reflecting upon the balanced relationships between human beings and nature. 3. To shape and build students that can demonstrate strong leadership and independent personality, along with the ability to socialize, communication effectively and uphold profession ethics.	
6.	**Class**	Regular, Non Reguler, and International	
7.	**Final Award**	Sarjana Teknik (S.T) Double Degree: Sarjana Teknik (S.T) and Bachelor of Engineering (B.Eng)	
8.	**Accreditation / Recognition**	BAN-PT: Excellent - accredited AUN-QA IABEE	
9.	**Language(s) of Instruction**	Bahasa Indonesia and English	
10.	**Study Scheme (Full Time / Part Time)**	Full Time	
11.	**Entry Requirements**	High school /equivalent, or D3 / Polytechnique / equivalent, AND pass the entrance exam.	
12.	**Study Duration**	Designed for 4 years	
	Type of Semester	Number of Semester	Number of weeks / semester
	Regular	8	16
	Short (optional)	3	8
13.	**Aims of The Programme** 1. Able to design environmentally friendly infrastructure professionally and based on reliable economic analysis; 2. Able to communicate and coordinate effectively; and 3. Have an adaptive attitude and open to the dynamics of science		

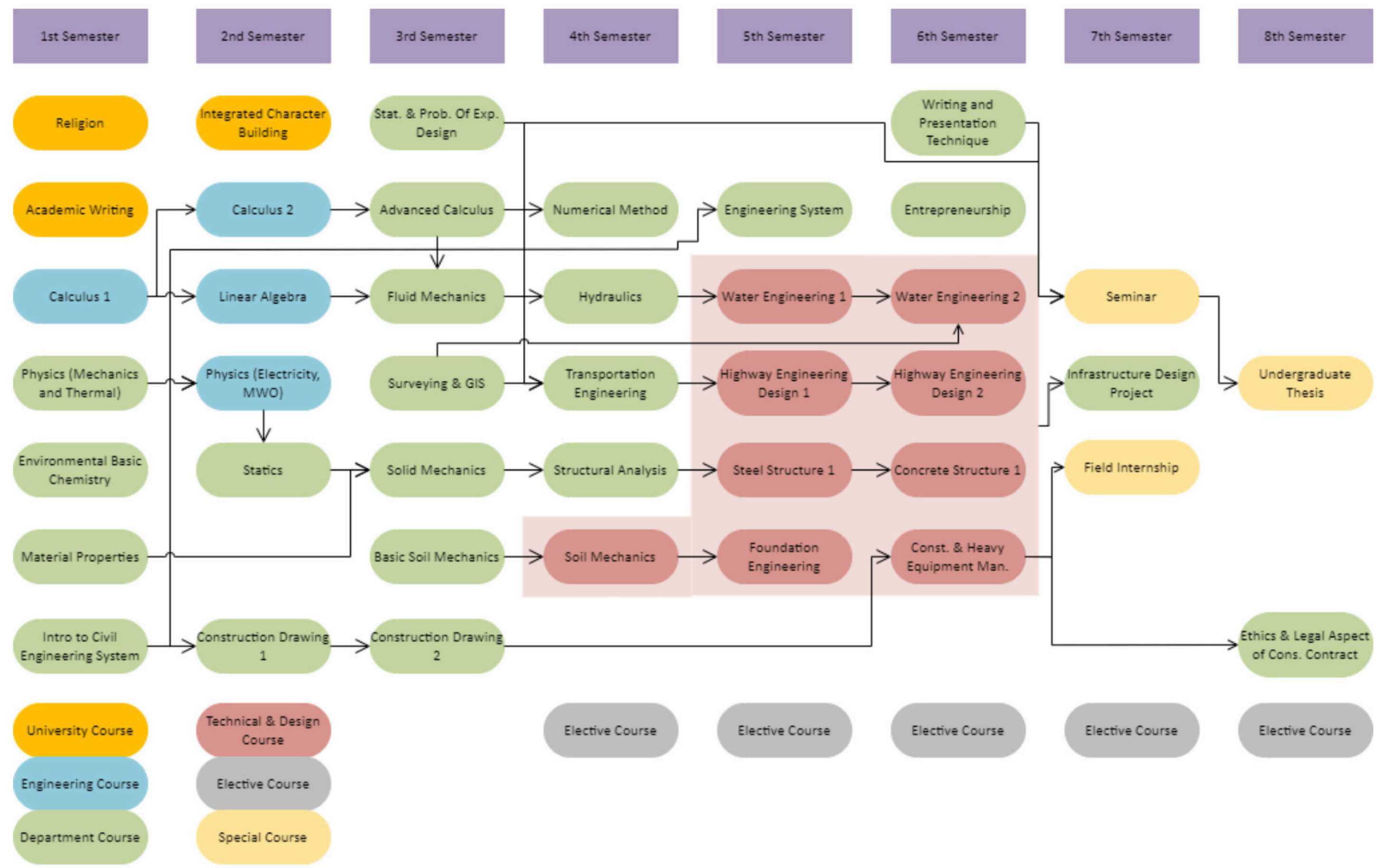
14.	**Graduate Profiles:** A professional/responsible Bachelor Engineer who are capable of designing and building civil engineering infrastructures by considering social, economic, and environmental aspects over the infrastructures' life cycle.
15.	Expected Learning Outcomes: 1. Apply knowledge of mathematics, natural science, engineering fundamentals and civil engineering to the solution of complex engineering problems. 2. Identify, formulate, research literature and analyze complex civil engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. 3. Design solutions for complex civil engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations. 4. Conduct investigations of complex civil engineering problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions. 5. Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex civil engineering problems, with an understanding of the limitations. 6. Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional civil engineering practice and solutions to complex civil engineering problems. 7. Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex civil engineering problems in societal and environmental contexts. 8. Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice. 9. Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings. 10. Communicate effectively on complex civil engineering activities with the civil engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. 11. Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. 12. Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. 13. Apply knowledge of entrepreneurship to identify an independent business based on creativity and professional ethics.
16.	**Classification of Subjects**

No.	Classification	Credit Hours (SKS)	Percentage
i	**University General Subjects**	10	6 %
ii	**Basic Engineering Subjects**	13	9 %
iii	**Core Subjects**	88	61 %
iv	**Elective Subjects**	26	18 %
v	**Industrial Attachment, Seminar, Undergraduate Thesis, Project**	8	6%
	Total	145	100 %
	Total Credit Hours to Graduate		145 SKS

Learning Outcomes



Flow Diagram of Subjects Undergraduate Program on Civil Engineering



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

Code	Subject	SKS
	1st Semester	
UIGE 600 004	Religion	2
UIGE 600 003	Academic Writing	2
ENGE 600 001	Calculus 1	3
ENCV 601 001	Physics (Mechanics and Thermal)	4
ENCV 601 002	Environmental Basic Chemistry	3
ENCV 601 003	Intro to Civil Engineering System	3
ENCV 601 004	Material Properties	**3**
	Sub-Total	**20**
	2nd Semester	
UIGE 600 007	Integrated Charater Building	6
ENGE 600 002	Calculus 2	3
ENGE 600 007	Physics (Electricity, MWO)	3
ENGE 600 004	Linear Algebra	4
ENCV 602 001	Construction Drawing 1	2
ENCV 602 002	Statics	3
	Sub-Total	**21**
	3rd Semester	
ENCV 603 001	Construction Drawing 2	3
ENCV 603 002	Solid Mechanics	4
ENCV 603 003	Fluid Mechanics	3
ENCV 603 004	Statistics and Probabilistic of Experimental Design	2
ENCV 603 005	Basic Soil Mechanics	3
ENCV 603 006	Surveying & Geospatial Information Systems	2
ENCV 603 007	Advanced Calculus	3
	Sub Total	**20**
	4th Semester	
ENCV 604 001	Soil Mechanics	3
ENCV 604 002	Hydraulics	3
ENCV 604 003	Structural Analysis	4
ENCV 604 004	Numerical Method	2
ENCV 604 005	Transportation Engineering	3
	Elective Course	5
	Sub-Total	**20**
	5th Semester	
ENCV 605 001	Foundation Engineering	3
ENCV 605 002	Engineering System	2
ENCV 605 003	Highway Engineering Design 1	4
ENCV 605 004	Steel Structure 1	3
ENCV 605 005	Water Engineering 1	3
	Elective Course	5
	Sub-Total	**20**
	6th Semester	
ENCV 606 001	Concrete Structure 1	3
ENCV 606 002	Construction & Heavy Equipment Management	4
ENCV 606 003	Highway Engineering Design 2	2
ENCV 606 004	Writing and Presentation Technique	2
ENCV 606 006	Water Engineering 2	3
	Elective Course	9
	Sub Total	**19**
	7th Semester	
ENCV600110	Seminar	1
ENCV 600 100	Field Internship	3
ENCV 607 001	Infrastucture Design Project	4
	Elective Courses	7
	Sub Total	**15**
	8th Semester	
ENCV 600 200	Undergraduate Thesis	4
ENCV 608 001	Ethics and Aspects in Construction Contract Laws	2
	Elective Courses	4
	Sub Total	**10**
	Total	**145**

Electives Course

Code	Elective Courses	SKS
	4th Semester	
ENCV 604 101	Application of the FEM with Program Package Software	3
ENCV 600 300	Internship A	2
ENCV 600 011	Engineering Economics	**3**
Code	**5th Semester**	**SKS**
ENCV 605 102	Cold Formed Steel Structure	2
ENCV 605 301	Airport Planning	2
ENCV 600 012	HSE Protection	**2**
Code	**6th Semester**	**SKS**
ENCV 600 400	Internship B	3
ENCV 606 103	Steel Structure 2	3
ENCV 606 201	Introduction to Geotechnical Investigation	2
ENCV 606 302	Railroad Transportation	2
ENCV 606 303	Transportation and Environment	3
ENCV 606 005	Entrepreneurship	**2**
Code	**7th Semester**	**SKS**
ENCV 607 104	Concrete Structure 2	3
ENCV 607 202	Geotechnical Construction Method	2
ENCV 607 304	Port Planning	3
ENCV 607 401	Coastal Engineering	3
ENCV 607 402	River Engineering	2
ENCV 607 501	Introduction to Stakeholders and Project Communications	2
ENCV 607 502	Introduction to Management System of HSE	2
ENCV 600 600	Special Topic of Research Collaboration	3
ENCV 600 200	Student Affairs	1
Code	**8th Semester**	**SKS**
ENCV 608 403	Stormwater management	2
ENCV 608 404	Water Resources Infrastructure	2
ENCV 608 503	Introduction to Quality & Risk Management	2
ENCV 608 504	Introduction to Procurement Management & Contract Administration and Claim	2

Structural Engineering Courses		
Code	**Course**	**SKS**
ENCV 601 004	Material Properties	2
ENCV 602 002	Statics	3
ENCV 603 002	Solid Mechanics	4
ENCV 604 101	Application of the FEM with Program Package Software	3
ENCV 605 004	Steel Structure 1	3
ENCV 606 001	Concrete Structure 1	3
Geotechnical Engineering Courses		
Code	**Course**	**SKS**
ENCV 602 002	Statics	3
ENCV 603 002	Solid Mechanics	4
ENCV 603 005	Basic Soil Mechanics	3
ENCV 604 001	Soil Mechanics	3
ENCV 605 001	Foundation Engineering	3
	Geotechnical Elective Course	2-3
Construction Management Engineering Courses		
Code	**Course**	**SKS**
ENCV 602 001	Construction Drawing 1	2
ENCV 603 001	Construction Drawing 2	3
ENCV 606 002	Construction & Heavy Equipment Management	4
ENCV 608 001	Ethics and Aspects in Construction Contract Laws	2
ENCV 607 501	Introduction to Stakeholders and Project Communications	3
ENCV 608 503	Introduction to Quality & Risk Management	3
Water Resource Engineering Courses		
Code	**Course**	**SKS**
ENCV 603 003	Fluid Mechanics	3
ENCV 604 002	Hydraulics	3
ENCV 605 005	Water Engineering 1	3
ENCV 606 006	Water Engineering 2	3
ENCV 801 402	Hydrological Engineering	3
ENCV 608 404	Water Resources Infrastructure	3
Transportation Engineering Courses		
Code	**Course**	**SKS**
ENCV 603 006	Surveying & GIS	2
ENCV 604 005	Transportation Engineering	3

ENCV 606 303	Transportation & Environment	2
ENCV 605 301	Airport Planning	2
ENCV 803 502	Public Transportation Planning	3
ENCV 803 508	Logistics Transportation	3

Transition Policy from the 2016 to the 2020 Curriculum

1. New curriculum 2020 will be applied effectively from Odd Semester 2020/2021. In principle, after curriculum 2020 is implemented, then only courses from this new curriculum will be opened.
2. For class 2019 and above will follow this transition rules.
3. The enforcement of the transitional period is one year. During this transition period, if a course in curriculum 2020 is in odd semester while in previous curriculum in even semester (vice versa), then this course can be held (if necessary) in both semesters.
4. For students who have not passed the compulsory courses in curriculum 2016, are required to take the same course or equivalent in curriculum 2020. Equivalence courses can be seen in the table below. All courses in the curriculum 2016 that are not listed in equivalence table have not changed, both in names and credits.
5. When there is a change in the course credits, then the number of graduation credits counted in, is the number of credits when it was taken. The same or equivalent courses when are equated with different credits, if retaken, or just taken will be acknowledged under a new name and credits. (see course equivalence table).
6. When a compulsory subject in the curriculum 2016 is deleted and there is no equivalence in the curriculum 2020 then:
7. For students who have passed these subjects, the credits that are achieved will be counted in the calculation of graduation 144 credits.For students who did not pass these courses, they can take new compulsory courses or choose elective subjects in the curriculum 2020 to complete 144 credits.

Equalizing the 2016 Curriculum Subjects and the 2020 Curriculum for Civil Engineering Undergraduate

No	Name of Courses in Curriculum 2016	Credits 2016	Name of Courses in Curriculum 2020	Credits 2020	Remarks
1	Integrated Character Building - A (MPKT A)	6	Integrated Character Building (MPKT)	6	Those who have not pass MPKT-A and MPKT-B can enroll in MPKT Those who have not pass one of MPKT-A or MPKT-B; do not have to retake MPKT
2	Integrated Character Building - B (MPKT B)	6			
3	Sport/Art	1	None		Those who have not pass; see transition rule #6
4	Religion	2	Religion	2	The change of teaching learning method; (refer to course plan / syllabus)
5	English	3	English	2	
6	Physics - Mechanics and Thermal	3	Physics - Mechanics and Thermodynamics	4	The change of course name
7	Physics - Mechanics and Thermal Lab	1	None	-	Those who have not pass the laboratory courses are suggested to enroll in one of new compulsory courses of Curriculum 2020
8	Physics - Electricity, MWO Lab	1	None	-	

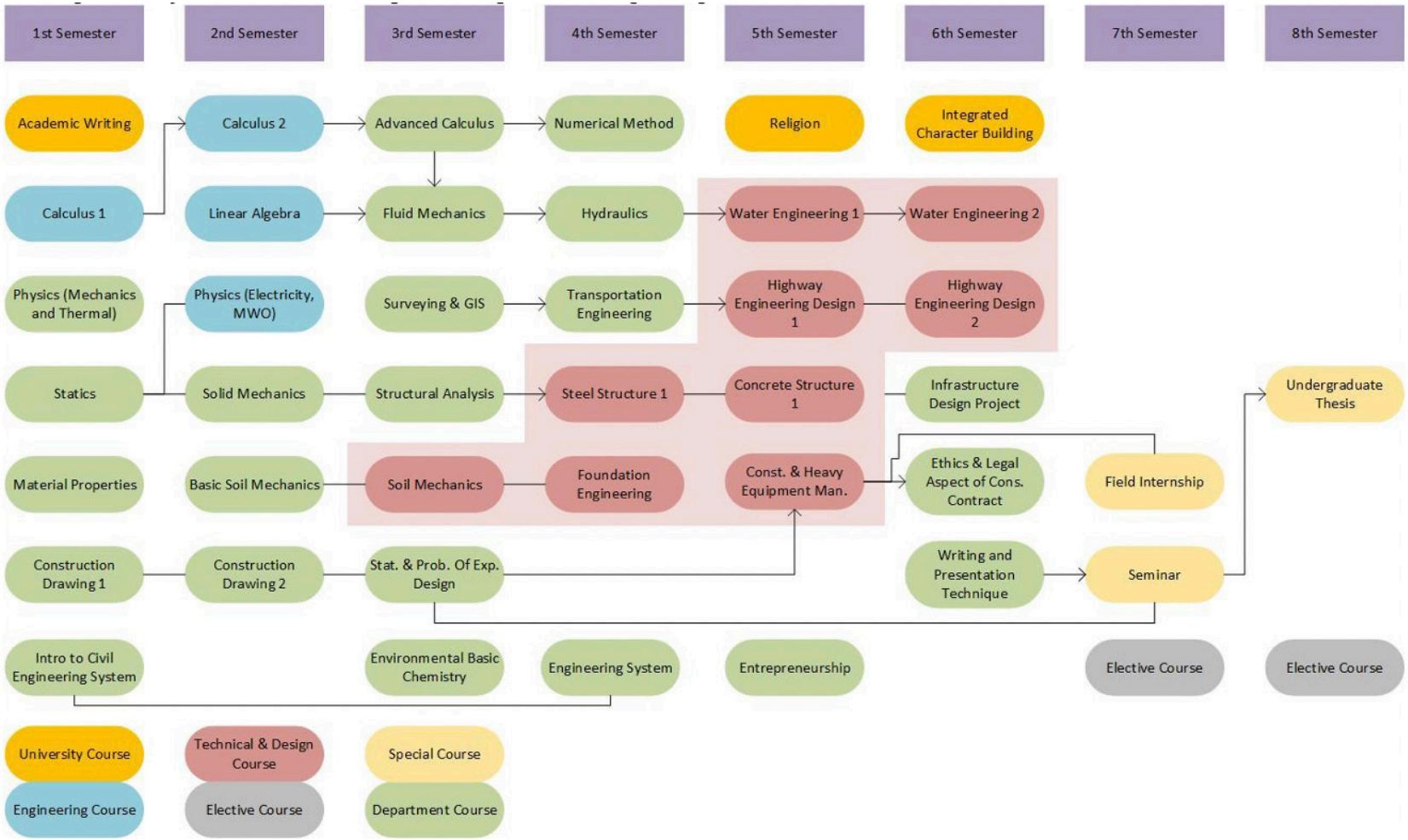
9	Basic Chemistry	2	Environmental Basic Chemistry	2	Those who have not pass one of Basic Chemistry or Advanced Chemistry should enroll in Environment Basic Chemistry
10	Advanced Chemistry	2		2	
11	Construction Drawing	2	Construction Drawing 1	2	The change of course name
12	Surveying	3	Surveying & Geospatial Information System	2	The change of course name & credits
13	Statics	4	Statics	3	The change of course credit
14	Statistic & Probabilistic	2	Statistic & Probabilistic Experiments	2	The change of course name
15	Building Construction	3	Construction Drawing 2	3	The change of course name
16	Structural Analysis	3	Structural Analysis	4	The change of course credit
17	Road Geometric Design	3	Highway Engineering Design 1	4	Those who have not pass one of Road Geometric Design or Pavement Engineering should enroll in both Highway Engineering 1 and 2
18	Pavement Design	3	Highway Engineering Design 2	2	
19	Construction Management	2	Construction & Heavy Equipment Management	4	Those who have not pass one of Construction Management or Construction Methods & Equipments should enroll in Construction & Heavy Equipment Management
20	Construction Methods & Equipments	2			
21	Capstone Project	3	Infrastructure Design Project	4	The change of course name & credits
22	Internship	3	Field Internship	3	The change of prequisite
23	Seminar	1	Seminar	1	
24	Final Project	4	Final Project	4	
25	-		Student Activity	1	New courses, compulsory for batch 2018 onward
26	-		Civil Engineering System	2	
27	-		Effective Communication	2	
28	-		Internship A Internship B	2/3	New elective courses

Course Structure International Undergraduate Program on Civil Engineering

Code	Subject	SKS
	1st Semester	
UIGE 600 003	Academic Writing	2
ENGE 610 001	Calculus 1	3
ENCV 611 001	Physics (Mechanics and Thermal)	4
ENCV 611 002	Statics	3
ENCV 611 003	Construction Drawing 1	2
ENCV 611 004	Material Properties	3
ENCV 611 005	Intro to Civil Engineering System	3
	Sub Total	**20**
	2nd Semester	
ENGE 610 002	Calculus 2	3
ENGE 610 007	Physics (Electricity, MWO)	3
ENGE 610 004	Linear Algebra	4
ENCV 612 001	Basic Soil Mechanics	3
ENCV 612 002	Construction Drawing 2	3
ENCV 612 003	Solid Mechanics	4
	Sub Total	**20**
	3rd Semester	
ENCV 613 001	Statistics and Probabilistic of Experimental Design	2
ENCV 613 002	Advanced Calculus	3
ENCV 613 003	Environmental Basic Chemistry	3
ENCV 613 004	Soil Mechanics	3
ENCV 613 005	Fluid Mechanics	3
ENCV 613 006	Surveying & Geospatial Information Systems	2
ENCV 613 007	Structural Analysis	4
	Sub Total	**20**
	4thSemester	
ENCV 614 001	Engineering System	2
ENCV 614 002	Transportation Engineering	3
ENCV 614 003	Steel Structure 1	3
ENCV 614 004	Hydraulics	3
ENCV 614 005	Numerical Method	2
ENCV 614 006	Foundation Engineering	3
	Elective Courses	**3**
	Sub Total	**19**
	5th Semester	
UIGE 600 004	Religion	2
ENCV 615 001	Highway Engineering Design 1	4
ENCV 615 002	Water Engineering 1	3
ENCV 615 003	Construction & Heavy Equipment Management	4
ENCV 615 004	Concrete Structure 1	3
	Elective Courses	**4**
	Sub Total	**20**
	6th Semester	
UIGE 600 007	Integrated Charater Building	6
ENCV 616 001	Water Engineering 2	3
ENCV 616 002	Writing and Presentation Technique	2
ENCV 616 003	Highway Engineering Design 2	2
ENCV 616 004	Ethics and Legal Aspect of Construction Contract	2
ENCV 616 005	Infrastructure Design Project	4
	Sub Total	**19**
	7th Semester	
ENCV 610 100	Field Internship	3
	Elective Course	10
	Sub Total	**13**
	8th Semester	
ENCV 610 300	Final Project	5
	Elective Course	9
	Total	**14**
	Total	**145**

Code	Elective Courses	SKS
	Odd Semester	
ENCV 617 101	Cold Formed Steel Structure	2
ENCV 617 102	Concrete Structure 2	3
ENCV 617 201	Geotechnical Construction Method	2
ENCV 617 301	Airport Planning	2
ENCV 617 302	Port Planning	3
ENCV 617 401	Coastal Engineering	3
ENCV 617 402	River Engineering	2
ENCV 617 501	Introduction to Stakeholders and Project Communications	2
ENCV 617 502	Introduction to Management System of HSE	2
ENCV 610 200	Service Learning	1
ENCV 610 400	Internship A	2
ENCV 610 500	Special Topic of Research Collaboration	3
ENGE 610 012	HSE Protection	2
ENCV 615 005	Entrepreneurship	2
ENCV 618 503	Introduction to Quality & Risk Management	2
	Even Semester	
ENCV 618 103	Application of the FEM with Program Package Software	3
ENCV 618 104	Steel Structure 2	3
ENCV 618 303	Railroad Transportation	2
ENCV 618 304	Transportation and Environment	3
ENCV 618 403	Stormwater management	2
ENCV 618 404	Water Resources Infrastructure	2
ENCV 618 503	Introduction to Quality & Risk Management	2
ENCV 618 504	Introduction to Procurement Management & Contract Administration and Claim	2
ENCV 610 600	Internship B	3
ENCV 610 011	Engineering Economics	3

Flow Diagram of Subjects – International Undergraduate Program on Civil Engineering



FACULTY OF ENGINEERING

Course Sylabus of University Subjects

INTEGRATED CHARACTER BUILDING
UIGE600007/UIGE600007
6 credits

Syllabus :

The Integrated Character Building is part of the Higher Education Personality Development Lecture which is held for students which contains elements of the internalization of basic life values, interaction/ relationship skills, nationality and academic skills as the basis for student personality to carry out learning according to scientific disciplines.

MPKT is carried out in the form of a series of learning activities outside the formal class. activities carried out include participation in lectures/seminars, internships, field work practices, social work, sports and/or arts activities and other forms of activities that have the main goal of equipping students with soft skills and proven by portfolio documents. The form of this learning activity is different from the MPKT courses that have been carried out at the previous UI.

The material provided at MPKT aims to form a human thinking pattern with values and morals to create a human personality by having critical, logical, creative, innovative thinking, and having intellectual curiosity and an entrepreneurial spirit. The material provided includes 9 UI values, national, state and citizen values based on Pancasila. Solving problems in science, technology, health, and humans as natural managers by using reasoning and utilizing Information and Communication Technology (ICT) to achieve the final objectives of this module.

Lecture activities are carried out using an online student-centered learning (SCL) approach which can use the following methods: experiential learning (EL), collaborative learning (CL), problem-based learning (PBL), question-based learning, and project based learning. The use of these various methods is carried out through group discussion activities, independent assignment exercises, presentations, writing papers in Indonesian and interactive discussions in online discussion forums. The language of instruction in this lecture is Indonesian.

Graduate Learning Outcomes :

- CPL 1: Able to use spoken and written language in Indonesian and English both for academic and non-academic activities (C3, A5)
- CPL 2: Have integrity and are able to think critically, creatively, and innovatively and have intellectual curiosity to solve problems at the individual and group level (C4, A3)
- CPL 3: Able to provide alternative solutions to various problems that arise in the community, nation, and country (C4, A2)
- CPL 4: Able to take advantage of information communication technology (C3)
- CPL 5: Able to identify various entrepreneurial efforts characterized by innovation and independence based on ethics (C2, A5)

Course Learning Outcomes :

- CPMK 1: After completing this course, students are able to apply self-regulated learning characteristically in studying critically, logically, creatively, innovatively through analysis of societal problems, nation, state, and Pancasila ideology based on self-understanding as individuals and members. the community by using good and correct Indonesian and the latest information and communication technology (C4, A4)
- CPMK 2: Able to identify various entrepreneurial efforts characterized by innovation and independence based on ethics (C2, A5)
- CPMK 3: After completing this course, students are able to apply self-regulated learning characteristically in pursuing integrated and comprehensive knowledge through analysis of science problems, technology based on the role of nature manager by using good and correct Indonesian and information technology and current communications. (C4, A4)
- CPMK 4: After completing this course, students are able to plan creative activities to solve problems in society and the world of work/ industry by showing creativity, critical thinking, collaborative self-discipline using good and correct Indonesian as well as the latest information and communication technology (C5, A5)

Prerequisite : -

ACADEMIC WRITING
UIGE610002
2 credits
The Objectives :

To activate students, English so that they will be able to communicate effectively in English;

To enable students to develop the learning strategies and study skills needed to finish their study successfully and o continue learning on their

own after taking the MPK program (to develop independent learners)

Main Competencies :

- Listen to, understand and take notes of key information in academic lectures of between 5-10 minutes length;
- Improve their listening skills through various listening materials and procedures;
- Speak confidently, ask questions in and contribute to small group discussions;
- Use different reading strategies needed to the effective readers;
- Improve their reading skills through extensive reading material;
- Develop skills in connecting ideas using appropriate transitions and conjunctions;
- Work as part of a group to prepare and deliver a 25-minute presentation on an academic topic using appropriate organization, language and visual aids;
- Write a summary of a short academic article;
- Write an expository paragraph;
- Write a short essay.

Learning Method : Active learning, Contextual language learning, small group discussion.

Prerequisite :

1. Students Learning Orientation/Orientasi Belajar Mahasiswa (OBM)

ENGLISH
UIGE600003
2 credits
Course Learning Outcomes (CLO) :

After attending this subject, students are expected to capable of use English to support the study in university and improve language learning independently.

Syllabus :

Study Skills : (Becoming an active learner, Vocabulary Building: word formation and using the dictionary Listening strategies Extensive reading) Grammar: (Revision of Basic grammar Types of sentences Adjective clauses, Adverb clauses Noun clauses, Reduced clauses) Reading: (Reading skills: skimming, scanning, main idea, supporting ideas, Note-taking Reading popular science arti-cle, Reading an academic text) Listening: (Listening to short conversations, Listening to a lecture and notetaking, Listening to a news broadcast, Listening to a short story) Speaking: (Participating in discussions and meetings, Giving a presentation) Writing: (Writing a summary of a short article Describing graphs and tables, Writing an academic paragraph, Writing a basic academic essay (5 paragraphs).

ISLAMIC STUDIES
UIGE6000010/UIGE610005
2 credits
General Instructional Objectives :

The cultivation of students who have concern for social, na-tional and countrys issues based on Islamic values which is applied in the development of science through intellectual skills.

Course Learning Outcomes (CLO) :

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 prac-tice 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).

CATHOLIC STUDIES
UIGE6000011/UIGE610006
2 credits
General Instructional Objectives :

To help deliver students as intellectual capital in implementing lifelong learning process to become scientists with mature personality who uphold humanity and life.

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.

CHRISTIAN STUDIES
UIGE6000012/UIGE610007
2 credits
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.

Course Learning Outcomes (CLO) :

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.

HINDU STUDIES
UIGE6000013/UIGE610008
2 credits

Syllabus :

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.

BUDDHIST STUDIES
UIGE6000014/UIGE610009
2 credits

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).

KONG HU CU STUDY
UIGE6000015/UIGE610010
2 credits

CALCULUS 1
ENGE600001/ENGE610001
3 credits
Course Learning Outcomes:

Able to use the basic concepts of calculus related to -a function of one variable, the derivative and integration of the function of one variable in order to solve its applied problems.

Graduates Learning Outcomes:

Able to apply mathematics, science, basic engineering, and engineering specialization to be used in solving complex engineering problems.

Syllabus :
Introduction, Functions and Limits, The Derivative, Applications of the Derivative, The Definite Integral, Applications of The Definte Integral, Transcendental Functions, Techniques of Integration, Indeterminate Forms and Improper Integrals.

Prerequisite: None

Textbooks:

Main reference:
D. Varberg, E. J. Purcell, S.E. Rigdon, Calculus, 9th ed., Pearson, Prentice Hall, 2007.

Additional eferences:
1. George B. Thomas Jr., Thomas' Calculus Early Transcendental, 12th ed., Addison–Wesley Pearson, 2009.
2. Howard Anton, Calculus, 10th ed., John Wiley and Sons, 2012.

CALCULUS 2
ENGE600002/ENGE610002
3 SKS
Course Learning Outcomes:

Students are able to use the concepts of sequences, series, conic sections, and the basic concepts of calculus which involve the function of two or three variables to solve their applied problems.

Graduates Learning Outcomes:

Able to apply mathematics, science, and basic engineering and an engineering specialization to be used in solving complex engineering problems.

Syllabus :
Infinite sequences and infinite series, Test for convergence of positive series and alternating series, Power series and operation on operations, Taylor and MacLaurin series, Conic sections , Calculus in polar coordinates, Derivatives, limits, and continuity of multi-variables functions, Directional derivatives and gradients, Chain Rule, Tangent planes and Approximations, Lagrange multipliers. Double integrals in Cartesian coordinates and polar coordinates, triple integrals in Cartesian coordinates, cylindrical coordinates and spherical coordinates, Applications of double and triple Integral.

Prerequisite: Calculus 1

Textbooks:
1. D. Varberg, E. J. Purcell, S.E. Rigdon, Calculus, 9th ed., PEARSON, Prentice Hall, 2007.
2. Thomas, Calculus Thirteenth Edition Volume 2, Erlangga, 2019.

CALCULUS
ENGE600003/ENGE610003
4 SKS
Course Learning Outcomes:

Students are able to use the basic concepts of calculus involving functions of one to three variables to solve their applied problems.

Graduates Learning Outcomes:

Able to apply mathematics, science, and basic engineering and an engineering specialization to be used in solving complex engineering problems.

Syllabus :

Introduction, Functions and Limits, Derivatives, Derived Applications, Indeterminate Integral, Integral Applications, Infinite Row, and Series. Derivatives with many variables, Duplicate Integral (2 and 3), Duplicate Integral Application.

Prerequisite: None

Textbooks:

Main :

D. Varberg, E. J. Purcell, S.E. Rigdon, Calculus, 9th ed., Pearson, Prentice Hall, 2007.

George B. Thomas Jr., Thomas' Calculus Early Transcendental, 12th ed., Addison – Wesley Pearson, 2009.

LINEAR ALGEBRA
ENGE600004/ENGE610004
4 SKS
Course Learning Outcomes:

Students are able to calculate linear system problems to solve engineering problems.

Graduates Learning Outcomes:

Able to apply mathematics, science, and basic engineering and an engineering specialization to be used in solving complex engineering problems.

Syllabus :

Linear Systems and matrix equations, Determinants, Euclid vector spaces, Common vector spaces, eigenvalues and eigenvectors, inner product spaces, Diagonalization and General Linear Transformation.

Prerequisite: None

Textbooks:
1. Elementary Linear Algebra, Howard Anton & Chris Rorres, 11th edition, 2014
2. Gilbert Strang, Introduction to linear algebra 3rd edition Wellesley Cambridge Press, 2003

MECHANICAL AND HEAT PHYSICS
ENGE600005 / ENGE610005
3 credits
Course Learning Outcomes:

Able to explain the basic concepts of mechanics and thermodynamics, and be able to apply them to understand natural phenomena and human engineering, including their applications.

Graduate Learning Outcomes:

Able to apply mathematics, science, and basic engineering and an engineering specialization to be used in solving complex engineering problems.

Syllabus:

Units, Magnitudes and Vectors, Motion Along Straight Lines, Motion in Two and Three Dimensions, Newton's Laws of Motion, Applications of Newton's Laws, Kinetic Energy, and Work, Potential Energy and Energy Conservation, Center of Mass, Linear Momentum, Rotation, Rolling Motion, Torque, Angular Momentum, Oscillation, Mechanical and Sound Waves, Gravity, Statics and Elasticity, Fluid Mechanics, Temperature, Heat, Law I Thermodynamics, Ideal Gas and Kinetic Theory of Gas, Heat Engine, Entropy, and Law II Thermodynamics.

Prerequisite: none

Textbooks:
1. Halliday, Resnick, and Walker, Principles of Physics 10th Edition, Wiley, 2014.
2. Serway Jewett, Physics for Scientists and Engineers 9th Edition, Thomson Brooks / Cole, 2013.
3. Giancoli, Physics for Scientists and Engineers 4th Edition, Pearson, 2008

ELECTRICAL MAGNETIC, OPTICAL AND WAVE PHYSICS
ENGE600007 / ENGE610007
3 credits
Course Learning Outcomes:

Students are able to apply the basic concepts of electrical physics, magnetism, waves, and optics to solve problems in the engineering field.

Graduate Learning Outcomes:

Able to apply mathematics, science, and basic engineering and an engineering specialization to be used in solving complex engineering problems.

Syllabus:

Unit, Magnitude, Vector, Electric Charge, Electric Field, Gauss Law, Electric Potential, Capacitance, Electric Current, Resistance, Direct Current, Magnetic Field Due to Electric Current, Magnetic Field Source, Induced GGL, Inductance, Alternating Current, Electromagnetic Waves, Light Properties and Propagation, Optical Geometry.

Prerequisite: none

Textbooks :
1. Halliday, Resnick, and Walker, Principles of Physics 9th Edition, Wiley, 2011.
2. Serway Jewett, Physics for Scientists and Engineers 9th Edition, Thomson Brooks / Cole, 2013.
3. Giancoli, Physics for Scientists and Engineers 4th Edition, Pearson, 2008.

ENGINEERING ECONOMY
ENGE600011 / ENGE610011
3 credits
Course Learning Outcomes:

Students are able to analyze the economic and financial feasibility of making economic practice decisions.

Graduate Learning Outcomes:

Able to apply the principles of technical management and decision making based on economic considerations, in individual and group, as well as in project management.

Syllabus:

Introduction to Engineering Economics, Time Value of Money, Combining Factors, Interest Rates, Money Worth Analysis, Rate of Return Analysis, Effects of Inflation, Benefit Cost & Break-Even Point Analysis, Sensitivity Analysis, Depreciation, Tax Analysis, Cost Estimation & Allocation, Capital Budgeting & Replacement Analysis.

Prerequisite:
1. Civil Engineering : -
2. Environmental Engineering : -
3. Naval Engineering : -
4. Industrial Engineering : must pass the introductory Economic course and have completed 38 credits
5. Chemical Engineering : -
6. Bioprocess Engineering : -

Textbooks:

1. Blank, Leland and Tarquin, Anthony. 2018. Engineering Economy 8th Ed. McGraw Hill.
2. Park, Chan S. 2016. Contemporary Engineering Economics 6th Ed. Pearson. Upper Saddle River.
3. White, Case and Pratt. 2012. Principles of Engineering Economic Analysis 6th ed. John Wiley and Sons.

STATISTICS AND PROBABILISTICS

ENGE600010 / ENGE610010

2 credits

Course Learning Outcomes:

Students are able to handle quantitative data/ information starting from the descriptive stage (collection, organization, and presentation) to the inductive stage, which includes forecasting and drawing conclusions based on the relationship between variables for decision making.

Graduate Learning Outcomes:

1. Apply descriptive statistics and probability theory to data processing and serving
2. Apply probability distribution to data processing and serving
3. Apply the principles of sampling and estimation for decision making
4. Apply hypothesis test samples for decision making

Syllabus:

Introduction to Statistics for Engineering Studies, Probability Theory, Dasar Basic concepts and definitions, Distribution Probability, Sampling, Estimation, Hypothesis testing, Hypothesis test 1 sample at an average value, Regression

Prerequisite: none

Textbooks :

1. Harinaldi, Basic Principles of Statistical Engineering and Science, Erlangga, 2004
2. Montgomery, DC., And Runger, GC., Applied Statistics and Probability for Engineers, John Wiley Sons, 2002

HSE PROTECTION

ENGE600012 / ENGE610012

2 credits

Course Learning Outcomes:

Upon completion of this subject students are expected to be able to carried out hazard identification, and characterization, to propose appropriate methods for risk reduction and mitigation, and to design safety management system. The student is also expected to improve their awareness on industrial safety and health, and understanding on safety regulation framework and standards as well as environmental program.

Graduate Learning Outcomes:

1. Students are expected to understand safety, health and environmental aspect as an integral part of fundamental principal in engineering code of ethics.
2. Students are expected to be able to carry out process of risk assessments by considering risk factors in the impact of hazards on people, facilities, and the surrounding community and environemt.
3. Students are expected to understand the regulatory framework and standard related to the stages of life cycle of machine, building structure, construction, and process.
4. Students are able to design and propose an effective hazard communication, management and engineering control, and risk mitigation through an engineering assignment project.
5. Students are able to identify the knowledge required to perform risk assesment, investigation and design improvement through a multidisiplinary case of incident and accident.

Syllabus:

Introduction to SHE Regulation and Standards, SHE Perception (Risk and Environment), Identification, Assessment and Management, Construction, machinery and Noise hazards, Process safety hazard and analysis technique, Fire and explosion hazard, Electrical hazard, Toxicology in the Workplace, Ergonomy Aspect, Hazard communication to employees, Environmental Protection, Case studies, Safety Health and Environment audits.

Prerequisite: none

Textbooks :

1. Charles A. Wentz, Safety, Health and Environmental Protection, McGraw Hill, 1998.
2. Asfahl, C.R., Rieske, D. W., Sixth Edition Industrial Safety and Health Management, Pearson Education, Inc., 2010.
3. United Kingdom - Health and Safety Executive, http://www.hse.gov.uk/
4. National laws and regulations related to the K3 Management System and the Environment.
5. Related Journal (http://www.journals.elsevier.com/safety-science/) etc, related standards and publications.

Course Syllabus of Undergraduate Program on Civil Engineering

Mechanics and Thermal Physics
ENCV 601 001
4 Credits
Expected Learning Outcomes :

CLO 1 (Engineering Knowledge)

Course Learning Outcomes :

Be able to apply the concepts of physics, mechanics and thermodynamics as an effort to understand natural phenomena and human engineering, including engineering application (CLO 1)

Learning Experiences :

Interactive lectures, individual assignments, and tutorials.
Syllabus :

Magnitude, kinematics of a point particle, mechanics of rigid bodies, the law of conservation of linear momentum and energy, harmonic motion, gravity, kinematics and dynamics of rigid bodies, basic concepts (pressure, thermodynamic system, state system, temperature), expansion, energy equilibrium (thermal state equations) , heat transfer, ideal gas, first law of thermodynamics, enthalpy and entropy, application of first law of thermodynamics for open and closed systems, second law of thermodynamics, kinetic theory of ideal gases, building ventilation systems, building insulation systems, building cooling systems and central air.
Prerequisites : -
Text Book References :
1. Halliday, Resnick, dan Walker, Principles of Physics 9th Edition, Wiley, 2011.
2. Serway Jewett, Physics for Scientists and Engineers 9th Edition, Thomson Brooks/Cole, 2013.
3. Giancoli, Physics for Scientists and Engineers 4th Edition, Pearson, 2008
4. Cengel, Y, Thermodynamics: An Engineering Approach 8th Edition, McGraw-Hill Education, 2014
5. Ganijanti AS, Mekanika,Penerbit Salemba Teknik, 2000.
6. Tipler PA, Fisika I, ed III, terjemahan Lea Prasetio, Penerbit Erlangga, 1998.

Environmental Basic Chemistry
ENCV 601 002
2 Credits
Expected Learning Outcomes :

CLO 1 (Engineering Knowledge)

CLO 7 (Environment and Suistanibility)

Course Learning Outcomes :
1. Be able to identify chemical processes that occur in the Civil Engineering construction cycle and analyse its effects on the environment (CLO 1)
2. Be able to identify basic theories of chemistry related to the concepts and principles of built environment sustainability (CLO 7)

Learning Experiences :
1. Interactive lectures
2. Case study in analysing chemical phenomena occurred in the lifecycle of civil engineering buildings.

Syllabus :
Table Periodic; Stoichiometry: Calculation with Chemical; Chemical Reaction in Solution and Stoichiometry Solution; Thermochemistry; Chemical Equilibrium; Acid and Base; Electrochemistry; Spontaneity of reactions (concept of irregularity, enthalpy, entropy, Gibbs free energy, Arrhenius equation), spontaneous and non-spontaneous reactions (effect of temperature, concentration and energy on spontaneity, cement production processes), steel production processes (mining and mineral purification, iron extraction from minerals, steel production), chemical weathering of building materials (causes and mechanisms of acid rain formation, ettringite formation and characteristics, ettringite effects on building strength, reaction of metals with acids, impact of acid raid on metals, aggressive and corrosive environments, examples of methods of materials protection), civil engineering life cycle concept (life cycle concept, production processes, transportation, constructions, operations and end of life of civil engineering building), impact of cement production processes and steel on increased air pollution (by-product of cement production processes, by-product of steel production processes, the contribution of cement industry and steel to CO2 and particulate levels in the air), pollution due to the life cycle of civil engineering building (air, water, and soil pollution from construction processes and operation of civil engineering buildings).

Prerequisites : -
Text Book References :
1. Brown and Holme, 2011, Chemistry for Engineering Students 2nd edition
2. Rainer Remus, Miguel A. Aguado-Monsonet, Serge Roudier and Luis Delgado Sanch, 2013, Best Available Techniques (BAT) Reference Document for Iron and Steel Production, JRC REFERENCE REPORT EU EU Commission
3. COLIN BAIRD, MICHAEL CANN, 2008, Environmental Chemistry 4th edition, W. H. Freeman
4. Moncmanová, 2007, Environmental Deteriora-

tion of Materials, WIT Press
5. Frauke Schorcht, Ioanna Kourti, Bianca Maria Scalet, Serge Roudier, Luis Delgano Sancho, 2013, Best Available Techniques (BAT) Reference Document for Cement, Lime and Magnesium Oxide, JRC REFERENCE REPORT EU EU Commis- sion
6. Building and Environment, Elsevier
7. Georgia Institute of Technology, 2010, AIA Guide to Building Life Cycle Assessment in Practice, The American Institute of Architects
8. Georgia Institute of Technology, 2010, AIA Guide to Building Life Cycle Assessment in Practice, The American Institute of Architects

Introduction to Civil Engineering System

ENCV 601 003

3 Credits

Expected Learning Outcomes :

CLO 2 (Problem Analysis),
CLO 6 (Engineer and Society),
CLO 9 (Team Work),
CLO 10 (Communication)

Course Learning Outcomes (CLO) :

1. Be able to analyse problems related to Civil Engineering and the surrounding environment (CLO 1)
2. Be able to analyse problems in society related to Civil Engineering and propose solutions (CLO 2)
3. Be able to work in teams in analysing Civil Engineering problems in society (CLO 9)
4. Be able to use appropriate and correct Indonesian in expressing opinions and ideas (CLO 10)

Learning Experiences :

1. Using problem-based learning (PBL) method in analysing problems within the scope of Civil Engineering.
2. Conducting a field survey to dig deeper into the analysed problems.
3. Presenting the results and proposing simple solutions in the form of posters.

Syllabus :

Introduction to the system and scope of work of Civil Engineering: General description of the scope of the Civil Engineering system and work, an overview of the sub-expertise of Transportation Engineering, Geotechnical Engineering, Water Resources Management, Environmental Engineering, Structural Engineering and Construction Management; Components and functions of Civil Engineering buildings / infrastructure: Physical and non-physical components of Civil Engineering buildings / infrastructure, Functions of physical and non-physical components of Civil Engineering buildings / infrastructure; The role of the Civil Engineering undergraduate: The role of the Civil Engineering undergraduate in the field of expertise of Transportation Engineering, Geotechnical Engineering, Water Resources Management, Environmental Engineering, Structural Engineering and Construction Management, The linkage of the scope of work between areas of expertise.

Prerequisites : -

Text Book References : -

Material Properties

ENCV 601 004

3 Credits

Expected Learning Outcomes :

CLO 1 (Engineering Knowledge)
CLO 4 (Experiment)

Course Learning Outcomes (CLO) :

1. Be able to identify the properties of materials used in Civil Engineering. (CLO 1)
2. Be able to conduct experiments in the laboratory and analyse the results. (CLO 4)

Learning Experiences :

1. Interactive lectures
2. Conducting experiments on concrete mix designs and cement
3. Observing the simulation of steel reinforcement tensile tests.
4. Conducting experiments on asphalt materials

Syllabus :

Particulate Materials, Aggregates, Portland Cement and Portland Cement Concrete, Structural steel, Asphalt cement and asphalt concrete, wood, bricks, polymers, consideration of environmental aspects in material selection, response of materials to loads, melting and fracture; Rheology of fluids and solids; Fatigue.

Prerequisites : -

Text Book References :

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
4. A.M Neville; Properties of Concrete

Construction Drawing 1

ENCV 602 001

2 Credits

Expected Learning Outcomes :

CLO 9 (Teamwork)
CLO 10 (Communication)

Course Learning Outcomes (CLO) :

1. Be able to work in teams in identifying specifications for simple healthy house building. (CLO 9)
2. Be able to draw a 1-storey house in accordance with engineering drawing principles (CLO 10)

Learning Experiences :

1. Interactive lectures
2. Individual assignments to draw building components
3. Conducting a field survey to identify the components of a healthy / unhealthy house building
4. Drawing the healthy / unhealthy house building on a working drawing in accordance with engineering drawing principles.

Syllabus :
Introduction to drawing techniques, functions and benefits of drawing in the design process; introduction of drawing equipment, drawing paper format, image header, image standard recognition, lettering, image captions (leader), image scale; geometric construction; pictorial projection; orthogonal projection; cross-sectional drawings and buildings; detailed drawings of buildings; wooden and light steel roof construction drawings; construction drawings of beams, columns and river stone foundations; Electrical Installation drawings and plumbing drawings. Introduction to external, internal and physical aspects, techniques and the relationship between space / function activities for designing a simple healthy house building. Introduction of standards and regulations for healthy house building.

Prerequisites : -

Text Book References :
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, Penerbit R. Sugihardjo
4. Giesecke, F. E., et al. (1997). Technical Drawing, Tenth Edition, Prentice Hall Publishing,

Statics
ENCV 602 002
3 Credits
Expected Learning Outcomes :
CLO1 (Engineering Knowledge)
Course Learning Outcomes (CLO) :
Be able to apply Newton's Laws in calculating reactions and forces in certain static structures (CLO 1)
Learning Experiences :
1. Interactive lectures and combined with flip classrooms on the topic of influence lines
2. Conducting individual assignments in a structured and scheduled manner.
3. Discussing in groups in a structured and scheduled manner.

Syllabus :
Particle statics; Rigid object; Rigid body equilibrium; Trusses structures analysis by joint and section methods; Forces in beam, portal and joint structures (gerbers); Influence lines on certain statistical structures due to moving loads.

Prerequisites : Mechanics & Thermal Physics

Text Book References :
1. Hibbeler, R.C., Engineering Mechanics Statics, Thirteenth Edition, Pearson, 2013
2. Hibbeler, R.C., Structural Analysis, Eighth Edition, Prentice Hall, 2012
3. Andrew Pytel ; Jaan Kiusalaas, Engineering Mechanics : Statics:, 3rd edition, The Pennsylvania State University, 2010

Construction Drawing 2
ENCV 603 001
3 Credits
Expected Learning Outcomes :
CLO 5 (Modern Tool Usage)
CLO 10 (Communication)
Course Learning Outcomes (CLO) :
1. Be able to use an AutoCAD software in drawing Civil Engineering building structures (CLO 5)
2. Be able to draw a 2-storeys civil engineering building structures or more in accordance with engineering drawing principles (CLO 10)

Learning Experiences :
1. Interactive lectures
2. Conducting a survey of existing building, identifying architectural and structural components.
3. Drawing "the structural drawing" of the surveyed building.
4. Attending an AutoCAD course organized by IMS.

Syllabus :
1. Reviewing drawing notations: Scale, title, layout; visible/invisible part; center line; grid, as.
2. Reviewing building components in accordance with architectural drawings: practical columns, ring balk, roof truss.
3. Drawing two story reinforced concrete structures building or more: Foundation plan, beam-column plan, roof plan, detail of beam reinforcement, detail of column reinforcement, detail of shallow and deep foundation, detail of beam-column joints, detail of bracing joints.
4. Drawing structural steel industry building: beam-column plan, detail of transversal frames, detail of longitudinal frames, detail of beam-column joints, detail of bracing joints.

Prerequisites : Construction Drawing 1

Text Book References :
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, Penerbit R. Sugihardjo

4. Tanggoro, Dwi., Utilitas Bangunan, Penerbit Universitas Indonesia, 2000
5. Giesecke, F. E., et al. (1997). Technical Drawing, Tenth Edition, Prentice Hall Publishing.

Solid Mechanics

ENCV 603 002

3 Credits

Expected Learning Outcomes :

CLO 1 (Engineering Knowledge)

Course Learning Outcomes (CLO) :

Be able to apply solid mechanic concepts in calculating stress and deflection occurred in certain static structures (CLO 1)

Learning Experiences :

1. Interactive lectures.
2. Carrying out individual assignments in a structured and scheduled manner.
3. Discussing in groups in a structured and scheduled manner.
4. Conducting experimental simulations in the laboratory.

Syllabus :

Definition of loads and forces acting on solid objects, effects of forces on solid objects, stress on solid objects, shape changes in solid object, properties of shape changes in solid object, elastic and inelastic phases, axial strain, Modulus of Elasticity, Poisson Ratio. Normal stress due to axial force, normal stress due to bending, normal and bending combination, direct and two-way bending stress, core plane (Kern), shear stress due to force in latitude, shear stress due to torsional inner force (torsion). A combination of normal and shear stress. The stress on the inclined plane and main stress. Deflection of certain static beam, frame and truss structures due to external loads using the elastic deflection line differential equation method, the moment plane area method with an equivalent beam, the energy method (unit load). Analysis of simple indeterminate static structures uses the principle of consistent deformation.

Prerequisites : Statics (pass)

Text Book References :

1. Hibbeler, R.C., Mechanics of Materials, 8/e, Pearson, 2011
2. Beer, F. and Johnston, P., Mechanics of Materials, 6/e. Mc Graw Hill, 2011
3. Egor P. Popov (Author), Engineering Mechanics of Solids (2nd Edition), Prentice Hall, 1998

Fluid Mechanic

ENCV 603 003

3 Credits

Expected Learning Outcomes :

CLO 1 (Engineering Knowledge)

Course Learning Outcomes (CLO) :

Be able to apply fluid mechanic concepts in calculating the hydrostatic pressure in civil engineering buildings and the dynamic forces caused by the fluid flow (CLO 1)

Learning Experiences :

1. Interactive lectures
2. Scheduled tutorials
3. Conducting experiments in the laboratory

Syllabus :

Basic formulation of motion and object forces that cannot be conceptualized as a unified whole, such as wind and water. Static fluids including the definition of pressure, the formulation of pressure distribution and its application to determine the magnitude of force due to pressure in various civil engineering structures. Fluid flows, starting from the conceptualization of Eulerian motion and its application to the law of conservation of mass, momentum, and energy to calculate the total amount of flow and the resulting dynamic force. The total flow and force are the basis for designing hydraulic buildings in particular or civil buildings in general.

Prerequisites: Calculus 1, Calculus 2, Mechanics & Thermal Physics

Text Book References :

1. Merle C. Potter, David C. Wiggert, Bassem H. Ramadan, Mechanics of Fluids, Fourth Edition, Cengage Learning, 2011
2. Frank M. White, Fluid Mechanics, Fourth Edition, McGraw-Hill, 1998

Statistics and Probabilistic of Experimental Design

ENCV 603 004

2 Credits

Expected Learning Outcomes :

CLO 1 (Engineering Knowledge)

CLO 4 (Experiment)

Course Learning Outcomes (CLO) :

1. Be able to calculate statistical and probabilistic variables needed to analyse data series (CLO 1)
2. Be able to apply statistical and probabilistic concepts in analysing the results of field experiments / measurements (CLO 4)

Learning Experiences :

1. Interactive lectures
2. Using “real data” from experiments to summarise the results
3. Using Ms. Excel to calculate some relevant statistical parameters for interpreting results from experiments or field measurements

Syllabus :

Basic concepts of statistics and probabilistic; Error Analysis and Error Propagation; Analysis of normal distribution; Standard error analysis at appropriate intervals; Estimation of Errors in Derived Quantities; Hypothesis Testing and the t-Test based on ANOVA results; Distribution and consistency test; Analysis of Toolpax data by using Excel to assist the computational process in statistical analysis

Prerequisites : -

Text Books References :

1. Catherine A. Peters, Statistics for Analysis of Experimental Data, Princeton University, 2001
2. Howard J. Seltman, Experimental Design and Analysis, 2018
3. Berthouex, P. M.; L. C. Brown. Statistics for Environmental Engineers. Lewis Publishers, 1994.
4. Bevington, P. R.; D. K. Robinson. Data Reduction and Error Analysis for the Physical Sciences. McGraw-Hill, Inc. 1992.
5. Box, G. E. P.; W. G. Hunter; J. S. Hunter. Statistics for Experimenters: An Introduction to Design, Data Analysis, and Model Building. John Wiley & Sons, 1978

Basic Soil Mechanics

ENCV 603 005

3 Credits

Expected Learning Outcomes :

CLO 1 (Engineering Knowledge)

CLO 4 (Experiment)

Course Learning Outcomes (CLO) :

1. Be able to categorise soil based on USCS and understand physics properties and three phase diagrams of soil (CLO 1)
2. Be able to conduct experiments in the laboratory to determine the characteristics of soil (CLO 4)

Learning Experiences :

1. Interactive lectures
2. Conducting experiments in the laboratory or watching a virtual laboratory to understand the physical properties of soil.

Syllabus :

Engineering Geology and Soil Property; The linkage of geology and geotechnics with civil engineering; Topographic and geomorphological maps; Topography and equipment; How to read and analyse mineralogy, rock types, and stratigraphy, types of minerals forming igneous rocks; Geological structures and types; Identification methods and effects of coating, stocking, faults, non-conformity for construction; Weathering and soil movement; Weathering types, processes, and identifications; Classification process; Geological and geotechnical maps; Topographic base map analysis; Geotechnical and geological map criteria; Soil Properties: Physical characteristics of soil; Soil Classification; Atterberg limit; Soil compaction and CBR test; 1-dimensional flow in soil, groundwater permeability and seepage, flow network; Stress theory and the principle of effective stress; Effective stress reactions due to changes in total stress in fully saturated soils; Soil shear strength; Test the shear strength of soil in the laboratory on clay and sand; Consolidation and consolidation test;

Prerequisites : Material Properties

Text Book References :

1. Burchfiel BC & Foster RJ et .al., "Physical Geology", Charlec E Merril Publishing Co., Colombus Toronto London Sydney, 1986.
2. Blyth, F.G.H. & de Freitas, M.H., "A Geology for Engineers, 7th Ed.". Elsevier. 2005.
3. Craig, R.F., " Soil Mechanics, 7th Ed.", 2007
4. Bowles, J.E., "Physical and Geotechnical Properties of Soils", McGraw-Hill Kogagusha Ltd., 1998.
5. Das, B.M., "Principles of Geotechnical Engineering", Seventh Edition, 2010, PWS Publishing Company, Boston
6. Budu M., "Soil Mechanics and Foundations", Third Edition, 2010, John Wiley& Sons, New York

Surveying & Geospatial Information Systems

ENCV 603 006

2 Credits

Expected Learning Outcomes :

CLO 4 (Experiment)

CLO 5 (Modern Tools)

Course Learning Outcomes (CLO) :

1. Be able to apply statical and probabilistic concepts in analysing the results of surveying measurements. (CLO 4)
2. Be able to use tools (ex: total station) to measure angles and distances and ArcGIS software in mapping of the earth's surface (CLO 5)

Learning Experiences :

1. Interactive lectures
2. Conducting field measurements using theodolite, water pass and total station.
3. Using ArcGIS software in mapping the earth's surface.

Syllabus :

Basics and roles of surveying & GIS in Civil and Environmental Engineering and their applications; Methods & possible errors in distance & angle measurement; Concept mapping and pegging. Geospatial data management in GIS to create custom data and all other data on the desktop; Analysis of geographically oriented spatial data based on certain coordinate systems.

Prerequisites :

Text Book References :

1. ESRI. GIS Solutions for Surveying. ESRI Publishers, 2007.
2. Gopi, S., Sathikumar, R., Madhu, N., Advanced Surveying: Total Station, GIS, and Remote Sensing, Pearson Education, 2008
3. Kavanagh, B. and Slattery, D., 2014. Surveying with Construction Applications 8th ed., Prentice-Hall, Inc.
4. Michael Govorov, Linas Bevainis, Andrius Balčiūnas. Remote Sensing and GIS for Cadastral Surveying, Center for Cartography at the Faculty of Natural Sciences Vilnius University. 2016.

5. Modul Praktikum Ilmu Ukur Tanah & GIS
6. Nathanson, J., Lanzafama, M. T., Kissam, P., Surveying Fundamental and Practices, 5th Ed., Prentice Hall, 2011

Advanced Calculus

ENCV 603 007

3 Credits

Expected Learning Outcomes :

CLO 1 (Engineering Knowledge)

Course Learning Outcomes (CLO) :

Be able to derive and use the concepts of ordinary differential equation and vector calculus in solving applied problems. (CLO 1)

Learning Experiences :

Interactive lectures

Syllabus :

Introduction to Differential Equations, Definitions and Terminology, Initial-Value Problems, Differential Equations as Mathematical Models, First-Order Differential Equations, Solution Curves without a Solution, Direction Fields, Autonomous First-Order Differential Equations, Separable Equations, Linear Equations, Exact Equations, Solution by Substitutions, A Numerical Method, Linear Models, Nonlinear Models, Modeling with Systems of First-Order Differential Equations.

Higher-Order Differential Equations, Theory of Linear Equations, Initial-Value and Boundary-Value Problems, Homogeneous Equations, Nonhomogeneous Equations, Reduction of Order, Homogeneous Linear Equations with Constant Coefficients, Undetermined Coefficients, Variation of Parameters, Cauchy-Euler Equations, Nonlinear Equations, Linear Models; Initial-Value Problems, Spring/Mass Systems: Free Undamped Motion, Spring/Mass Systems: Free Damped Motion, Spring/Mass Systems: Driven Motion, Series Circuit Analogue, Linear Models : Boundary-Value Problems, Green's Function (Initial-Value and Boundary-Value Problems), Nonlinear Models, Solving Systems of Linear Equations. Vector Functions, Motion on a Curve, Curvature and Components of Acceleration, Partial Derivatives, Directional Derivative, Tangent Planes and Normal Lines, Curl and Divergence, Line Integrals, Independence of the Path, Double Integrals, Double Integrals in Polar Coordinates, Green's Theorem, Surface Integrals, Stokes' Theorem, Triple Integrals, Divergence Theorem, Change of Variables in Multiple Integrals.

Prerequisites : Calculus 1 and Calculus 2

Text Book References :

1. D.G Zill and W.S Wright, Advanced Engineering Mathematics, 5th ed., Jones & Barlett Learning, 2014
2. E. Kreyzig, Advanced Mathematical Engineering, Johnwiley & Son, 5th ed., 2011

Soil Mechanics

ENCV 604 001

3 Credits

Expected Learning Outcomes :

CLO 2 (Problem Analysis),
CLO 3 (Design)
CLO 5 (Modern Tool Usage)

Course Learning Outcomes (CLO) :

1. Be able to analyse slope stability with the limit equilibrium method (CLO 2)
2. Be able to design retaining walls and calculate shallow foundation dimensions (CLO 3)
3. Be able to use GeoStudio software to analyse slope stability (CLO 5)

Learning Experiences :

1. Interactive lectures
2. Watching virtual laboratory videos
3. Using GeoStudio software to analyse slope stability.

Syllabus :

Soil bearing capacity: limit bearing capacity and allowable bearing capacity due to tilting, eccentric loads; Elastic decline and one-dimensional consolidation settlement; Drawing and designing shallow foundations; Seepage through dams; Lateral pressure: Rankine theory and Coulomb theory; Structural design of retaining walls, gravity walls, cantilever walls, cantilever sheet pile walls, sheet pile walls; Slope stability: Slope stability concept, undrained analysis, slice method, introduction to Fellenius method, Bishop method, soil stabilization method, and use of equilibrium method software.

Prerequisites : Basic Soil Mechanics (pass)

Text Book References :

1. Craig, R.F., " Soil Mechanics, 7th Ed.", 2007
2. Bowles, J.E., "Physical and Geotechnical Properties of Soils", McGraw-Hill Kogagusha Ltd., 1998.
3. Das, B.M., "Principles of Geotechnical Engineering", Seventh Edition, 2010, PWS Publishing Company, Boston
4. Budu M., "Soil Mechanics and Foundations", Third Edition, 2010, John Wiley& Sons, New York

Hydraulic

ENCV 604 002

3 Credits

Expected Learning Outcomes :

CLO 1 (Engineering Knowledge)

Course Learning Outcomes (CLO) :

Be able to apply the law of Conservation of Mass, energy, and momentum on a stream media (CLO 1)

Learning Experiences :

1. Interactive lectures
2. Tutorial in a structured and schedule manner

Syllabus :

Hydraulic is an application of the law of mass, energy, and momentum conservation which is applied theoretically in drainage medias generally found in

civil engineering world. These drainage media cover flows in pipes (under pressure), and flows in open drainage system (the water surface has atmospheric pressure). Until midterms, awareness is built to obtain the formulation that can be used in designing dimension which basically needed in formulating energy lost. This concept is introduced in designing a piping system. After the midterm, the energy lost concept is continued by applying it to an open drainage system. Due to the incapability of obtaining accuracy just by using the theoretical formulation for energy loss, it is introduced that the application for some of the water structures will be forced to use empirical coefficients.

Prerequisites : Fluid Mechanics, Linear Algebra

Text Book References :

1. Merle C. Potter, David C. Wiggert, Bassem H. Ramadan, Mechanics of Fluids, Fourth Edition, Cengage Learning, 2011.
2. Frank M. White, Fluid Mechanics, Fourth Edition, McGraw-Hill, 1998.

Structure Analysis

ENCV 604 003

4 Credits

Expected Learning Outcomes :

CLO 2 (Problem Analysis)

CLO 5 (Modern Tool Usage)

Course Learning Outcomes (CLO) :

1. Be able to analyse indeterminate static structures with classical methods (three-moment equation, slope deflection and moment distribution) and stiffness methods (CLO 2)
2. Be able to use MATLAB/SAP software to confirm the structural analysis results calculated by stiffness methods (CLO 5)

Learning Experiences :

1. Interactive lectures
2. Carrying out individual assignments in a structured and scheduled manner
3. Conducting experiments to understand moment distribution methods

Syllabus :

Definition of uncertain static vs certain static structures, external indefinite static, Application of the Three Moment Equation method, Slope deflection and moment distribution on continuous beams with various support reaction conditions, fixed frames with single sway, gable frames, symmetrical and asymmetric structures.

Application of the direct stiffness method in cases of 2D truss, continuous beams, frames, joists / grids and composite structures (combined beam-frame, frame-trusses)

Prerequisites : Statics (pass) dan Solid Mechanics

Text Book References :

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. Marc Hoit, Computer-Assisted Structural Analysis and Modelling, Prentice Hall, Englewood Cliffs, New Jersey, 1995
5. KATILI, Irwan, Metode Elemen Hingga untuk Skeletal, Rajawali Pers, 2008

Numerical Methods

ENCV 604 004

2 Credits

Expected Learning Outcomes :

CLO 1 (Engineering Knowledge)

Course Learning Outcomes (CLO) :

Be able to solve mathematical equations in linear algebra and differential equations numerically (CLO 1)

Learning Experiences :

1. Interactive lectures
2. Using one of available software to analyse linear algebra problems and differential equations

Syllabus :

Basics of programming using MATLAB / PHYTON / VB software, finding the root of the equation (Bracketing Method & Open Method); Linear System (Solving Simultaneous Linear Algebraic Equation, Gauss Elimination, LU-Factorization, Matrix Inversion, Solution by Iteration, Eigenvalues)

Numerical Method in Curve Fitting (Linear Regression & Least Square), Numerical Method in solving: Ordinary Differential Equations (Initial Value Problems, Adaptive Method and Stiff System, Boundary Value Problems)

Prerequisites : Calculus 1, Calculus 2, Advanced Calculus, Linear Algebra

Text Book References :

1. Numerical Methods for Engineers, Steven C. Chapra & Raymond P Canale, 7th edition, 2013
2. Applied Numerical Methods with MATLAB for Engineers and Scientist, 3rd edition, Steven C. Chapra, Mc Graw Hill, 2012
3. KATILI, Irwan, Metode Elemen Hingga untuk Skeletal, Rajawali Pers, 2008

Transportation Engineering

ENCV 604 005

3 Credits

Expected Learning Outcomes :

CLO 2 (Problem Analysis),

CLO 4 (Experiment)

CLO 9 (Teamwork)

Course Learning Outcomes (CLO) :

1. Be able to analyse traffic performance, road and traffic capacity (CLO 2)
2. Be able to apply statistical and probabilistic

concepts in analysing traffic survey data (CLO 4)
3. Be able to work in teams in conducting traffic surveys (CLO 9)

Learning Experiences :
1. Interactive lectures
2. Conducting a field survey to calculate the volume of vehicles

Syllabus :
Traffic elements; Interaction of activity systems, network systems, and movement systems; Estimation and prediction of trip generation and attraction using empirical and analogy methods; travel distribution estimation and prediction using growth and synthesis methods; Traffic variables (flow, speed, and density); Greenshield traffic flow model; Measurement method; Road capacity; Simulation-based road performance.

Prerequisites : Statistics and Probabilistic of Experimental Design

Text Book References :

1. AASHTO, Highway Capacity Manual, 2010
2. May, Adolf D.,Traffic Flow Fundamentals. Prentice-Hall, 1990
3. Molugaram, K., Rao, G. S., Statistical Techniques for Transportation Engineering, Butterworth-Heinemann, 2017
4. Pandem, A., Wolshon, B., Traffic Engineering Handbook 7th ed., Wiley, 2016
5. Papacostas, C., Prevedouros, P., Transportation Engineering and Planning 3rd ed., Prentice-Hall, Inc., 2000
6. Washington, S.P., Karlaftis, M.G. and Mannering, F.L. Statistical and Econometric Methods for Transportation Data Analysis. Second Edition, Chapman & Hall/CRC, Boca Raton, FL., 2011

Foundation Engineering

ENCV 605 001

3 Credits

Expected Learning Outcomes :
CLO 2 (Problem Analysis),
CLO 3 (Design),
CLO 10 (Communication)

Course Learning Outcomes (CLO) :
1. Be able to determine the soil parameters of foundation design / retaining wall based on the test results of soil parameter (CLO 2)
2. Be able to design deep foundations and retaining walls (CLO 3)
3. Be able to draw foundation structures in accordance with engineering drawing principles (CLO 10)

Learning Experiences :
Interactive lectures

Syllabus :
Introduction to the types and systems of deep foundations, methods of determining the axial bearing capacity of deep foundations; Methods of determining the lateral bearing capacity of deep foundations; Methods of determining the vertical deformation and lateral deformation of deep foundations; Pile load test method and introduction of deep soil retaining system and types; Methods of calculating the soil retaining system, as well as understanding the required soil parameters; Drawing deep foundation structures; Designing deep foundation based on existing soil parameters.

Prerequisites : Solic Mechanics

Text Book References :

1. Bowles, J.E., "Foundation Analysis and Design, Int.Student Edition", McGraw-Hill, Kogakusha, Ltd., Japan, 1988
2. Coduto D.P., "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., "Pile Design and Construction Practice, 5th Ed.", Taylor & Francis, Oxon, UK., 2007
6. Reese L.C., Isenhower W.M. dan Wang S.-T., "Analysis and Design of Shallow and Deep Foundations", John Wiley & Sons, Inc., Hoboken, USA., 2006.
7. Fleming K., Weltman A., Randolph M., and Elson K., "Piling Engineering, 3rd Ed.", Taylor & Francis, Oxon, UK., 2009

Journal :
1. ASCE, journal of geotechnic and geomechanics
2. Canadian geotechnical journal

Civil Engineering System

ENCV 605 002

2 Credits

Expected Learning Outcomes :
CLO 2 (Problem Analysis)

Course Learning Outcomes (CLO) :
Be able to analyse Civil Engineering problems and quantify parameters associated with linear programming approach (CLO 2)

Learning Experiences :
1. Interactive lectures
2. Conducting a survey to understand more deeply about Civil Engineering problems.

Syllabus :
Roles and functions of civil engineering undergraduates, process of solving engineering problems, systems approach, system characteristics in engineering problems, understanding of problem characteristics, statements of needs, system hierarchy, scopes and boundaries of problems, systems analysis, solution approach, role of modelling, types of modelling, Linear Graph Modelling concepts, Mathematical Modelling Concepts, Optimization Process, Motivation and

Freedom of Choices, Purposes, Objectives and Criteria for Optimization, Optimization Methods, Feasibility Studies, Planning Horizons. Time Value of Money, Economic Analysis Methods, Financial Analysis, Decision Problem Elements, Decision Models, Basic Probability, Decision Analysis based on utility value.

Prerequisites : Linear Algebra, Introduction to Civil Engineering System

Text Book References :

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, McGraw Hills.

Highway Engineering Design 1

ENCV 605 003

4 Credits

Expected Learning Outcomes :

CLO 3 (Design)

Course Learning Outcomes (CLO) :

Be able to design road geometric components and pavements (CLO 3)

Learning Experiences :

Interactive lectures

Syllabus :

Introduction of Norms, Standards, Procedures and Criteria (NSPK) in connection with the geometric design that applies in Indonesia; Road classification, based on: designation, network system, function, status, road supply specifications; Design and control criteria: namely factors of vehicle, driver, road capacity, safety, environment and economy; Design elements: visibility, alignment (horizontal and vertical), coordination between alignments; Excavation and stockpile analysis; Road cross section elements: road space, traffic lane, shoulder, median, roadside, pedestrian and bicycle facilities; Highway drainage; Street lighting.

Introduction to the history and development of highway design technology; Introduction of Norms, Standards, Procedures and Criteria (NSPK) in connection with road construction, including: type of pavement material, function of each pavement layer, stabilization of the subgrade; Introduction and testing of road pavement materials, design mix and test mix plans, supplemented with practical activities in the laboratory; introduction of asphalt mixing plant (AMP); design criteria and various design methods by empirical and analytical methods, flexible bending pavement design by AASHTO method and component analysis methods (Bina Marga method), gradual construction, and re-construction; rigid pavement design concepts, connection methods; Road maintenance strategies, types of road damage and ways of detection and ways to repair road damage.

Prerequisites : Transportation Engineering; Basic Soil Mechanics

Text Book References :

1. AASHTO, 2007. Maintenance Manual for Roadways and Bridges. 4th Ed.
2. Brockenbrough, R.L., Highway Engineering Handbook 3rd Ed, Mc Graw Hill, 2009
3. BSN (2004) : RSNI Perencanaan Geometrik Jalan Perkotaan
4. Direktorat Jenderal Bina MArga, (2013), Manual Desain Perkerasan Jalan no 02/M/BM/2013, Kementerian Pekerjaan Umum.
5. Direktorat Jendral Bina Marga (1990) : Petunjuk Desain Drainase Permukaan Jalan
6. Direktorat Jendral Bina Marga (1997) : Standar Perencanaan Geometrik Jalan Luar Kota
7. Fwa, T.F., The Handbook of Highway Engineering, Taylor & Fancis Group, 2006
8. Huang, Y., 2004. Pavement Analysis and Design 2nd ed., Prentice-Hall, Inc.

Steel Structure 1

ENCV 605 004

3 Credits

Expected Learning Outcomes :

CLO 2 (Problem Analysis)

CLO 3 (Design)

CLO 9 (Individual and team work)

CLO 10 (Communication)

Course Learning Outcomes (CLO) :

1. Be able to analyse steel structure capacity that experience compression, tensile, bending, shear and to ANAYSE the joint capacity with bolts and welds. (CLO 2)
2. Be able to design trusses structures (bridge or trusses) with steel structures (CLO 3)
3. Be able to work in teams in designing steel structures (CLO 9)
4. Be able to draw steel truss structures or pedestrians in working drawing according to engineering drawing principles and write a clear and organized design report (CLO 10)

Learning Experiences :

1. Interactive lectures
2. Carrying out design assignments related to roof truss structures or pedestrian bridge.

Syllabus :

Simple steel structure system; Types of steel structures; Mechanical Properties; Factors affecting the steel quality, the stress-strain curve of steel, the properties of steel material; Proportion of structural member with LRFD to tensile force, compressive force, bending force, shear force according to

applicable standards; Analysis and design of steel structure elements: Tensile bar, compression bar, Elastic bending, Inelastic bending, Bidirectional bending, Shearing, Lateral torsion bending; Analysis and design of steel structure joints; Bolt connection; HTB; Welded joints; Pedestrian bridge design / roof truss.

Prerequisites : Statics, Solid Mechanics, and Drawing Construction 2

Text Book References :

1. Spesifikasi untuk Bangunan Gedung Baja Struktural ; SNI 1729 : 2015
2. Segui,William T., Steel Design,5th edition, 2013
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. Structural Steel Design, Prentice Hall, 2012

Water Engineering 1

ENCV 605 005

3 Credits

Expected Learning Outcomes :

CLO 2 (problem analysis)

CLO 3 (design)

CLO 9 (teamwork)

Course Learning Outcomes (CLO) :

1. Be able to analyse hydrological data (CLO2)
2. Be able to design channels, culverts, spillways and reservoirs/ponds (CLO 3)
3. Be able to work in teams (CLO 9)

Learning Experiences :

Students actively discuss in class in analysing problems of water infrastructure (Problem Based Learning)

Syllabus :

Determine the dimensions of canals, culverts, and overflow reservoirs / retention ponds based on the calculation of flooding plans and open channel hydraulics and determine the dimensions of reservoir / retention pond based on water balance calculation. Learning methods including introductory lectures, individual / group exercises, written quizzes / examinations, primary and secondary data surveys, group discussion, as well as presentation and writing of group assignment. The assignment includes the design of canals, culverts, spillways and reservoirs / retention ponds in a water catchment area (DTA) with an area not exceeding 50 Km2, based on information on topographical maps at 1: 25,000 scale, rainfall data and or in the vicinity of DTA, the survey results of domestic water demand and related regency / municipal social-economic data.

Prerequisites : Hydraulics

Text Book References :

1. Bedient, Philip B. and Huber, Wayne C., 1992. Hydrology and Floodplain Analysis. Second Edition. Addison-Wesley Publishing Company, USA.
2. Chow, Ven Te, 1959. Open-Channel Hydraulics. International Student Edition. McGraw-Hill Kogakusha, Ltd., Tokyo.
3. Chow, Ven Te, Maidment, David R. and Mays, Larry W., 1988. Applied Hydrology. McGraw-Hill Book Company, Singapore.
4. Dewberry, Sidney O. and Rauenzahn, Lisa N., 2008. Land Development Handbook: Planning, Engineering, And Surveying / Dewberry. Third edition. McGraw-Hill, USA. E-Book
5. Mays, Larry W., 1996. Water Resources Handbook. McGraw-Hill, USA.
6. Wanielista, M., Kersten, R. and Eaglin, R., 1997. Hydrology: Water Quantity and Quality Control. Second Edition. John Wiley & Sons, Inc., Canada.
7. Maine Stream Team Program of the Maine Department of Environmental Protection-Stream, 2009. Survey Manual. A CITIZEN'S GUIDE to Basic Watershed, Habitat, and Geomorphology Surveys in Stream and River Watersheds — Volume I.
8. The USDA Natural Resources Conservation Service. How to Read a Topographic Map and Delineate a Watershed. http://www.geo.brown.edu/research/Hydrology/FTP_site_5099-05/Delineate_watersheds_NH_NRCS.pdf

Concrete Structure 1

ENCV 606 001

3 Credits

Expected Learning Outcomes :

CLO 3 (design),

CLO 5 (Modern Tools)

CLO 10 (Communication)

Course Learning Outcomes (CLO) :

1. Be able to design a simple 2-story building using reinforced concrete structures (CLO 3)
2. Be able to use SAP software in analysing a 2-story concrete building structure (CLO 5)
3. Be able to draw a 2-story concrete building according to engineering drawing principles and write a clear and organized design report (CLO 10)

Learning Experiences :

1. Interactive lectures
2. Participating in SAP software training workshop organized by IMS
3. Carrying out design assignments of reinforced concrete structures

Syllabus :

Introduction to design and analysis; system structure: Objectives, design steps; LRFD, reduction factor and permit voltage; Load; and Loading: Load form, type of load; load placement, load

distribution, factor; load and combination load; The basic concept of reinforced concrete; The stress and strain properties of concrete and steel; Compressive strength of concrete characteristics; The evolution of concrete compressive strength; The concept of boundary strength, simplification of Whitney stress blocks, balanced collapse; Single reinforcement and double reinforcement analysis on ordinary beams; Reinforcement analysis on the T beam section due to the force in the bending moment; Analysis of shear reinforcement in beam and torsion reinforcement; Analysis of one-way plate reinforcement, two-way plate with moment coefficient method, reinforcement analysis in short columns; Types of local shallow foundations and plans and their depictions; Able to calculate deflection in reinforced concrete structures.

Prerequisites : Construction Drawing 2, Material Properties, Structural Analysis, and Solid Mechanics

Text Book References :

1. Persyaratan Beton Struktural Untuk Bangunan Gedung, SNI 2847 : 2013
2. Beban Minimum Untuk Perancangan Bangunan Gedung Dan Struktur Lain, SNI 1727 : 2013
3. MacGregor, J.G., Reinforced Concrete: Mechanics and design, 6th edition, Pearson, 2012
4. Wahyudi, Syahril A.Rahim, Struktur Beton Bertulang, Penerbit Gramedia, 1997

Construction & Heavy Equipment Management

ENCV 606 002

4 Credits

Expected Learning Outcomes :

CLO 5 (Modern Tool Usage)

CLO 11 (Project Management and Finance)

Course Learning Outcomes (CLO) :

1. Be able to use Ms. Project to develop the planning schedule of construction (CLO 5)
2. Be able to plan construction work and handover of construction projects (CLO 11)

Learning Experiences :

1. Interactive lectures
2. Participating in the MS Project training workshop organised by IMS
3. Carrying out assignments on the work planning of mechanical earthmoving

Syllabus :

An understanding of construction project including: Project Design; Preparation of bidding documents; Contract administration; Construction planning; Methods and implementation of construction; Supervision and control; Material management; Quality management; Project Cost Management; Time Management; Safety, Health and Environment; Resource management and project stakeholders. Understanding of mechanical earthmoving, properties, type and volume of soil, heavy equipment operation, capacity and production cost of heavy equipment, calculating work volume, determining equipment requirements, designing tool combinations to optimize time and costs; calculating the production of heavy equipment, methods of each heavy equipment, how to plan projects. Several ways to calculate the volume of excavation and fill, construction method, calculation of work schedule and associated costs.

Prerequisites : Surveying and Geospatial Information Systems

Text Book References :

1. Kerzner, Harold, Project Management, John Wiley & Sons, Inc., 2006
2. Project Management Institute, A Guide to Project Management Body of Knowledge, 2013
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 Contracting, 7th ed., John Wiley & Sons Inc., New York, 2005
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. Gould, F. E. Managing the Construction Process (Estimating, Scheduling and Project Control)., Prentice Hall., New Jersey, 1997
8. Halpin, D., W., Construction Management. USA, John Wiley and Sons, Inc., New York, 1998
9. Hendrickson, C., Project Management for Construction. Fundamental Concepts for Owners, Engineer, Architects, and Builders., Prentice Hall, Singapore, 2008
10. Barrie, D. and Paulson B., Professional Construction Management, McGraw Hill, New York, 1992
11. Imam Sugoto. 1980. Mempersiapkan Lapisan Dasar Konstruksi Jilid 1 dan 2. Jakarta: Departemen Pekerjaan Umum.

Highway Engineering Design 2

ENCV 606 003

2 Credits

Expected Learning Outcomes :

CLO 3 (Design),

CLO 5 (Modern Tool Usage),

CLO 10 (Communication)

Course Learning Outcomes (CLO) :

1. Be able to design roads (CLO 3)
2. Be able to use Open Roads software to design roads (CLO 5)
3. Be able to draw geometric and road pavement in accordance with engineering drawing principles (CLO 10)

Learning Experiences :

Interactive lectures

1. Interactive lectures

2. Participating in Open Roads software training workshop organized by IMS
3. Carrying out assignment related to road design

Syllabus :

Inventory of existing conditions; Identification of needs; Highway Design; Basic Design Presentation

Prerequisites : Surveying & Geospatial Information Systems, Highway Engineering Design 1

Text Book References :

1. AASHTO, 2007. Maintenance Manual for Roadways and Bridges. 4th Ed.
2. Brockenbrough, R.L., Highway Engineering Handbook 3rd Ed, Mc Graw Hill, 2009
3. BSN (2004) : RSNI Perencanaan Geometrik Jalan Perkotaan
4. Direktorat Jenderal Bina MArga, (2013), Manual Desain Perkerasan Jalan no 02/M/BM/2013, Kementerian Pekerjaan Umum.
5. Direktorat Jendral Bina Marga (1990) : Petunjuk Desain Drainase Permukaan Jalan
6. Direktorat Jendral Bina Marga (1997) : Standar Perencanaan Geometrik Jalan Luar Kota
7. Fwa, T.F., The Handbook of Highway Engineering, Taylor & Fancis Group, 2006
8. Huang, Y., 2004. Pavement Analysis and Design 2nd ed., Prentice-Hall, Inc.

Writing and Presentation Techniques

ENCV 606 004

2 Credits

Expected Learning Outcomes :

CLO 8 (Ethics)

CLO 10 (Communication)

Course Learning Outcomes (CLO) :

1. Be able to identify ethnical principles and professionalism in communication (CLO 8)
2. Be able to write academic papers, compile presentation documents and present it well to audiences using appropriate Indonesian language (CLO 10)

Learning Experiences :

1. Interactive lecturer
2. Practice writing effective sentences
3. Practice doing scientific writing
4. Practice compiling power points
5. Practice presenting scientific papers
6. Practice compiling CV / motivation letter

Syllabus :

Introduction : the importance of verbal and written communication; Written communication using Indonesian and English; Data presenting in the form of tables, graphs and charts; How to make a good presentation using power points; Preparing a curriculum vitae; Compiling a motivation letter.

Prerequisites : -

Text Book References :

1. Ruiz-Garrido, Miguel. Palmer-Silveira, Juan C., Fortanet-Gomez, Immaculada. English for Professional and Academic Purposes.

Water Engineering 2

ENCV 606 006

3 Credits

Expected Learning Outcomes :

CLO 5 (Modern Tool Usage)

CLO 7 (Environment & Sustainability)

CLO 10 (Communication skill)

Course Learning Outcomes (CLO) :

1. Be able to operate ArcGIS geospatial model to prepare Hec-HMS hydrological model input data (CLO 5)
2. Be able to evaluate the implications of changes in the hypothetical area spatial planning for the magnitude of flooding plan and dimensions of water infrastructure (CLO 7)
3. Be able to present results of analysis or evaluation both in verbal and writing effectively (CLO 10)

Learning Experiences :

Students actively discuss in class analysing water infrastructure problems (Problem Based Learning)

Syllabus :

Utilise a hydrological model assisted by geospatial models to evaluate the implications of changes in spatial planning in a water catchment area (DTA) with an area not exceeding 50 km2, and present the results in the form of systematic written documents and effective oral presentations. The learning method consists of introductory lectures, group discussions inside & outside the classroom, written examinations, as well as oral presentations and writing assignments. The task includes utilizing the ArcGIS geospatial model for the preparation of input data for the WinTR-20 deterministic hydrological model which is used to simulate rainfall-flow relationships that are affected by changes in regional spatial planning. The evaluation focuses on the implications of changes in hypothetical spatial planning for changes in the magnitude of the planned flood which will then affect the dimensions of the related water infrastructure.

Prerequisites : Water Engineering 1, Surveying and Geospatial Information Systems

Text Book References :

1. John E. Gribbin, 2014, Introduction To Hydraulics And Hydrology With Applications For Stormwater Management, Fourth Edition
2. Bedient, Philip B. And Huber, Wayne C., 1992. Hydrology And Floodplain Analysis. Second Edition. Addison-Wesley Publishing Company, Usa.
3. Chow, Ven Te, 1959. Open-Channel Hydraulics. International Student Edition. Mcgraw-Hill Kogakusha, Ltd., Tokyo.
4. Chow, Ven Te, Maidment, David R. And Mays, Larry W., 1988. Applied Hydrology. Mcgraw-Hill

Book Company, Singapore.
5. Dewberry, Sidney O. And Rauenzahn, Lisa N., 2008. Land Development Handbook: Planning, Engineering, And Surveying / Dewberry. Third Edition. Mcgraw-Hill, Usa. E-Book
6. Mays, Larry W., 1996. Water Resources Handbook. Mcgraw-Hill, Usa.
7. Wanielista, M., Kersten, R. And Eaglin, R., 1997. Hydrology: Water Quantity And Quality Control. Second Edition. John Wiley & Sons, Inc., Canada.
8. Esri. Gis Solutions For Surveying. Esri Publishers, 2007.
9. Maine Stream Team Program Of The Maine Department Of Environmental Protection-stream, 2009. Survey Manual. A Citizen's Guide To Basic Watershed, Habitat, And Geomorphology Surveys In Stream And River Watersheds — Volume I.
10. The Usda Natural Resources Conservation Service. How To Read A Topographic Map And Delineate A Watershed. http://www.geo.brown.edu/research/Hydrology/FTP_site_5099-05/Delineate_watersheds_NH_NRCS.pdf

Infrastructure Design Project

ENCV 607 001

4 Credits

Expected Learning Outcomes :

CLO 3 (Design),
CLO 7 (Sustainability),
CLO 9 (Teamwork),
CLO 10 (Communication),
CLO 11 (Project and Finance)

Course Learning Outcomes (CLO) :

1. Be able to design civil engineering building structures (CLO 3)
2. Be able to consider sustainability aspect in selecting design alternatives (CLO 7)
3. Be able to work in teams in building design, preparing design reports and DED (CLO 9)
4. Be able to compile design reports, present it in a clear and organized manner and be able to present design results in construction drawings in accordance with engineering drawing principles (CLO 10)
5. Be able to conduct cost studies on infrastructure project based on RKS and DED (CLO 11)

Learning Experiences :

Students actively discuss in class related to design process of civil engineering infrastructure (Problem Based Learning)

Syllabus :

Problem identifications in accordance with social problems or problems in society (Problem-Based Solutions), providing design alternatives and determining possible solutions; Providing planning components related to the scope of work and implementation time in accordance with the alternative design solution chosen; Formulating the main and secondary components of civil engineering building structures; Preparing analysis reports including planning concepts, calculation methods and implementation methods, by applying regulations, manuals and standards; Preparing the specifications for the components of civil engineering construction work in accordance with regulations and technical specifications, calculation of unit prices and "bill of quantity", and details of overall costs; Preparing the planning result reports including technical specifications, calculation of unit prices and "bill of quantity", details of the overall cost of the work, and detailed drawing of the main building components in accordance with technical standards and provisions. Preparing a "blueprint" of the structural calculation results in the form of working drawing that are ready to be implemented by construction stakeholders.

Prerequisites : Construction Drawing 1 (pass), Structural Analysis, Construction & Heavy Equipment Management, Steel Structure.

Text Book References :

1. SNI (standar tata cara perhitungan struktur beton untuk bangunan gedung; standar tata cara perencanaan struktur baja untuk bangunan gedung; standar tata cara perencanaan ketahanan gempa bangunan gedung, dan standar yang dikeluarkan oleh Kementerian PU)
2. ASTM (Amerixan Standar for Testing Material)
3. AISC (American Institute of Steel Construction)
4. The American Concrete Institute' (ACI)
5. ASCE 07-2010 – Minimum Design Load for Building and other structures

Ethics and Legal Aspect of Construction Contract

ENCV 608 001

2 Credits

Expected Learning Outcomes :

CLO 6 (Engineer and Society) dan
CLO 8 (Ethics)

Course Learning Outcomes (CLO) :

1. Be able to apply knowledge related to ethics and construction law in drafting construction contracts (CLO 6)
2. Be able to analyse ethical erros in construction projects and their implications (CLO 8)

Learning Experiences :

1. Interactive lecture
2. Students actively discuss ethical cases in the construction field (Problem Based Learning)

Syllabus :

Understanding ethics and morals; Ethical theories; Professional ethics; Construction business ethics; Ethics towards the environment; Laws and regulations in the construction sector; Legal aspects in construction disputes; Construction contract

Prequisites : -

Text Book References :

1. Mike W. Martin & Roland Schinzinger, Ethics in Engineering, Mc Graw Hill, 2005
2. Chow Kok Fong, Law and Practice of Construction Contracts, Sweet & Maxwell Asia, 2012
3. Nazarkhan Yasin, Kontrak Konstruksi di Indonesia, Gramedia Pustaka Utama, 2014

Special Course

Seminar

ENCV600110

1 credits

Learning Objective(s):

Student can communicate in verbal or written with final project pjroposal; able to formulate the problems and objectives of the research, conduct theoretical review to formulate the hypothesis, design the research method for empirical proof and present the preliminary result to the supervisor

Topic:

Problem description, basic concept of research with assumption and constraint; making prelimi- nary report, conducting the preparation, literature review and research methodology; present final report with structured report, language, graphical presentation, table etc, reference and clarity.

Pre-requisite(s): Passed 110 CREDITS and GPA > 2.00 without Grade E

References: -

Field Internship

ENCV 600 100

3 Credits

Expected Learning Outcomes :

CLO 8 (Ethics),
CLO 9 (Teamwork),
CLO 10 (Communication)
CLO 11 (Project Management and Finance)

Course Learning Outcomes (CLO) :

1. Be able to write applications of professionalism ethics in construction projects such as quality control, timeliness and work safety (CLO 8)
2. Be able to work in teams to implement and complete a report (CLO 9)
3. Be able to write down observations on a construction project using appropriate Indonesian and present it to the examiners (CLO 10)
4. Be able to write down the application of CM BOK on observed projects in the report (CLO 11)

Learning Experiences :

1. Students in the group conduct field observations on a construction project, observe the complexity of the project and how construction project can be done by implementing CM-BOK (Construction Management Body of Knowledge)
2. Students observe how the decision-making process (problem solving) can be done quickly and accurately.
3. At the end of 200-hour observation, students write a report and present it in front of the examiners.

Syllabus :

Carrying out an internship in a construction project for a minimum of 200 hours; Conducting field observations; Reading a construction drawing; Writing observation report; Describing technical work process, quality control, project management, project specification, engineering drawing and other aspects; Problem solving in construction; Presenting the results of observation.

Prerequisites :

1. Has been doing 6th Semester and taking > 75 credits in accordance with regulation in the Department of Civil Engineering, Universitas Indonesia and or other relevant provisions of Engineering Faculty, Universitas Indonesia.
2. For administrative purposes, students must have passed 60 credits.
3. Students have taken the following courses: Foundation Engineering, Concrete Structure 1, and Construction & Heavy Equipment Management.
4. Fill out the IRS for Special Courses ”Practical Works” and convey the willingness to do the practical work to the course coordinator.
5. Students have to select a location for practical work themselves and have made observation at the selected location
6. Students must fill out and submit the registration form to the administration staffs of Civil Engineering department.

Final Project/Bachelor Thesis

ENCV 600 300

5 Credits

Expected Learning Outcomes :

CLO 4 (Experiment), dan
CLO 8 (Ethics),
CLO 10 (Communication)
CLO 12 (Lifelong Learning)

Course Learning Outcomes (CLO) :

1. Be able to investigate problems, design research methodologies, conduct research and analyse results. (CLO 4)
2. Be able to apply ethics in conducting research as proven by scientific writing report having a maximum similarity test of 30% (CLO 8)
3. Be able to write a research report appropriately using Indonesian and present it clearly to the examiners (CLO 10)
4. Be able to work independently and complete

research work within the specified time (CLO 12)

Learning Experiences :

Students are encouraged to carry out research independently under the supervision of lecturers, write a research report and present it clearly to the examiners.

Syllabus :

Problem formulation, literature study, conducting research, data analysis, result interpretation, writing and presenting research report.

Prerequisites : Has completed 114 credits with a GPA>=2.00 and without E grade

Elective Course

Entrepreneurship

ENCV 606 005

2 Credits

Expected Learning Outcomes :

CLO 9 (Teamwork)

CLO 10 (Communication)

CLO 13 (Entrepreneurship)

Course Learning Outcomes (CLO) :

1. Be able to work in teams to conceive business ideas (CLO 9)
2. Be able to effectively present the innovative ideas to general public (CLO 10)
3. Be able to come up with entrepreneurial ideas in the field of Civil Engineering (CLO 13)

Learning Experiences :

1. Listening to the alumni stories who have successfully create a business in construction area or who secure high position in a construction company
2. Discussing in teams to explore business prospects in the field of Civil Engineering
3. Presenting business ideas to potential investors / customers

Syllabus :

The problems and needs of various stakeholders in the field of Civil Engineering, General entrepreneurial opportunities to solve Civil Engineering problems, definitions of entrepreneurship, actions, plans and challenges of business people, actions, plans and challenges of academics and observers, Business model canvas concepts, general company profiles, profiles customers in general, Cost and Turnover, Identification of differences and similarities between BMC components, Assessment of the advantages and disadvantages of each BMC component, Various environmental engineering products and services, Definition of product value, Human needs, Customer segments, Various customer profiles, excavating customer profiles, excavating customer profiles, identifying differences and similarities between VPC components, assessing the advantages and disadvantages of each VPC component.

Prerequisites : Engineering Economics

Textbooks : -

Service Learning

ENCV 600 300

1 Credits

Expected Learning Outcomes (CLO):

CLO 12 (Lifelong Learning)

Course Learning Outcomes (CLO):

Be able to independently allocate time to actively involved in student activities without disrupting academic activities as indicated by the achievement of activity points (CLO 12)

Learning Experiences:

Being actively involved in various student activities

Syllabus :

Students take part in activities outside the Civil Engineering curriculum. For each activity that is followed, the equivalent will be calculated in the form of points (scores). Students must achieve a minimum point according to the implementation instructions issued by the department.

Prerequisites :

Students can claim 1 credit for this course after reaching the minimum number of points stipulated. (see the Student Affairs Manual of the Department of Civil Engineering, 2020 Curriculum, authorized by the Department).

Civil Engineering Fast-Track Curriculum (Undergraduate and Graduate)

Code	Subject	SKS
	1st Semester	
	Religion	2
	Academic Writing	**2**
ENGE 600 001	Calculus 1	3
ENCV 601 001	Physics (Mechanics and Thermal)	4
ENCV 601 002	Environmental Basic Chemistry	**3**
ENCV 601 003	Intro to Civil Engineering System	3
ENCV 601 004	Material Properties	3
	Sub Total	**20**
	2nd Semester	
	Integrated Character Building	5
ENGE 600 002	Calculus 2	3
ENGE 600 007	Physics (Electricity, MWO)	3
ENGE 600 004	Linear Algebra	4
ENCV 602 001	Construction Drawing 1	2
ENCV 602 002	Statics	3
	Sub Total	**20**
	3rd Semester	
ENCV 603 001	Construction Drawing 2	3
ENCV 603 002	Solid Mechanics	4
ENCV 603 003	Fluid Mechanics	3
ENCV 603 004	Statistics and Probabilistic of Experimental Design	2
ENCV 603 005	Basic Soil Mechanics	3
ENCV 603 006	Surveying & Geospatial Information Systems	2
ENCV 603 007	Advanced Calculus	3
	Sub Total	**20**
	4thSemester	
ENGE 600 011	Engineering Economics	3
ENCV 604 001	Soil Mechanics	3
ENCV 604 002	Hydraulics	3
ENCV 604 003	Structural Analysis	4
ENCV 604 004	Numerical Method	2
ENCV 604 005	Transportation Engineering	3
	Elective Courses	**9**
	Sub Total	**20**
	5th Semester	
ENGE 600 012	HSE Protection	2
ENCV 605 001	Foundation Engineering	3
ENCV 605 002	Engineering System	2
ENCV 605 003	Highway Engineering Design 1	4
ENCV 605 004	Steel Structure 1	3
ENCV 605 005	Water Engineering 1	3
	Elective Courses	9
	Sub Total	**20**
	6th Semester	
ENCV 606 001	Concrete Structure 1	3
ENCV 606 002	Construction & Heavy Equipment Management	4
ENCV 606 003	Highway Engineering Design 2	2
ENCV 606 004	Effective Communication	2
ENCV 606 005	Entrepreneurship	**2**
ENCV 606 006	Water Engineering 2	3
	Elective Course	3
	Sub Total	**19**
	7th Semester	
ENCV 600 100	Field Internship	3
ENCV 600 300	Service Learning	1
ENCV 607 001	Infrastructure Design Project	4
ENCV 801 101	Applied Mathematics (S2)	3
ENCV 801 102	Value and System Engineering (S2)	3
	Mandatory Specialization Course S2	3
	Sub Total	**17**
	8th Semester	
ENCV 608 001	Ethics and Legal Aspect of Construction Contract	2
ENCV 802 103	Research Methodology	3
ENCV 800 104	Pra Master Thesis	4

	Mandatory Specialization Course S2	3
	Sub Total	**12**
	9th Semester	
ENCV 800 105	Master Thesis	4
	Mandatory/Elective Specialization Course S2	3
	Mandatory/Elective Specialization Course S2	3
	Sub Total	**15**
	10th Semester	
ENCV 800 106	Scientific Pub;lication	2
	Mandatory/Elective Specialization Course S2	3
	Mandatory/Elective Specialization Course S2	3
	Mandatory/Elective Specialization Course S2	3
	Sub Total	**10**

Undergraduate Program in Environmental Engineering

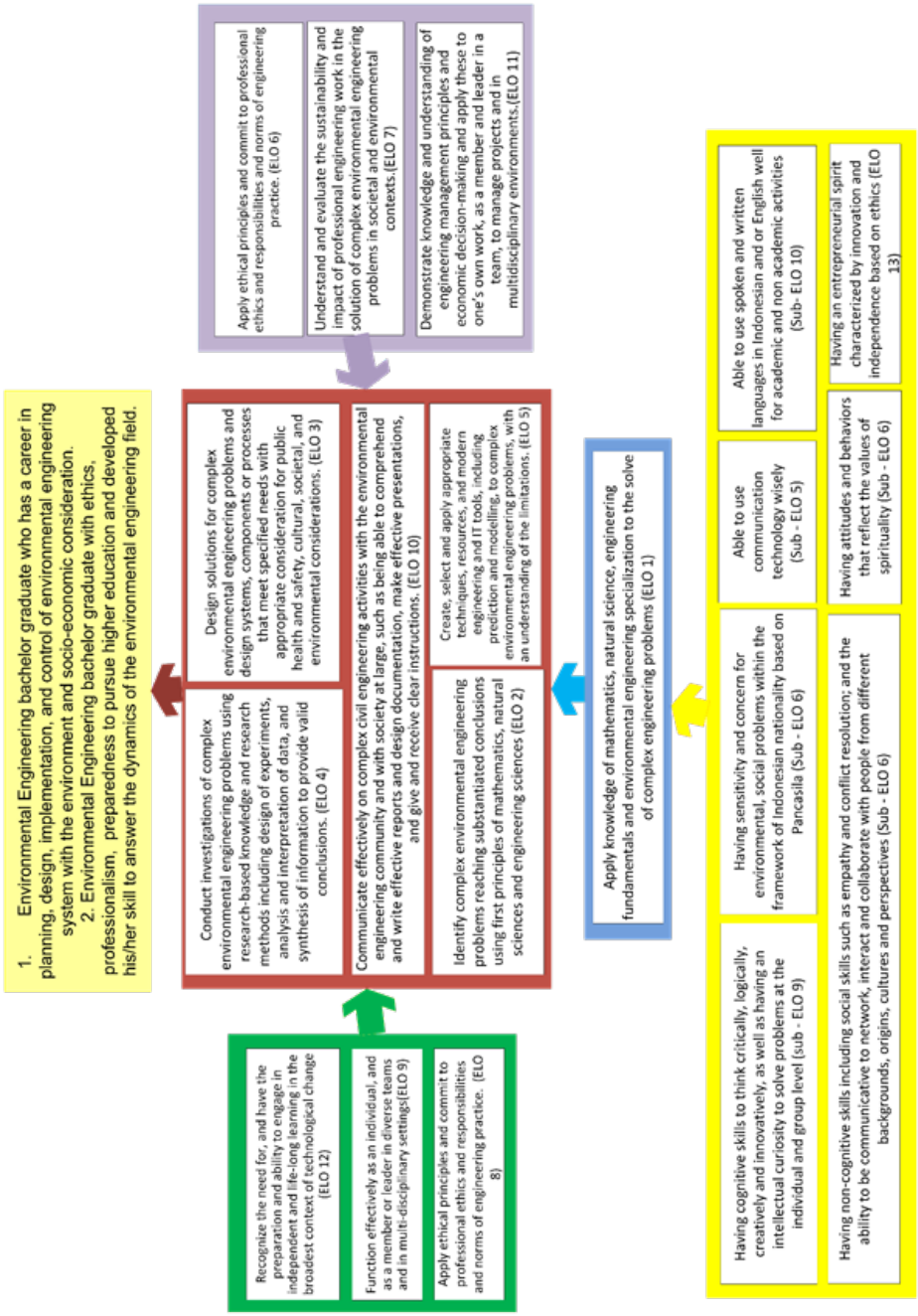
Program Specification

1.	**Awarding Institution**	Universitas Indonesia	
2.	**Teaching Institution**	Universitas Indonesia	
3.	**Faculty**	Engineering	
4.	**Programme Tittle**	Undergraduate Program in Environmental Engineering	
5.	**Vision and Misson**	The Vision: "As an exceptional center for science and technology in the field of environmental engineering that contributes to the global market" The Mission: a. Produce graduates who mastered the technique of the environment with the underlying technology of basic civil and environmental engineering and a robust international standard. b. Actively contribute ideas to society through research and development of environmental engineering facilities and infrastructure, considering the harmonious relationship between humans and nature. c. Develop students to have leadership skills, independence, sociable, communicative, and upholds professional ethics.	
6.	**Class**	Regular and Non Reguler	
7.	**Final Award**	Sarjana Teknik (S.T)	
8.	**Accreditation / Recognition**	National Accreditation: Excellent accreditation from BAN – PT: International accreditation from IABEE and AUN-QA	
9.	**Language(s) of Instruction**	Bahasa Indonesia	
10.	**Study Scheme (Full Time / Part Time)**	Full Time	
11.	**Entry Requirements**	High school /equivalent, or D3 / Polytechnique / equivalent, AND pass the entrance exam.	
12.	**Study Duration**	Designed for 4 years	
	Type of Semester	Number of Semester	Number of weeks / semester
	Regular	8	16
	Short (optional)	3	8
13.	T**he aims of the programme** is produce environmental engineering bachelor graduate that protects the environment, through the design, implementation, and control in the areas of : 1. Drinking Water Supply. 2. Wastewater management and solid waste management (Hazardous and Non-Hazardous) 3. Drainage 4. Environmental Sanitation 5. Water Resource 6. Air Pollution 7. Pollution Prevention 8. Environmental Impact Assessment		

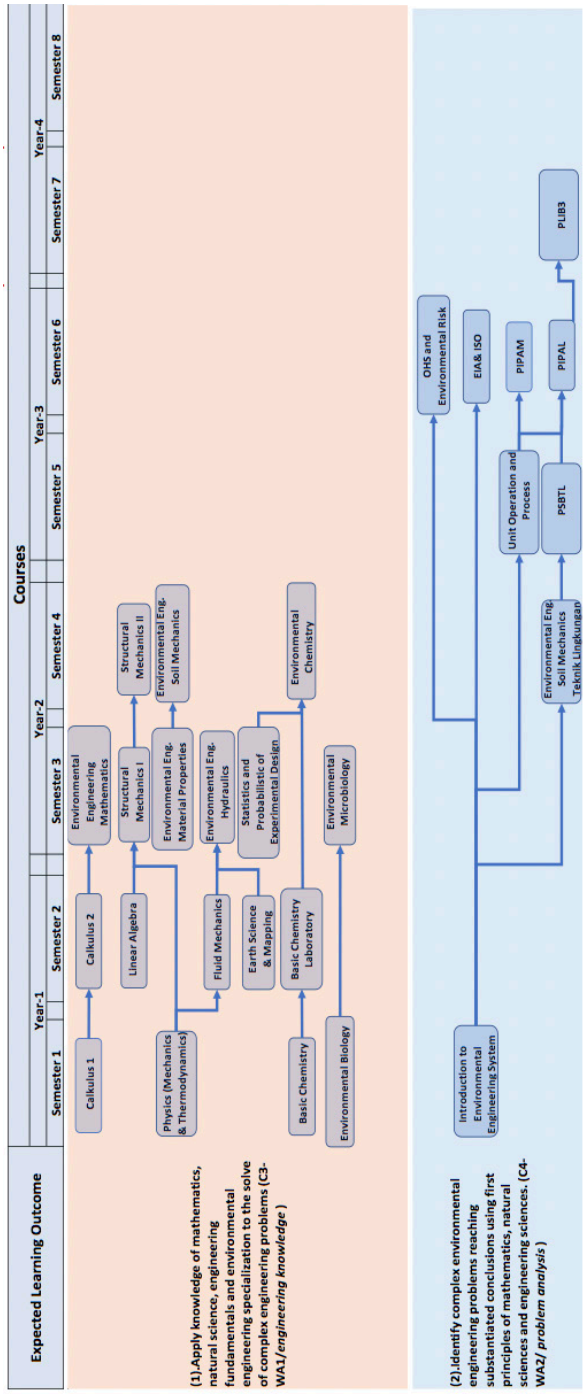
14.	**Profile of Graduates** 1. Environmental Engineering bachelor graduate who has a career in planning, design, implementation, and control of environmental engineering system with the environment and socio-economic consideration. 2. Environmental Engineering bachelor graduate with ethics, professionalism, preparedness to pursue higher education and developed his/her skill to answer the dynamics of the environmental engineering field.
15.	**Expected Learning Outcomes (ELO):** 1. Apply knowledge of mathematics, natural science, engineering fundamentals and environmental engineering specialization to the solve of complex engineering problems (C3-WA1/engineering knowledge) 2. Identify complex environmental engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. (C4-WA2/problem analysis) 3. Design solutions for complex environmental engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations. (C5-WA3/design or development of solutions) 4. Conduct investigations of complex environmental engineering problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions. (C4-WA4/investigation) 5. Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex environmental engineering problems, with an understanding of the limitations. (P3-WA5/modern tool usage) 6. Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional civil engineering practice and solutions to complex environmental engineering problems.(C3-WA6/the engineer and society) 7. Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex environmental engineering problems in societal and environmental contexts. (C3-WA7/environment and sustainability) 8. Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice. (A4-WA8/ethics) 9. Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings. (P3-WA9/individual and team work) 10. Communicate effectively on complex civil engineering activities with the environmental engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. (C3, P3/WA10 communication) 11. Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. (C3-WA11/project management and finance) 12. Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. (C3-WA12/lifelong learning) 13. Use knowledge of entrepreneurship to identify an independent business based on creativity and professional ethics. (C3-UI-E)
16.	**Classification of Subjects**

No.	Classification	Credit Hours (SKS)	Percentage
i	University General Subjects	10	6,25 %
ii	Basic Engineering Subjects	12	8,33 %
iii	Core Subjects	88	61,11 %
iv	Electives	26	18,06 %
v	Industrial Attachment, Seminar, Undergraduate Thesis	9	6,25 %
	Total	145	100 %
	Total Credit Hours to Graduate		145 SKS

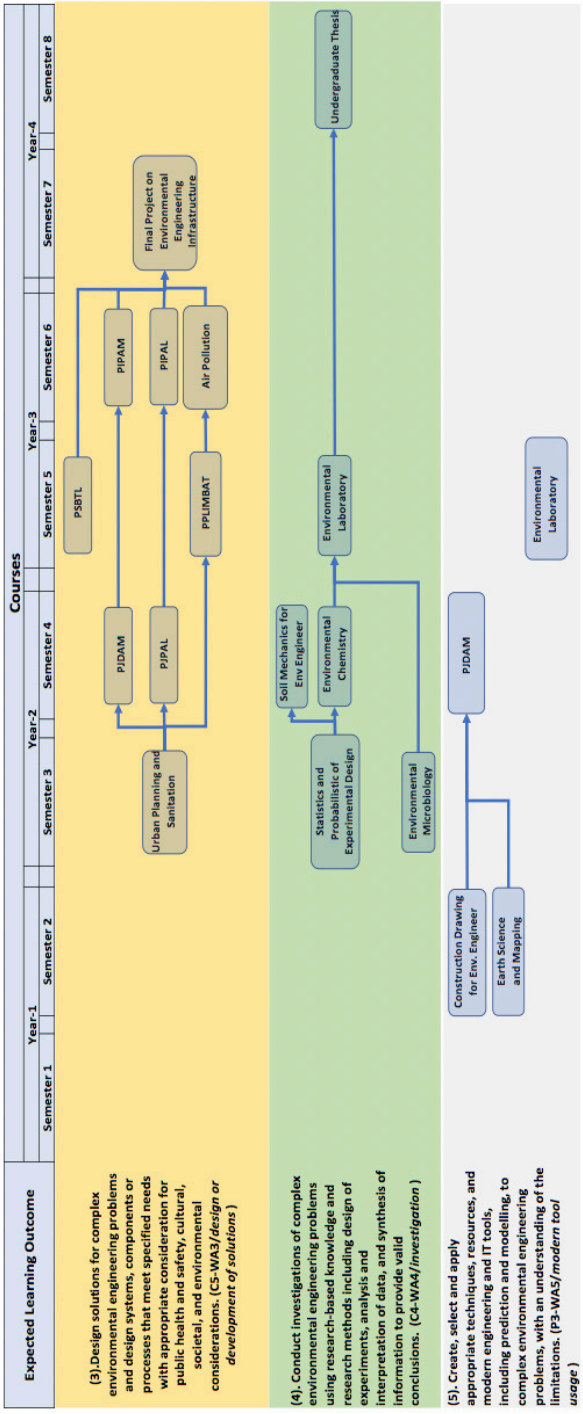
Learning Outcome



Flow Diagram Of Subject to Reach ELO in Environmental Engineering Undergraduate Programme



PSBTL: Structural Design for Environmental Engineering Infra-structure	PIPAL: Domestic Wastewater Treatment Plant Design
EIA & ISO: Environmental Impact Assessment & ISO	PJPAL: Wastewater Collection System Design
PIPAM: Water Treatment Plant Design	PLIB3: Hazardous dan Industrial Waste Treatment
PJDAM: Drinking Water Distribution System Design	PPLIMBAT: Integrated Solid Waste Management Planning
OHS and Environmental Risk : Occupational Health and Safety and Environmental Risk	



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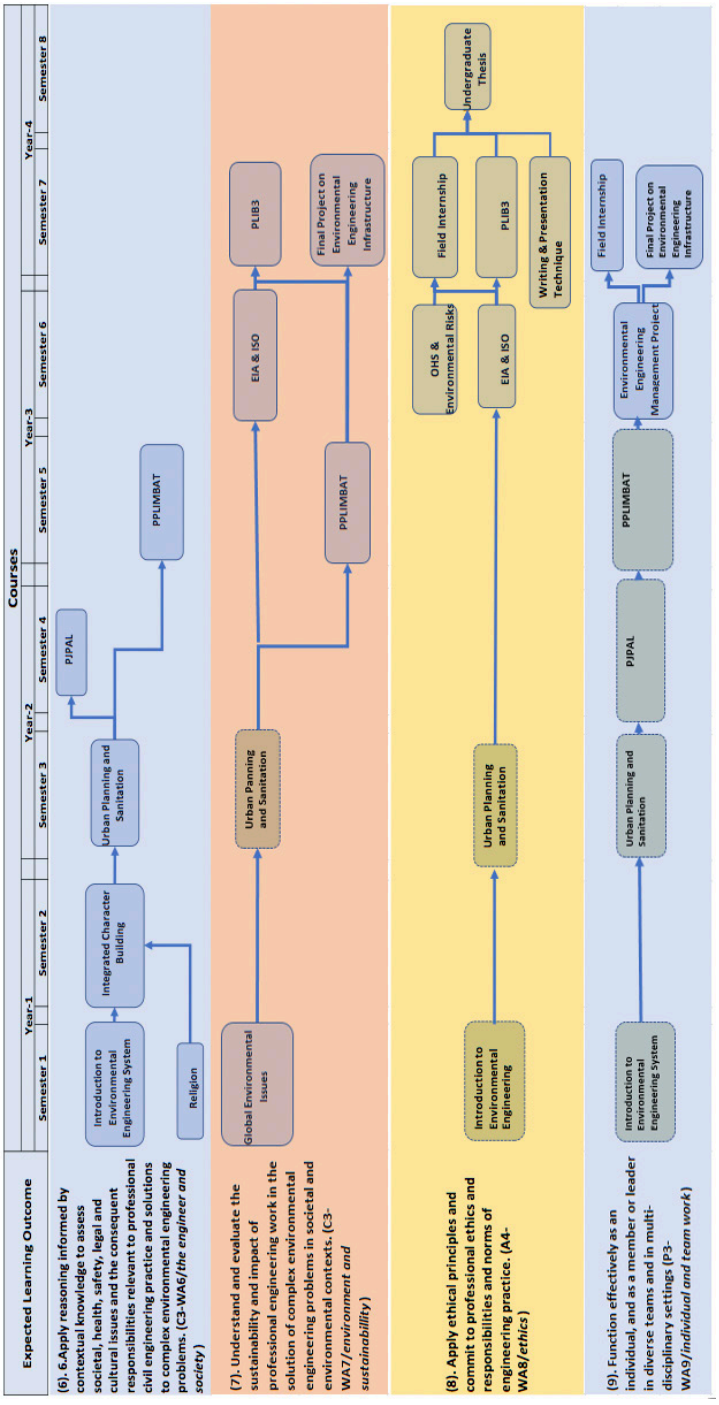

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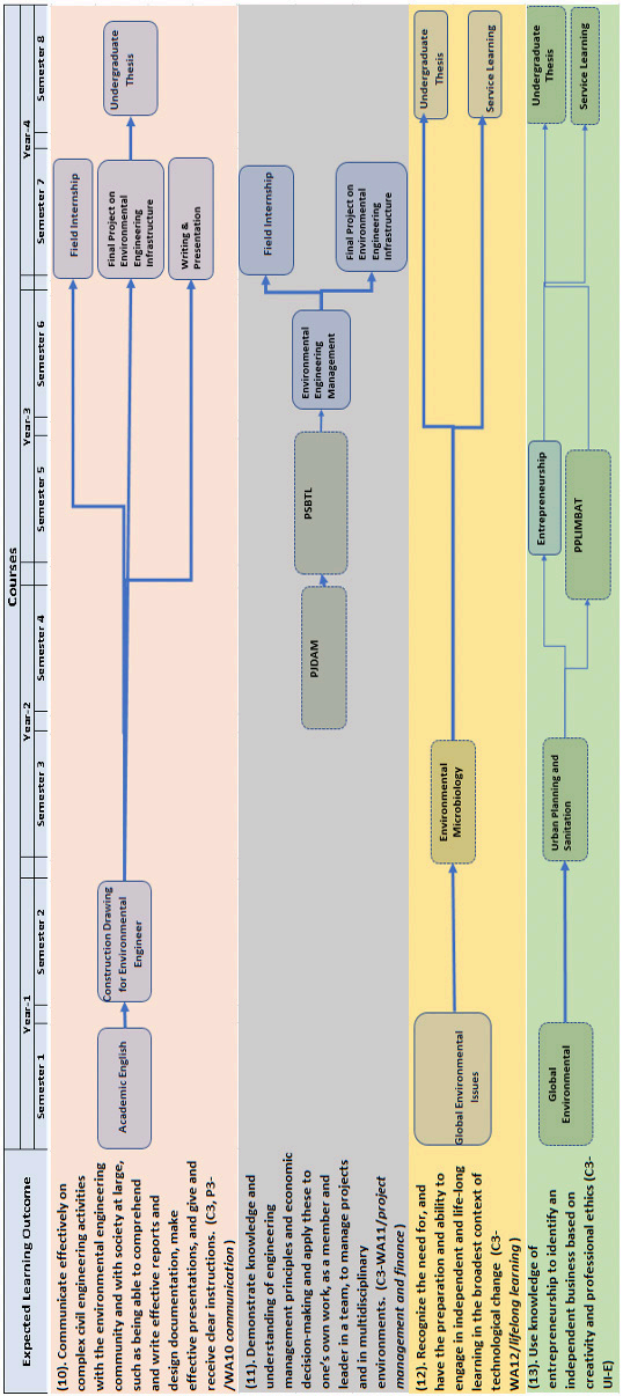

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OHS and Environmental Risk : Occupational Health and Safety and Environmental Risk	

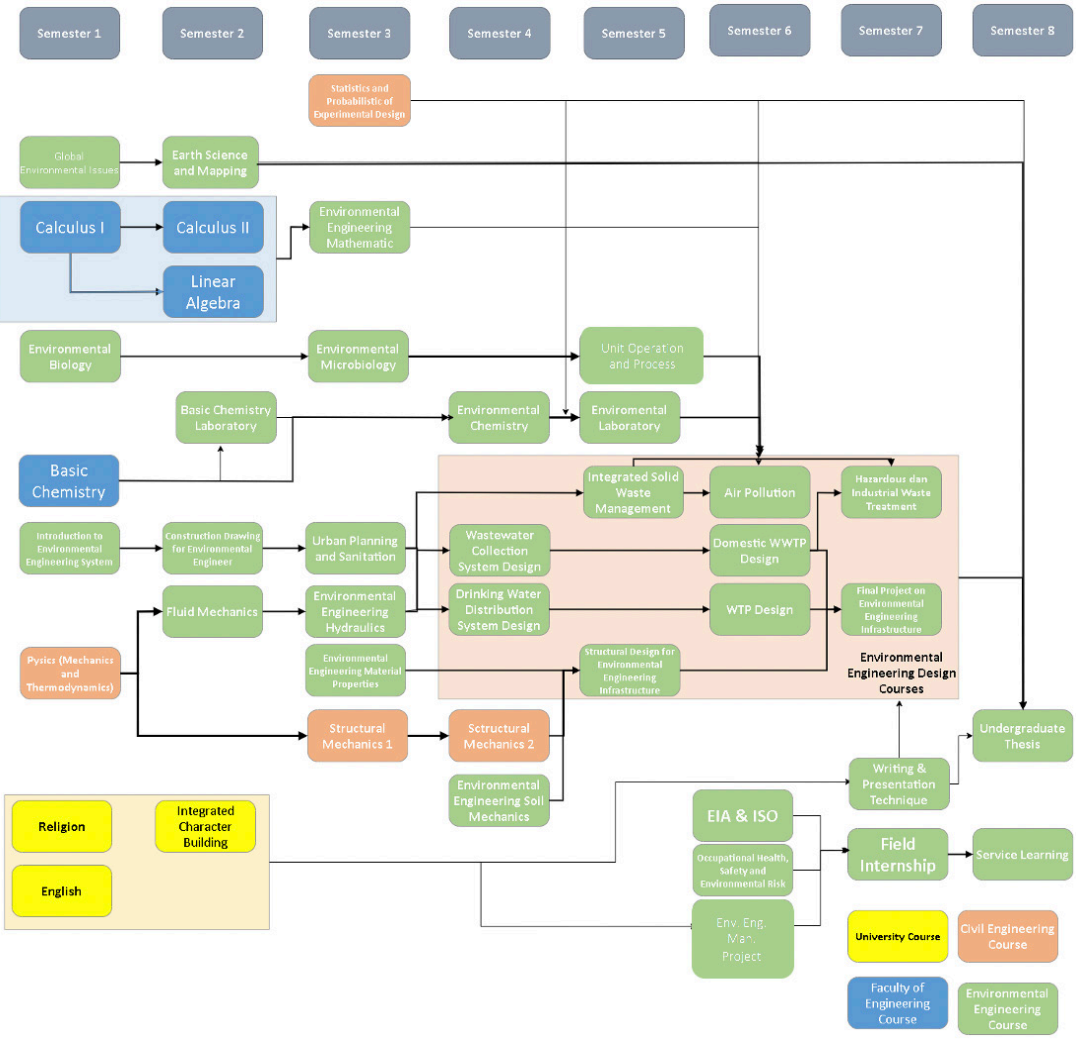
Code	Course	SKS	ELO													Total Assessment
			Engineering Knowledge	Problem Analysis	Design	Experiments	Modern Tools	Engineer and Society	Sustainability	Ethics	Individual and Teamwork	Communication	Project Management	Lifelong	(Ul-e)	
			1	2	3	4	5	6	7	8	9	10	11	12	13	
Semester 1		**20**														
UIGE 600 003	Academic English	2										O				1
UIGE 600 004	Religion	2						O								1
ENGE 600 001	Calculus 1	3	O													1
ENGE 600 009	Basic Chemistry	2	O													1
ENCV 601 001	Physics (Mechanics and Thermodynamics)	4	O													1
ENEV 601 001	Introduction to Environmental Engineering System	3		O				O								2
ENEV 601 002	Global Environmental Issues	2							O					O		2
ENEV 601 003	Environmental Biology	2	O													1
Semester 2		**20**														
UIGE 600 006	Integrated Character Building	5	O													1
ENGE 600 002	Calculus 2	3	O													1
ENGE 600 004	Linear Algebra	4	O													1
ENCV 603 003	Fluid Mechanics	3	O													1
ENEV 602 001	Earth Science and Mapping	2	O				O									2
ENEV 602 002	Construction Drawing for Environmental Engineer	2					O					O				2
ENEV 602 003	Basic Environmental Chemistry	1	O													1

Code	Course	SKS	ELO													Total Assessment
			Engineering Knowledge	Problem Analysis	Design	Experiments	Modern Tools	Engineer and Society	Sustainability	Ethics	Individual and Teamwork	Communication	Project Management	Lifelong	(Ul-e)	
			1	2	3	4	5	6	7	8	9	10	11	12	13	
Semester 3		**18**														
ENCV 603 004	Statistics and Probabilistic of Experimental Design	2	O			O										2
ENEV 603 001	Environmental Engineering Mathematic	3	O													1
ENEV 603 002	Environmental Microbiology	3	O			O										2
ENEV 603 003	Environmental Engineering Material Properties	2	O													1
ENEV 603 004	Environmental Hydraulics	3	O													1
ENEV 603 005	Structural Mechanics I	2	O													1
ENEV 603 006	Urban Planning and Sanitation	3			O			O								2
Semester 4		**18**														
ENEV 604 001	Structural Mechanics II	2	O													1
ENEV 604 002	Drinking Water Distribution System Design	2			O		O									2
ENEV 604 003	Soil Mechanics for Environmental Engineer	3	O	O		O										3
ENEV 604 004	Environmental Chemistry	3	O			O										2
ENEV 604 005	Wastewater Collection System Design	2			O			O								2
ENGE 600 011	Engineering Economy*	3														0
	Elective/Minor	3	O													1

Code	Course	SKS	ELO													Total Assessment
			Engineering Knowledge	Problem Analysis	Design	Experiments	Modern Tools	Engineer and Society	Sustainability	Ethics	Individual and Teamwork	Communication	Project Management	Lifelong	(Ul-e)	
			1	2	3	4	5	6	7	8	9	10	11	12	13	
Semester 5		**20**														
ENEV 605 002	Unit Operation and Process	4		O												1
ENEV 605 003	Environmental Laboratory	3				O	O									2
ENEV 605 004	Integrated Solid Waste Management Planning	3			O			O	O							3
ENEV 605 005	Structural Design for Environmental Engineering Infrastructure	3		O	O											2
	Elective/Minor	7														0
Semester 6		**20**														
ENEV 606 001	Occupational Health, Safety and Environmental Risk	2		O						O						2
ENEV 606 002	Environmental Impact Assessment and ISO	3		O					O	O						3
ENEV 606 003	Environmental Engineering Project Management	3									O		O			2
ENEV 606 004	Water Treatment Plant Design	3		O	O											2
ENEV 606 005	Domestic Wastewater Treatment Plant Design	3		O	O											2
ENEV 606 006	Air Pollution	3			O											1
	Elective/Minor	3														0

Code	Course	SKS	ELO													Total Assessment
			Engineering Knowledge	Problem Analysis	Design	Experiments	Modern Tools	Engineer and Society	Sustainability	Ethics	Individual and Teamwork	Communication	Project Management	Lifelong	(UI-e)	
			1	2	3	4	5	6	7	8	9	10	11	12	13	
Semester 7		**15**														
ENEV 600 100	Field Internship	3								O	O	O	O			4
ENEV 607 001	Final Project on Environmental Engineering Infrastructure	4			O				x		O	O	O			4
ENEV 607 002	Hazardous dan Industrial Waste Treatment	3		O					O	O						3
ENEV 603 007	Writing and Presentation Technique	2								O		O				2
	Elective/Minor	3														0
Semester 8		**13**														
ENEV 600 300	Service Learning	1												O		1
ENEV 600 400	Undergraduate Thesis	5				O				O		O		O		4
	Elective/Minor	7														0
	Total	144														77
	Number of Course assessed by each ELO		19	19	9	9	6	4	5	4	6	3	6	3	3	0

Flow Diagram of Subjects in Environmental Engineering Undergraduate Programme



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OHS and Environmental Risk : Occupational Health and Safety and Environmental Risk	

FACULTY OF ENGINEERING

Course Structure Undergraduate Program Environmental Engineering

Code	Subject	SKS
	1st Semester	
UIGE 600 003	Academic English	2
UIGE 600 004	Religion	2
ENGE 600 001	Calculus 1	3
ENGE 600 009	Basic Chemistry	2
ENCV 601 001	Physics (Mechanics and Thermodynamics)	4
ENEV 601 001	Introduction to Environmental Engineering System	3
ENEV 601 002	Global Environmental Issues	**2**
ENEV 601 003	Environmental Biology	**2**
	Sub Total	**20**
	2nd Semester	
UIGE 600 007	Integrated Character Building	6
ENGE 600 002	Calculus 2	3
ENGE 600 004	Linear Algebra	4
ENCV 603 003	Fluid Mechanics	3
ENEV 602 001	Earth Science and Mapping	2
ENEV 602 002	Construction Drawing for Environmental Engineer	2
ENEV 602 003	Basic Environmental Chemistry	1
	Sub Total	**21**
	3rd Semester	
ENCV 603 004	Statistics and Probabilistic of Experimental Design	2
ENEV 603 001	Environmental Engineering Mathematic	3
ENEV 603 002	Environmental Microbiology	3
ENEV 603 003	Environmental Engineering Material Properties	2
ENEV 603 004	Environmental Hydraulics	3
ENEV 603 005	Structural Mechanics I	2
ENEV 603 006	Urban Planning and Sanitation	3
	Sub Total	**18**
	4th Semester	
ENEV 604 001	Structural Mechanics II	2
ENEV 604 002	Drinking Water Distribution System Design	2
ENEV 604 003	Soil Mechanics for Environmental Engineer	3
ENEV 604 004	Environmental Chemistry	3
ENEV 604 005	Wastewater Collection System Design	2
	Elective/Minor	6
	Sub Total	**18**
	5th Semester	
ENEV 605 002	Unit Operation and Process	4
ENEV 605 003	Environmental Laboratory	3
ENEV 605 004	Integrated Solid Waste Management Planning	3
ENEV 605 005	Structural Design for Environmental Engineering Infrastructure	3
	Elective/Minor	7
	Sub Total	**20**
	6th Semester	
ENEV 606 001	Occupational Health, Safety and Environmental Risk	2
ENEV 606 002	Environmental Impact Assessment and ISO	3
ENEV 606 003	Environmental Engineering Project Management	3
ENEV 606 004	Water Treatment Plant Design	3
ENEV 606 005	Domestic Wastewater Treatment Plant Design	3
ENEV 606 006	Air Pollution	3
	Elective/Minor	3
	Sub Total	**20**
	7th Semester	
ENEV 600 100	Field Internship	3
ENEV 607 001	Final Project on Environmental Engineering Infrastructure	4
ENEV 607 002	Hazardous and Industrial Waste Treatment	3
ENEV 607 003	Writing and Presentation Technique	2
	Elective/Minor	3

	Sub Total	**15**
	8th Semester	
ENEV 600 300	Service Learning	1
ENEV 600 400	Undergraduate Thesis	5
	Elective/Minor	7
	Sub Total	**13**
	Total	**145**

Electives Subject in Environmental Engineering Undergraduate Programme

Course Code	Electives Semester 4	SKS
ENEV 604 101	Applied Sanitation	3
ENGE 600 011	Engineering Economics	3
ENEV 600 500	Internship A	2
Course Code	**Electives Semester 5**	**SKS**
ENEV 605 102	Introduction to Environmental Economics	3
ENEV 605 103	Entrepreneurship	2
ENEV 605 104	Environmental Modelling	2
Course Code	**Electives Semester 6**	**SKS**
ENEV 606 105	Environmental System Analysis	3
ENEV 600 600	Internship B	3
Course Code	**Electives Semester 7**	**SKS**
ENEV 607 106	Monitoring and Optimation of Water Treatment Plant	3
ENEV 607 107	Emerging Topics on Environmental Engineering	3
ENEV 600 700	Special Topic of Research Collaboration	3
Course Code	**Electives Semester 8**	**SKS**
ENEV 608 108	Sludge processing and Valorization	3
ENEV 608 109	Pollution Prevention	3

Environmental Engineering Undegraduate Minor Curriculum for other programme

Subjects Code	Environmental Engineering Minor	SKS
ENEV 601 001	Introduction to Environmental Engineering System	3
ENEV 603 006	Urban Planning and Sanitation	3
ENEV 606 002	Environmental Impact Assessment and ISO	3
ENEV 606 006	Air Pollution	3
ENEV 607 002	Hazardous dan Industrial Waste Treatment	3
ENEV 608 109	Pollution Prevention	3
	Total	**18**

Transition Policy from the 2016 to the 2020 Curriculum

1. New curriculum 2020 will be applied effectively from Odd Semester 2020/2021. In principle, after curriculum 2020 is implemented, then only courses from this new curriculum will be opened.
2. For class 2019 and above will follow this transition rules
3. The enforcement of the transitional period is one year. During this transition period, if a course in curriculum 2020 is in odd semester while in previous curriculum in even semester (vice versa), then this course can be held (if necessary) in both semesters.
4. For students who have not passed the compulsory courses in curriculum 2016, are required to take the same course or equivalent in curriculum 2020. Equivalence courses can be seen in the table below. All courses in the curriculum 2016 that are not listed in equivalence table have not changed, both in names and credits.
5. When there is a change in the course credits, then the number of graduation credits counted in, is the number of credits when it was taken. The same or equivalent courses when are equated with different credits, if retaken, or just taken will be acknowledged under a new name and credits. (see course equivalence table).
6. When a compulsory subject in the curriculum 2016 is deleted and there is no equivalence in the curriculum 2020 then:For students who have passed these subjects, the credits that are achieved will be counted in the calculation of graduation 144 credits. For students who did not pass these courses, they can take new compulsory courses or choose elective subjects in the curriculum 2020 to complete 144 credits.
7. The shortage of credits due to curriculum changes can be covered by taking new compulsory courses in the 2020 curriculum as stated in the equivalence of courses. The excess of credits due to curriculum changes has an impact on reducing the obligation of credits for elective courses.
8. If there is a change in the credit of a course, the number of credits taken into account in graduation is the number of credits at the time the course is taken. The same subject or equivalent with different credits weights, if repeated or newly taken will be listed with a new name and calculated with the new credit weight.
9. The new mandatory courses in the 2020 curriculum such as Practicum of Basic Chemistry, Environmental Biology, and Student Affairs are elective courses for the 2019 class, 2018 and before and become a compulsory MK for the 2020 class and after.
10. The new mandatory courses in the 2020 curriculum such as Practicum of Basic Chemistry, Environmental Biology, and Student Affairs are elective courses for the 2019 class, 2018 and before and become a compulsory MK for the 2020 class and after
11. It should be noted for the following courses managed by the University:

a. Students who have passed one of the MPKT A (6 credits) or MPKT B (6 credits) courses in the 2016 Curriculum are not required to take the MPKT MK (5 credits) in the 2020 Curriculum.

b. Students who have not passed or have not taken the MK Sports/Arts (2 credits) are required to take the MK Option/Minor.

c. Students who have not passed or have not taken the English Constitutional Court (3 credits) are required to take the English Constitutional Court (2 credits) in the 2020 Curriculum.

12. It should be noted for the following courses managed by the faculty:

a. Students who have not passed or have not taken the MK Calculus (4 credits), are required to repeat the MK Calculus course (4 credits) organized by the Study Program within the FTUI environment.

b. Students who have not passed or have not taken the MK Physics of Mechanics and Heat (3 credits), are required to take Physics of Mechanics and Thermodynamics (4 credits) in the 2020 Curriculum.

c. Students who have not passed or have not taken the Basic Physics Practicum 1 (1 credit) in the 2016 curriculum, are not required to take the MK in the 2020 curriculum. To meet the shortage of credits, they can take the Mandatory MK Study Programs in the 2020 Curriculum

d. Students who have not passed or have not taken the MGO Electrical Physics MK (3 credits) in the 2016 curriculum are required to take the compulsory MK Study Program in the 2020 curriculum which is equivalent, namely Environmental Biology (2 credits) To meet the shortage of credits, they can take the compulsory MK Study Program in the 2020 curriculum.

e. For students who have not passed or have not taken the MK Electrical Physics Practicum (1

Equalizing the 2016 Curriculum Subjects and the 2020 Curriculum for Civil Engineering Undergraduate

No	Name of Courses in Curriculum 2016	Credits 2016	Name of Courses in Curriculum 2020	Credits 2020	Remarks
1	Physics - Mechanics and Thermal	3	Physics - Mechanics and Thermody-namics	4	New courses are mandatory for the study program. The number of credits is reduced. Merger of two courses, Exception for 2019; 2018; 2017 during transition
2	Thermodynamics	2			
3	Praktikum Fisika Dasar	1	None	-	
4	Academic English	3	Academic English	2	The change of course credit
5	Integrated Character Building A	6	Integrated Character Building	5	The change of course name & credits
6	Integrated Character Building B	6			
7	Olahraga/ Seni	1	None	1	None
8	Religion	2	Religion		The change of position form even to odd
9	Physics - Electricity, MWO	3	Environmental Biology	2	New courses are mandatory for the study program
10	Physics - Electricity, MWO Lab	1	None	-	
11	Basic Chemistry	2	Basic Chemistry	2	The change of position (semester 3 become semester 1) and New courses are mandatory
12			Basic Chemistry Lab	1	
13	Statistic & Probabi-listic	2	Statistik & Probabilistik Eksperimen	2	The course become study programme mandatory course; The change of course name.
14	Advanced Calculus	3	Environmental Engineering Math-ematic	3	The change of course name
15	Occupational Health, Safety and Environ-mental Risk	2	Occupational Health, Safety and Environmental Risk	2	The course become study programme mandatory course; The change of course name.
16	Construction Drawing	2	Construction Drawing for Environmental Engineer	2	The new courses of the study program replace these courses and change credit
17	Construction Building	2		2	

18	Surveying	3	Earth Science and Mapping	2	The new courses of the study program replace these courses and change credit
19	Theory of Material Property	2	Environmental Engineering Material Properties	2	The change of course name
20	Structural Mechanics	3	Structural Mechanics I	2	The change of course name and change of credits
21	Fluid Mechanics	3	Fluid Mechanics	3	The change of course position form odd to even
22	Basic Soil Mechanics	3	Soil Environment for Environmental Engineer	3	The change of course name
23	Soil Mechanics	3	Structural Mechanics II	2	The change of course name and change of credits
24	Environmental Hydraulics	3	Environmental Hydraulics	3	The change of course position form even (semester 4) to odd (semester 3)
25	Global Envinronmental Issues	2	Global Envinronmental Issues	2	The change of course position from evenp(semester 4) to odd (semester 1)
26	Environmental Microbiology	2	Environmental Microbiology	3	The change of course position form even (semester 4) to odd (semester 3)
27	Urban Planning and Sanitation	3	Urban Planning and Sanitation	3	The change of course position form semester 5 to semester 3
28	Water Supply Sewerage Network Design	3	Wastewater Collection System Design	2	The new course that split from Water Supply and Sewerage Network Design course. The total credits increase. The change of course position form odd (semester 5) to even (semester 4) The change of course name
29			Drinking Water Distribution System Design	2	
30	Structural Design of Environmental Engineering Facilities	3	Structural Design for Environmental Engineering Infrastructure	3	
31	Water Treatment Design	3	Water Treatment Plant Design	3	The change of course name
32	Domestic Waste Water Treatment Design	3	Domestic Waste Water Treatment Plant Design	3	The change of course name
33	Air Pollution	3	Air Pollution	3	The change of course position from odd (semester 7) to even (semester 6)

34	Research Methodology & Proposal	2	Undergraduate Thesis	5	The new course of the study program replaces the course.
35	Final Project	4			Increase the number of credits
36	-	-	Final Project on Environmental Engineerin Infra-structure	4	New courses are mandatory for the study program
37	-	-	Service Learning	1	New courses are mandatory for the study program
38	-		Writing and Presentation Technique	2	New courses are mandatory for the study program

Course Syllabus of University Subjects

INTEGRATED CHARACTER BUILDING
UIGE600007/UIGE610011
6 credits

Syllabus :

The Integrated Character Building is part of the Higher Education Personality Development Lecture which is held for students which contains elements of the internalization of basic life values, interaction/ relationship skills, nationality and academic skills as the basis for student personality to carry out learning according to scientific disciplines.

MPKT is carried out in the form of a series of learning activities outside the formal class. activities carried out include participation in lectures/seminars, internships, field work practices, social work, sports and/or arts activities and other forms of activities that have the main goal of equipping students with soft skills and proven by portfolio documents. The form of this learning activity is different from the MPKT courses that have been carried out at the previous UI.

The material provided at MPKT aims to form a human thinking pattern with values and morals to create a human personality by having critical, logical, creative, innovative thinking, and having intellectual curiosity and an entrepreneurial spirit. The material provided includes 9 UI values, national, state and citizen values based on Pancasila. Solving problems in science, technology, health, and humans as natural managers by using reasoning and utilizing Information and Communication Technology (ICT) to achieve the final objectives of this module.

Lecture activities are carried out using an online student-centered learning (SCL) approach which can use the following methods: experiential learning (EL), collaborative learning (CL), problem-based learning (PBL), question-based learning, and project based learning. The use of these various methods is carried out through group discussion activities, independent assignment exercises, presentations, writing papers in Indonesian and interactive discussions in online discussion forums. The language of instruction in this lecture is Indonesian.

Graduate Learning Outcomes :

- CPL 1: Able to use spoken and written language in Indonesian and English both for academic and non-academic activities (C3, A5)
- CPL 2: Have integrity and are able to think critically, creatively, and innovatively and have intellectual curiosity to solve problems at the individual and group level (C4, A3)
- CPL 3: Able to provide alternative solutions to various problems that arise in the community, nation, and country (C4, A2)
- CPL 4: Able to take advantage of information communication technology (C3)
- CPL 5: Able to identify various entrepreneurial efforts characterized by innovation and independence based on ethics (C2, A5)

Course Learning Outcomes :

- CPMK 1: After completing this course, students are able to apply self-regulated learning characteristically in studying critically, logically, creatively, innovatively through analysis of societal problems, nation, state, and Pancasila ideology based on self-understanding as individuals and members. the community by using good and correct Indonesian and the latest information and communication technology (C4, A4)
- CPMK 2: Able to identify various entrepreneurial efforts characterized by innovation and independence based on ethics (C2, A5)
- CPMK 3: After completing this course, students are able to apply self-regulated learning characteristically in pursuing integrated and comprehensive knowledge through analysis of science problems, technology based on the role of nature manager by using good and correct Indonesian and information technology and current communications. (C4, A4)
- CPMK 4: After completing this course, students are able to plan creative activities to solve problems in society and the world of work/ industry by showing creativity, critical thinking, collaborative self-discipline using good and correct Indonesian as well as the latest information and communication technology (C5, A5)

Prerequisite : -

ACADEMIC WRITING
UIGE610002
2 credits
The Objectives :

To activate students, English so that they will be able to communicate effectively in English;

To enable students to develop the learning strategies and study skills needed to finish their study successfully and o continue learning on their

own after taking the MPK program (to develop independent learners)

Main Competencies :

- Listen to, understand and take notes of key information in academic lectures of between 5-10 minutes length;
- Improve their listening skills through various listening materials and procedures;
- Speak confidently, ask questions in and contribute to small group discussions;
- Use different reading strategies needed to the effective readers;
- Improve their reading skills through extensive reading material;
- Develop skills in connecting ideas using appropriate transitions and conjunctions;
- Work as part of a group to prepare and deliver a 25-minute presentation on an academic topic using appropriate organization, language and visual aids;
- Write a summary of a short academic article;
- Write an expository paragraph;
- Write a short essay.

Learning Method : Active learning, Contextual language learning, small group discussion.

Prerequisite :

1. Students Learning Orientation/Orientasi Belajar Mahasiswa (OBM)

ENGLISH
UIGE600003
2 credits
Course Learning Outcomes (CLO) :

After attending this subject, students are expected to capable of use English to support the study in university and improve language learning independently.

Syllabus :

Study Skills : (Becoming an active learner, Vocabulary Building: word formation and using the dictionary Listening strategies Extensive reading) Grammar: (Revision of Basic grammar Types of sentences Adjective clauses, Adverb clauses Noun clauses, Reduced clauses) Reading: (Reading skills: skimming, scanning, main idea, supporting ideas, Note-taking Reading popular science arti-cle, Reading an academic text) Listening: (Listening to short conversations, Listening to a lecture and notetaking, Listening to a news broadcast, Listening to a short story) Speaking: (Participating in discussions and meetings, Giving a presentation) Writing: (Writing a summary of a short article Describing graphs and tables, Writing an academic paragraph, Writing a basic academic essay (5 paragraphs).

ISLAMIC STUDIES
UIGE6000010/UIGE610005
2 credits
General Instructional Objectives :

The cultivation of students who have concern for social, na-tional and countrys issues based on Islamic values which is applied in the development of science through intellectual skills.

Course Learning Outcomes (CLO) :

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 prac-tice 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).

CATHOLIC STUDIES
UIGE6000011/UIGE610006
2 credits
General Instructional Objectives :

To help deliver students as intellectual capital in implementing lifelong learning process to become scientists with mature personality who uphold humanity and life.

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.

CHRISTIAN STUDIES
UIGE6000012/UIGE610007
2 credits
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.

Course Learning Outcomes (CLO) :

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.

HINDU STUDIES
UIGE6000013/UIGE610008
2 credits

Syllabus :

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.

BUDDHIST STUDIES
UIGE6000014/UIGE610009
2 credits

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).

KONG HU CU STUDY
UIGE6000015/UIGE610010
2 credits

Syllabus Of Faculty Subjects

CALCULUS 1
ENGE600001/ENGE610001
3 credits
Course Learning Outcomes:

Able to use the basic concepts of calculus related to -a function of one variable, the derivative and integration of the function of one variable in order to solve its applied problems.

Graduates Learning Outcomes:

Able to apply mathematics, science, basic engineering, and engineering specialization to be used in solving complex engineering problems.

Syllabus :
Introduction, Functions and Limits, The Derivative, Applications of the Derivative, The Definite Integral, Applications of The Definte Integral, Transcendental Functions, Techniques of Integration, Indeterminate Forms and Improper Integrals.

Prerequisite: None

Textbooks:

Main reference:
D. Varberg, E. J. Purcell, S.E. Rigdon, Calculus, 9th ed., Pearson, Prentice Hall, 2007.

Additional eferences:
1. George B. Thomas Jr., Thomas' Calculus Early Transcendental, 12th ed., Addison–Wesley Pearson, 2009.
2. Howard Anton, Calculus, 10th ed., John Wiley and Sons, 2012.

CALCULUS 2
ENGE600002/ENGE610002
3 SKS
Course Learning Outcomes:
Students are able to use the concepts of sequences, series, conic sections, and the basic concepts of calculus which involve the function of two or three variables to solve their applied problems.

Graduates Learning Outcomes:

Able to apply mathematics, science, and basic engineering and an engineering specialization to be used in solving complex engineering problems.

Syllabus :

Infinite sequences and infinite series, Test for convergence of positive series and alternating series, Power series and operation on operations, Taylor and MacLaurin series, Conic sections , Calculus in polar coordinates, Derivatives, limits, and continuity of multi-variables functions, Directional derivatives and gradients, Chain Rule, Tangent planes and Approximations, Lagrange multipliers. Double integrals in Cartesian coordinates and polar coordinates, triple integrals in Cartesian coordinates, cylindrical coordinates and spherical coordinates, Applications of double and triple Integral.

Prerequisite: Calculus 1

Textbooks:
1. D. Varberg, E. J. Purcell, S.E. Rigdon, Calculus, 9th ed., PEARSON, Prentice Hall, 2007.
2. Thomas, Calculus Thirteenth Edition Volume 2, Erlangga, 2019.

CALCULUS
ENGE600003/ENGE610003
4 SKS
Course Learning Outcomes:

Students are able to use the basic concepts of calculus involving functions of one to three variables to solve their applied problems.

Graduates Learning Outcomes:

Able to apply mathematics, science, and basic engineering and an engineering specialization to be used in solving complex engineering problems.

Syllabus :

Introduction, Functions and Limits, Derivatives, Derived Applications, Indeterminate Integral, Integral Applications, Infinite Row, and Series. Derivatives with many variables, Duplicate Integral (2 and 3), Duplicate Integral Application.

Prerequisite: None

Textbooks:

Main :
D. Varberg, E. J. Purcell, S.E. Rigdon, Calculus, 9th ed., Pearson, Prentice Hall, 2007.

George B. Thomas Jr., Thomas' Calculus Early Transcendental, 12th ed., Addison – Wesley Pearson, 2009.

LINEAR ALGEBRA
ENGE600004/ENGE610004
4 SKS
Course Learning Outcomes:
Students are able to calculate linear system problems to solve engineering problems.

Graduates Learning Outcomes:

Able to apply mathematics, science, and basic engineering and an engineering specialization to be used in solving complex engineering problems.

Syllabus :

Linear Systems and matrix equations, Determinants, Euclid vector spaces, Common vector spaces, eigenvalues and eigenvectors, inner product spaces, Diagonalization and General Linear Transformation.

Prerequisite: None

Textbooks:

1. Elementary Linear Algebra, Howard Anton & Chris Rorres, 11th edition, 2014
2. Gilbert Strang, Introduction to linear algebra 3rd edition Wellesley Cambridge Press, 2003

MECHANICAL AND HEAT PHYSICS
ENGE600005 / ENGE610005
3 credits
Course Learning Outcomes:

Able to explain the basic concepts of mechanics and thermodynamics, and be able to apply them to understand natural phenomena and human engineering, including their applications.

Graduate Learning Outcomes:

Able to apply mathematics, science, and basic engineering and an engineering specialization to be used in solving complex engineering problems.

Syllabus:

Units, Magnitudes and Vectors, Motion Along Straight Lines, Motion in Two and Three Dimensions, Newton's Laws of Motion, Applications of Newton's Laws, Kinetic Energy, and Work, Potential Energy and Energy Conservation, Center of Mass, Linear Momentum, Rotation, Rolling Motion, Torque, Angular Momentum, Oscillation, Mechanical and Sound Waves, Gravity, Statics and Elasticity, Fluid Mechanics, Temperature, Heat, Law I Thermodynamics, Ideal Gas and Kinetic Theory of Gas, Heat Engine, Entropy, and Law II Thermodynamics.

Prerequisite: none

Textbooks:

1. Halliday, Resnick, and Walker, Principles of Physics 10th Edition, Wiley, 2014.
2. Serway Jewett, Physics for Scientists and Engineers 9th Edition, Thomson Brooks / Cole, 2013.
3. Giancoli, Physics for Scientists and Engineers 4th Edition, Pearson, 2008

ELECTRICAL MAGNETIC, OPTICAL AND WAVE PHYSICS
ENGE600007 / ENGE610007
3 credits
Course Learning Outcomes:

Students are able to apply the basic concepts of electrical physics, magnetism, waves, and optics to solve problems in the engineering field.

Graduate Learning Outcomes:

Able to apply mathematics, science, and basic engineering and an engineering specialization to be used in solving complex engineering problems.

Syllabus:

Unit, Magnitude, Vector, Electric Charge, Electric Field, Gauss Law, Electric Potential, Capacitance, Electric Current, Resistance, Direct Current, Magnetic Field Due to Electric Current, Magnetic Field Source, Induced GGL, Inductance, Alternating Current, Electromagnetic Waves, Light Properties and Propagation, Optical Geometry.

Prerequisite: none

Textbooks :

1. Halliday, Resnick, and Walker, Principles of Physics 9th Edition, Wiley, 2011.
2. Serway Jewett, Physics for Scientists and Engineers 9th Edition, Thomson Brooks / Cole, 2013.
3. Giancoli, Physics for Scientists and Engineers 4th Edition, Pearson, 2008.

BASIC CHEMISTRY
ENGE600009 / ENGE610009
2 credits
Course Learning Outcomes:

Students are able to analyze the principe of basic chemistry for application in engineering.

Graduates' Learning Outcomes:

Able to apply mathematics, science, and basic engineering to be used in solving complex engineering problems.

Syllabus:

Material and measurements, atoms, molecules and ions, stochiometry, water phase reactions and solution stochiometry, thermochemistry, chemical equilibrium, acid and base equilibrium, electrochemistry, chemical kinetics, and chemical applications.

Prerequisite: none

Textbooks :

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.

ENGINEERING ECONOMY
ENGE600011 / ENGE610011
3 credits
Course Learning Outcomes:

Students are able to analyze the economic and financial feasibility of making economic practice decisions.

Graduate Learning Outcomes:

Able to apply the principles of technical management and decision making based on economic considerations, in individual and group, as well as in project management.

Syllabus:

Introduction to Engineering Economics, Time Value of Money, Combining Factors, Interest Rates, Money Worth Analysis, Rate of Return Analysis, Effects of Inflation, Benefit Cost & Break-Even Point Analysis, Sensitivity Analysis, Depreciation, Tax Analysis, Cost Estimation & Allocation, Capital Budgeting & Replacement Analysis.

Prerequisite:
1. Civil Engineering : -
2. Environmental Engineering : -
3. Naval Engineering : -
4. Industrial Engineering : must pass the introductory Economic course and have completed 38 credits
5. Chemical Engineering : -
6. Bioprocess Engineering : -

Textbooks:
1. Blank, Leland and Tarquin, Anthony. 2018. Engineering Economy 8th Ed. McGraw Hill.
2. Park, Chan S. 2016. Contemporary Engineering Economics 6th Ed. Pearson. Upper Saddle River.
3. White, Case and Pratt. 2012. Principles of Engineering Economic Analysis 6th ed. John Wiley and Sons.

STATISTICS AND PROBABILISTICS
ENGE600010 / ENGE610010
2 credits
Course Learning Outcomes:

Students are able to handle quantitative data/ information starting from the descriptive stage (collection, organization, and presentation) to the inductive stage, which includes forecasting and drawing conclusions based on the relationship between variables for decision making.

Graduate Learning Outcomes:
1. Apply descriptive statistics and probability theory to data processing and serving
2. Apply probability distribution to data processing and serving
3. Apply the principles of sampling and estimation for decision making
4. Apply hypothesis test samples for decision making

Syllabus:

Introduction to Statistics for Engineering Studies, Probability Theory, Dasar Basic concepts and definitions, Distribution Probability, Sampling, Estimation, Hypothesis testing, Hypothesis test 1 sample at an average value, Regression

Prerequisite: none

Textbooks :
1. Harinaldi, Basic Principles of Statistical Engineering and Science, Erlangga, 2004
2. Montgomery, DC., And Runger, GC., Applied Statistics and Probability for Engineers, John Wiley Sons, 2002

HSE PROTECTION
ENGE600012 / ENGE610012
2 credits
Course Learning Outcomes:

Upon completion of this subject students are expected to be able to carried out hazard identification, and characterization, to propose appropriate methods for risk reduction and mitigation, and to design safety management system. The student is also expected to improve their awareness on industrial safety and health, and understanding on safety regulation framework and standards as well as environmental program.

Graduate Learning Outcomes:
1. Students are expected to understand safety, health and environmental aspect as an integral part of fundamental principal in engineering code of ethics.
2. Students are expected to be able to carry out process of risk assessments by considering risk factors in the impact of hazards on people, facilities, and the surrounding community and environemt.
3. Students are expected to understand the regulatory framework and standard related to the stages of life cycle of machine, building structure, construction, and process.
4. Students are able to design and propose an effective hazard communication, management and engineering control, and risk mitigation through an engineering assignment project.

5. Students are able to identify the knowledge required to perform risk assesment, investigation and design improvement through a multidisiplinary case of incident and accident.

Syllabus:

Introduction to SHE Regulation and Standards, SHE Perception (Risk and Environment), Identification, Assessment and Management, Construction, machinery and Noise hazards, Process safety hazard and analysis technique, Fire and explosion hazard, Electrical hazard, Toxicology in the Workplace, Ergonomy Aspect, Hazard communication to employees, Environmental Protection, Case studies, Safety Health and Environment audits.

Prerequisite: none

Textbooks :

1. Charles A. Wentz, Safety, Health and Environmental Protection, McGraw Hill, 1998.
2. Asfahl, C.R., Rieske, D. W., Sixth Edition Industrial Safety and Health Management, Pearson Education, Inc., 2010.
3. United Kingdom - Health and Safety Executive, http://www.hse.gov.uk/
4. National laws and regulations related to the K3 Management System and the Environment.
5. Related Journal (http://www.journals.elsevier.com/safety-science/) etc, related standards and publications.

Syllabus of Undergraduate Program on Environmental Engineering

Physics (Mechanics and Thermodynamics)
ENCV 601 001
4 credits
Expected Learning Outcomes:
ELO 1 Engineering Knowledge
Course Learning Outcomes:
Able to apply fundamental concept and physic mechanics and thermodynamics in solving engineering problem
Learning Experiences:
Syllabus:
Magnitude, point object kinematic, point object mechanics, the law of conservation of linear momentum and energy, harmonic movement, gravitation, kinematics and dynamics of rigid bodies, introduction and concept of thermodynamics (pressure, thermodynamics system, system condition, temperature), expansion, energy equilibirum (isoterm equation), heat trasnfer, noble gas, first law of thermodynamics, enthalpy and enthropy, Hk application. First thermodynamics law in open and closed system, second law of thermodynamics, noble gas kinetic theory, building ventilation system, building insulation system, building cooling system and centralizer air control.
Prerequisite: -
Textbook references :

1. Halliday, Resnick, dan Walker, Principles of Physics 9th Edition, Wiley, 2011.
2. Serway Jewett, Physics for Scientists and Engineers 9th Edition, Thomson Brooks/Cole, 2013.
3. Giancoli, Physics for Scientists and Engineers 4th Edition, Pearson, 2008

Introduction to Environmental Engineering System
ENEV 601 001
2 credits
Expected Learning Outcomes:
ELO 2 Problem Analysis
ELO 6 Engineer and Society
Course Learning Outcomes:
Explain environmental engineering and its sub-specialization scope of work through teamwork skills and deliver a verbal and written report about environmental engineering works.
Learning Experiences:
Syllabus:
Understanding of ecology, ecosystems, natural resources, vegetation and tropical forests, ecosystem waters, dams, agricultural, land use management, climate change, element, energy, life, life cycle, the hydrologic cycle, water and pollution, management of water resources, water needs, water treatment facility and distribution network, the characteristics of liquid waste, domestic waste water treatment facilities and collecting ducts, solid waste and hazardous waste, air emissions, soil and water contamination by sewage, renewable and nonrenewable natural resources, regulations.
Physical and non-physical components in Environmental Engineering System; interconnecting scope of work amongst sub-specialization in environmental engineering; technical and non-technical (law, social, economic, and health) aspect in engineering infrastructure system, environmental engineering and its sub-specialization scope of work; role of environmetal engineer.
Prerequisites: -
Text Book References :

1. Danny Reible, CRC Press, 14 Des 2017, Fundamentals of Environmental Engineering
2. Mackenzie L Davis, Susan J Masten, McGraw-Hill Education, Mar 11, 2019, Loose Leaf for Principles of Environmental Engineering and Science

Global Environmental Issues
ENEV 601 002
2 credits
Expected Learning Outcomes:
ELO 7 Sustainability
ELO 12 Lifelong Learning
Course Learning Outcomes:
Students can relate the (C3) concepts and knowledge of environmental science to investigate (C3), criticized (A3) and demonstrating (P2) causes, effects and solutions of the existing contemporary global environmental problems
Learning Experiences:
Syllabus:
Abiotic environment problems and decrease of resilience of various spatial and temporal scales, (concept of D-P-S-I-R, climate change, water, air and land pollution, scarcity of Natural Resources, Probability and statistics in environmental science, Resilienc); Ecosystems and living beings (Recycling of energy and water, the food chain, biodiversity, nutrient cycle in nature, the main ecosystems of the earth, Sustainability); The harmful effects of environmental problems on society, the economy, and the environment particularly which is irreversible (System thinking, State shift and irreversibility, health impacts, economic impacts, the impact of welfare); Anthropocene era and the concept of sustainable development (population, changes in land use, consumption, economy and development, Nexus Water-Energy-Food, Three pillars of sustainability); Solutions to environmental problems (L-C-A, Greenwashing, Geo-Engineering, End-of-pipe vs closed loop, Reflexive Engineer, Sustainable Consumption and Production, Resiliency)
Prerequisites: Integrated Character Building Course
Text Book References :

1. Berg, Linda R. 2013. Visualizing Environmental Science 4th Edition. Wiley.
2. Easton, Thomas. 2013. Taking Sides: Clashing Views on Environmental Issues 15th Edition. McGraw-Hill/Dushkin.
3. Hardisty, Paul E. 2010. Environmental and Economic Sustainability 1st Edition. CRC Press.
4. Harris, Frances. 2012. Global Environmental Issues 2nd edition. Wiley Blackwell
5. The Worldwatch Institute & Erik Assdourian. 2013. State of The World 2013: Is Sustainable Still Possible? 1st Edition. Island Press.

Environmental Biology
ENEV 601 003
2 credits
Expected Learning Outcomes:
ELO 1 Engineering Knowledge
Course Learning Outcomes:
Able to explain the function of biological component in the ecosystem including the environmental quality and support **(C2)**
Learning Experiences:
Syllabus :
Structure and impact of biogeochemistry cycles, energy transformation in every trophic level, interaction between biotic and abiotic factor in the environment, principle of biodiversity and biological conservation, Anthropocene impact on the environment, environmental hazard and risk and its socio-economic consequences.
Prerequisites:
Textbook References:

Withgott, J and Laposata, M. 2018. Essential Environment: The Science Behind the Stories 6th. Pearson Publications.

Fluids Mechanics
ENCV 603 003
3 credits
Expected Learning Outcomes:
ELO 1 Engineering Knowledge
Course Learning Outcomes:
Students are able to understand the fluid characteristics, concept of hydraulic pressure and forces on static and dynamic fluid and apply the basic equation to calculate the hydraulic pressure and forces on static and dynamic fluid.
Learning Experiences:
Syllabus:
a) The characteristics of the fluid, liquid and gaseous fluids, dimensions and units; (b) Types of flow; laminar, transitional, turbulent; (c) Concept of hydraulic pressure and forces on static and dynamic fluid; the pressure at a point, the pressure on a flat plane, the pressure on the curved area, the pressure of fluid in container undertake linear acceleration, and the pressure of fluid in rotating cylinder; (d) The buoyancy and stability of an object, metacentrum of floating objects; (e) The basic equations of the hydraulic pressure and forces on static and dynamic fluid (Bernoulli, Law of Continuity, Energy, and Momentum), to be applied on Environmental Engineering building structure.
Prerequisite:
Physics (Mechanics and Thermodynamics), Calculus
Text Book Reference:

1. Fundamentals of Fluid Mechanics, 7th Edition. Bruce R. Munson, Bruce R. Munson, Alric P. Rothmayer, Alric P. Rothmayer, Theodore H. Okiishi, Theodore H. Okiishi, Wade W. Huebsch, Wade W. Huebsch, ©2013
2. Fluid Mechanics, 7th Edition SI Version. Bruce R. Munson, Theodore H. Okiishi, Wade W. Huebsch, Alric P. Rothmayer. ISBN: 978-1-118-31867-6, 792 pages. January 2013, ©2013
3. Engineering Fluid Mechanics, 10th Edition SI Version. Donald F. Elger, Barbara C. Williams, Clayton T. Crowe, John A. Roberson. ISBN: 978-1-

118-31875-1, 696 pages. June 2013, ©2013
4. Fluid Mechanics, 9th Edition SI Version. Robert W. Fox, Alan T. McDonald, Philip J. Pritchard, John W. Mitchell. ISBN: 978-1-118-96127-8, 680 pages. September 2015, ©2015

Earth Science and Mapping
ENEV 602 001
2 credits
Expected Learning Outcomes (CLO):
ELO 1 Engineering knowledge
ELO 5 Modern Tools

Course Learning Outcomes :

Explain the fundamental concept of earth science and geography and have geographic technical skills through GIS (Geographic Information System). Therefore students can process and analyze data in the form of an earth surface model that can be manipulated, modeled, and analyzed by text, spatial, and the combination of both as required.

Syllabus :
Introduction to earth science, earth surface mapping, atmosphere, ocean and climate, climate change, biogeochemistry cycles. Concept and theory of geomatics science including determining position, photogrammetry, remote sensing, geographic information system (component function in GIS and GIS spatial model), cartography and surveying concept.

Prerequisite: -

Text Book References:
1. de Blij, H.J., Physical Geography of the Global Environment, John Wiley and Sons, 1996
2. Michael,etc,1996, GIS & Environmental Modelling : Progress & Research Issues, GIS World Books, Fort Collins,USA

Construction Drawing for Environmental Engineering
ENEV 602 002
2 credits
Expected Learning Outcomes:
ELO 5 Modern Tools
ELO10 Communication.

Course Learning Outcomes:

Able to understand and draws environmental engineering construction drawing in accordance of applicable standard

Learning Experiences:
Syllabus:
Types and function of construction drawing; engineering drawing standard; introduction to drawing tools; CAD basics; scale; line type; material and drawing notation; lettering and dimensioning; geometric construction; pictorial projection; orthogonal projection; section view drawing; details of the building drawing; drawing of building structural element; drawing of sanitation, piping and its accessory; drawing of unit operation and process; hydraulic profile drawing; example of engineering drawing; survey and observation of case study.

Prerequisites:

Textbook References:
K. Rathnam. (2017). A First Course in Engineering Drawing. Springer Nature Singapore Pte Ltd. 2018. ISBN 978-981-10-5357-3

Basic Chemistry Laboratory
ENEV 602 003
1 credits
Expected Learning Outcomes:
ELO 1 Engineering Knowledge
Course Learning Outcomes:
1. Students are able report initial theory for each laboratory experiments module.
2. Student are able to conduct experiments in laboratory.
3. Student are able to process and analyze the laboratory experiment data and submit final report explaining the phenomenon during the laboratory experiment.

Learning Experiences:
Syllabus:
General techniques and safety aspect in chemistry laboratory, physical and chemical characteristic, chemical reaction and stoichiometry, chemical kinetics, chemical equilibrium and acid-base reaction, redox reaction, and electrochemical cells, organic substance.

Prerequisites: -

Text Book References:
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. Moran, L. dan Masciangioli, T.Safety and Security of Chemical Lab, the National Academies Press, 2010.
6. Brown, T.L., H. E. LeMay and B.E. Bursten, Chemistry, ed. 8, Prentice Hall, 2000.
7. Vogel, Anorganic Qualitative Analyze, PT. Kalman Media Pustaka, 1985.
8. Raymond Chang, Williams College, Chemistry (7th Ed.), McGraw-Hill, 2003.

Statistics and Probabilistic of Experimental Design
ENCV 603 004
2 credits
Expected Learning Outcomes:
ELO 1 Engineering Knowledge
ELO 4 Experiment

Course Learning Outcomes:
1. Student able to identify data requirement, and appy valid experimental data in accordance of statistic and probabilistic concept
2. Student able to utilize and apply excel to analyse experimental and report the analysis result.

Learning Experiences:
Syllabus:
Basic concept of statistic and probabilistic, error analysis and error propagation; normal distribution analysis; standard error analysis; estimation of errors in derived quantities; hypothesis testing and the t-test based on ANOVA result; distrubtion and consistency test; analysis using excel toolpax; multiple regression; Classical Assumption test; probabilistic theory.
Prerequisites:
Textbook References:
1. Catherine A. Peters, Statistics for Analysis of Experimental Data, Princeton University, 2001
2. Howard J. Seltman, Experimental Design and Analysis, 2018
3. Berthouex, P. M.; L. C. Brown. Statistics for Environmental Engineers. Lewis Publishers, 1994.
4. Bevington, P. R.; D. K. Robinson. Data Reduction and Error Analysis for the Physical Sciences. McGraw-Hill, Inc. 1992.
5. Box, G. E. P.; W. G. Hunter; J. S. Hunter. Statistics for Experimenters: An Introduction to Design, Data Analysis, and Model Building. John Wiley & Sons, 1978

Environmental Engineering Mathematic
ENEV 603 001
3 credits
Expected Learning Outcomes (CLO):
ELO 1 Engineering knowledge

Course Learning Outcomes (CLO):
Able to apply basic calculus concepts to solve environmental engineering problems using analytical and numerical solutions of ordinary differential equations **(C3)**
Learning Experiences:
Syllabus:
Introduction to Differential Equations, Definitions and Terminology, Initial-Value Problems, Differential Equations as Mathematical Models**,** Analytical solution for first order Differential Equation (Separable Equations, Linear Equations, Exact Equations, Solution by Substitutions, Linear Models, Nonlinear Models, Cauchy-Euler Equations, Modeling with Systems of First-Order Differential Equations), Analytical solution for Higher-Order Differential Equations (Homogeneous Equations, Nonhomogeneous Equations, Reduction of Order, Homogeneous Linear Equations with Constant Coefficients, Undetermined Coefficients, Variation of Parameters, Nonlinear Equations). Numerical solution for Ordinary Differential Equation (Euleur Method, Heun Method, Runge Kutta Method, Stiffness and Multistep), Boundary value and eigenvalue problem, Introduction to Matlab.
Prerequisites:
Calculus 1, Calculus 2
Textbook References:
1. Charles Prochaska and Louis Theodore, Introduction to Mathematical Methods for Environmental Engineers and Scientists. Wiley, 2018
2. E. Kreyzig, Advanced Mathematical Engineering, Johnwiley & Son, 5th ed., 2011
3. Numerical Methods for Engineers, Steven C. Chapra & Raymond P Canale, 7th edition, 2013

Environmental Microbiology
ENEV 603 002
3 credits
Expected Learning Outcomes (CLO):
ELO 1 Engineering Knowledge
ELO 4 Experiments

Course Learning Outcomes (CLO):
1. Able to explain the microbiological system and its relation to growth, the spreading, and the habitat.
2. Able to conduct microbial test from water and air sample.

Learning Experiences:
Syllabus:
The basic concepts of microbiology (Introduction of environmental microbiology, microorganisms found in the environment, diversity of microorganisms and their interaction at natural ecosystem); Nutrition for microorganisms; Bacterial growth; Environmental microorganism (Earth environments, Aero microbiology, Aquatic environments, Extreme environments); environmental sampling and testing; microbial diversity and its interaction in natural ecosystem; waterborne and foodborne pathogen (pathogen environmental transmission); wastewater biological treatment; Urban microbiology (domestic and outdoor microbiology); microbial emerging global issues in the Anthropocene era. Microorganism indicator, microbes enumeration using TPC and gram coloring method, microbes culturing method; water quality test using MTF method; sampling and testing of bioaerosol (bacteria and fungi)
Prerequisite:
Introduction to Environmental Engineering System

Textbook References:

1. Ian L.P., Charles P.G., Terry J.G. 2015. Environmental Microbiology, 3rd ed. Elsevier. Amsterdam.
2. Johnson, T.R., Case, C.L. 2010. Laboratory Experiments in Microbiology. Benjamin Cummings. Pearson. San Fransisco
3. Novita, E., Gusniani, I., G.B.Andari, Pipit Fitriah. 2019. Modul Praktikum Mikrobiologi Lingkungan. Laboratorium Teknik Lingkungan-Departemen Teknik Sipil FT-UI. Depok
4. Willey, J.M., Sherwood, L.M., Woolverton, C.J. 2008. Microbiology. 7th. Edition. Mc Graw Hill, Boston.

Environmental Engineering Material Properties

ENEV 603 003

2 credits

Expected Learning Outcomes (CLO):

ELO 2 Problem Analysis

Course Learning Outcomes (CLO):

Able to explain the various physical properties and chemical properties of materials used for water treatment systems, waste management systems, and environmental engineering buildings

Learning Experiences:

Syllabus:

Properties of construction materials (aggregate, cement, concrete, steel, and polymer); the concept of tension-strain; material for unit operation and process (water, adsorbent, membrane, catalyst); concrete mix design (concrete mix composition, curing, strong concrete press, slump test, etc); material characterization theory (particle size distribution, morphology, elemental and crystalline composition, surface area and pore volume, phpzc, etc.).

Prerequisites: -

Textbook References:

1. A. M. Neville. Properties of Concrete. 5th Edition. Pearson.
2. Nagaratnam Sivakugan, Carthigesu T. Gnanendran, Rabin Tuladhar, M. Bobby Kannan. (2017). Civil Engineering Materials. CL Engineering. ISBN: 1305386647
3. Surender Kumar Sharma. (2018). Handbook of Materials Characterization-Springer International Publishing. Springer International Publishing. ISBN 978-3-319-92954-5

Environmental Hydraulics

ENEV 603 004

3 credits

Expected Learning Outcomes (CLO):

ELO 1 Engineering Knowledge

Course Learning Outcomes (CLO):

Able to understand the basic concepts of the behavior of water flow in open channels and closed conduits, understand the functions of the water buildings and measuring the flow rate, and able to calculate the flow rate in open channels and closed conduits, calculate the energy loss, and mathematically describe the flow and pressure distribution within a pipe network.

Syllabus:

a) the concept of hydraulics in open-channel flow and closed-conduits flow; (b) Flow in open channel; basic equation, minor and major losses; (c) Flow in pipe network; the use of concept of HGL (Hydraulic Grade Line) and EGL (Energy Grade Line), Bernoulli equation, Hardy-cross method for calculating flow distribution in a pipe network: series, parallel, and branching; (d) The concept of energy (specific energy and critical energy), the type of flow; steady, unsteady, uniform, non-uniform; (e) Various primary water buildings; weir, intake building, distribution channel, flow or discharge measuring tools/gauges; Chipoleti-weir, Parshall-flume, V-notch weir, loggers, etc.

Prerequisite: Fluid Mechanics

Textbook References:

1. Fundamentals of Hydraulic Engineering Systems (4th Edition), Houghtalen, Robert J.; Akan, A. Osman; Hwang, Ned H. C., Publisher: Prentice Hall, 2009. ISBN 10: 0136016383 ISBN 13: 9780136016380
2. Hydraulics in Civil and Environmental Engineering, 5th edition. Andrew Chadwick, John Morfett, Martin Borthwick. Publisher: CRC Press ISBN: 978-1-118-31875-1, 648 pages. © February 21, 2013

Structural Mechanics 1

ENEV 603 005

2 credits

Expected Learning Outcomes (CLO):

ELO 1 Engineering knowledge

Course Learning Outcomes (CLO):

Students are able to apply the concept of equilibrium in calculating and analyzing the response of a rigid body due to force that works on specific simple static structures such as beam beams, rod frame, portals, three-joint arch, and Gerber structure..

Learning Experiences:

Syllabus:

Statics of particle; rigid body; equilibrium of rigid body; action-reaction; structural analysis of two trusses with point equilibrium method; Structural analysis of beam on two points, cantilever beam, Gerber Beam, portal, three joint Portal, Gerber structure and frame structure

Prerequisites:

Physics (Mechanics and Thermodynamics), Calculus 1 and Calculus 2

Textbook References:

1. Hibbeler, R.C., Engineering Mechanics Statics, Thirteenth Edition, Pearson, 2013
2. Hibbeler, R.C., Structural Analysis, Eighth Edition, Prentice Hall, 2012

Urban Planning and Sanitation

ENEV 603 006

3 credits

Expected Learning Outcomes (CLO):

ELO 3 Design

ELO 6 Engineering and Society

Course Learning Outcomes (CLO):

1. Able to explain the role of environmental engineer in setting up the infrastructure needed in an urban area and apply that knowledge in the planning, monitoring, and implementation of the regional arrangement.
2. Able to describe the components of urban sanitation technology and apply that knowledge in the planning, monitoring, and implementation to create an environmentally sustainable region

Learning Experiences:

Syllabus:

Definition and function of urban planning; urban development model; Primary factor in urban planning ; Spatial policy and urban area planning; green and sustainable city concept; Population aspect in urban planning; urban facilities and infrastructure; Sanitation and the components of urban sanitation; Sustainable sanitation; urban sanitation policy; Master plan for solid waste management, drinking water supply system, wastewater management, and urban drainage system. Public health and control of vector-borne disease; local sanitation system and technology.

Prerequisites:

Introduction to Environmental Engineering System

Textbook References:

1. (Kurt W. Bauer 2009). City Planning for Civil Engineers, Environmental Engineers, and Surveyors. CRC Press.
2. J.A. Salvato, N.L. Nemerow, F.J. Ahardy. (2003). Environmental Engineering, 5th ed. John Wiley & Sons Inc. New Jersey.
3. IHP-UNESCO, GTZ. (2006). Concept for Ecologically Sustainable Sanitation in Formal and Continuing Education. Paris.
4. Standards, Technical Guidelines, SNI and related regulations

Structural Mechanics 2

ENEV 604 001

2 credits

Expected Learning Outcomes (CLO):

ELO 1 Engineering knowledge

Course Learning Outcomes (CLO):

Students able to analyze tension, shape changes because of working forces on various shape of certain static structure with the variation side sections and type of materials.

Learning Experiences:

Syllabus :

The meaning of loads and forces working on a solid object, effect of forces to a solid object, stresses on a solid object, shape deformation of a solid object, characteristics of shape deformation of a solid object, elastic and inelastic phases, axial strain, Modulus of Elasticity, Poisson Ratio. Section Properties, area, center of gravity, cross-axis system, maximum moment of inertia of a section, minimum moment of inertia of a section, radius of gyration, symmetric section, asymmetric section. Normal stress due to axial internal forces, normal stress due to flexure, combination of normal stress and flexure, one way and two-way flexural stress, core area (Kern), shear stress due to transversal internal forces, shear stress due to torsion internal forces. Combination of normal and shear stresses. Deflection of beam, portal, and trusses of statically determined structure caused by external forces using energy/unit load method.

Prerequisite: Statics

Textbook References:

1. Hibbeler, R.C., Mechanics of Materials, 9/e, Pearson, 2014
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

Drinking Water Distribution System Design

ENEV 604 002

2 credits

Expected Learning Outcomes (CLO):

ELO 3 Design;

ELO 5 Modern Tools.

Course Learning Outcomes (CLO):

Able to apply the principles of hydraulics and design criteria in designing the drinking water distribution system layout, its pipe dimensions and including operational and maintenance aspects.

Learning Experiences:

Syllabus:
hydrological cycles; water balance; components of drinking water supply system; gravitation and pump flow system; type of pipeline distribution system (branch, grid, arterial loop); service unit (home connection, general hydrant); pipe material alternative; analysis of a piping loop with hardy-cross method; calculation of pipe diameter; accessories in distribution pipelines; water pressure and pressure lost; distribution reservoir; analysis with epanet software; installation and pipeline connections; pipeline monitoring and repair.

Prerequisite:
Environmental Engineering Hydraulics; Urban Planning and Sanitation

Textbook References:

1. Fair, Geyer and Okun. (2011). Water Supply and Wastewater Removal 3rd edition. John Wiley & Sons, Inc.
2. Hydrology and Floodplain Analysis, 5th Edition. Philip B. Bedient, Wayne C. Huber, Baxter E. Vieux. Publisher: Prentice Hall ISBN-10: 0132567962, 816 pages. © February 25, 2012
3. Introduction to Hydrology. Warren Viessman, Gary L. Lewis., Pearson Education, 2012.

Soil Mechanics for Environmental Engineer
ENEV 604 003
3 credits
Expected Learning Outcomes (CLO):
ELO 1 Engineering Knowledge
ELO 2 Problem Analysis
ELO 4 Experiments

Course Learning Outcomes (CLO):
Students is able to explain the basic understanding of geology and able to explain the physical properties of soil and its parameters which covers its application in environmental engineering

Learning Experiences:

Syllabus :
Engineering geology and soil properties; definition of geological sciences, geoengineering with other disciplines/civil engineering; Topographical and geomorphological maps; How to read and analyze mineralogy, rock type, and stratigraphy, geological structure and its type; identification and influence plating, Croar, fault, misalignment for construction; Weathering and ground movements; Introduction of type, process, and identification of weathering; Explanation of classification process; Geological and geotechnical maps; Analysis of topographic base maps; Geotechnical geological map criteria; Property Land: Ground as a 3 phase material; Physical characteristics of soil; Classification of land; Atterberg limit; Soil compaction theory and CBR test; 1 dimensional flow in soil, permeability and introduction of groundwater seepage, flow tissue; Voltage theory and effective voltage principle; Effective voltage reaction due to total voltage change in the perfect saturated soil; Ground shear strength theory; Vigorous test of sliding soil in the laboratory on clay and sand; Consolidation theory and consolidation test; Ground support: The carrying power of the limit and the carrying capacity of permits due to tilt, eccentric loads; Elastic decline and decreased one-dimensional consolidation; Drawing a shallow foundation design; leaks through the dam; Distribution of ground voltage: Point load, line load, field path, Circle field, square field with Fadum and Newmark theory

Prerequisite: Environmental Engineering Material Properties

Textbook References:

1. Burchfiel BC & Foster RJ et .al., "Physical Geology", Charlec E Merril Publishing Co., Colombus Toronto London Sydney, 1986.
2. Blyth, F.G.H. & de Freitas, M.H., "A Geology for Engineers, 7th Ed.". Elsevier. 2005.
3. Craig, R.F., " Soil Mechanics, 7th Ed.", 2007
4. Bowles, J.E., "Physical and Geotechnical Properties of Soils", McGraw-Hill Kogagusha Ltd., 1998.
5. Das, B.M., "Principles of Geotechnical Engineering", Seventh edition, 2010, PWS Publishing Company, Boston
6. Budu M., "Soil Mechanics and Foundations", Third Edition, 2010, John Wiley & Sons, New York

Environmental Chemistry
ENEV 604 004
3 credits
Expected Learning Outcomes (CLO):
ELO 1 Engineering Knowledge
ELO 4 Experiments

Course Learning Outcomes (CLO):
Students are able to explain the chemical factor of the environment that causes pollution and can conduct parameter testing for drinking water/waste quality

Learning Experiences:

Syllabus:
Raw water characteristics; Water Source and its function; body of water properties; Drinking water and water body quality standard; The chemical properties of the water body(physical, chemical); Microorganism as catalyst in water environmental chemistry; aquatic life; chemical substance in water body; Water pollution; Water parameters (acidity, alkalinity, hardness, turbidity, color, pH, Nitrogen, sulphate, colloidal and solid, iron and manganese, dissolved oxygen, BOD and COD, Fluoride and chlorine and residual chlorine).

Prerequisite: Basic Chemistry

Textbook References:

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

Wastewater Collection System Design
ENEV 604 005
2 credits
Expected Learning Outcomes (CLO):
ELO 3 Design
ELO 6 Engineering and Society

Course Learning Outcomes (CLO):
Students are able to apply the principles of hydraulics and design criteria for the layout and dimensions of drainage channels and waste water pipes and their operational and maintenance aspects.
Learning Experiences:
Syllabus:
Hydrological cycles; water catchment area; Determination of the average rainfall from an area, rain plan with the distribution method, extreme; Intensity-duration curve determination of the rainy frequency of a region; The calculation of flood discharge plans for various retimes; Planning of drainage channel dimensions; Waste water collection system; Design criteria; Planning a network layout; Pipe Material; Design of waste water pipe dimensions; Pipe Accessories (turns, branches, valves, etc.); Support Infrastructure (pumps, manholes, siphon, interceptors, detensions tank, overflow, etc.); Pipe fitting method; Operational-Maintenance-Troubleshooting.
Prequisite: Environmental engineering hydraulics; urban planning and sanitation
Textbook References:

1. Introduction to Hydrology. Warren Viessman, Gary L. Lewis., Pearson Education, 2012.
2. Hydrology and Floodplain Analysis, 5th Edition. Philip B. Bedient, Wayne C. Huber, Baxter E. Vieux. Publisher: Prentice Hall ISBN-10: 0132567962, 816 pages. © February 25, 2012
3. Fair, Geyer and Okun. (2011). Water Supply and Wastewater Removal 3rd edition. John Wiley & Sons, Inc.

Unit Operation and Process
ENEV 605 002
4 credits
Expected Learning Outcomes (CLO):

ELO 2 Problem Analysis

Course Learning Outcomes (CLO):
Students are able to explain unit operations and unit processes used in water treatment and waste water, using the basic principles of engineering calculations for the deterimining processes of physics, chemistry, and biology.
Learning Experiences:
Syllabus:
Unit operations and processes based on the principle (physical processing, chemical, biology), classification level of water treatment plantl; the concept of balanced mass, flow model, and reactor; unit operation and process for oxygen transfer and mixing; unit operations and process of preliminary treatment in the process of water treatment and waste water; process and operation of the coagulation process and Flocculation; an operating unit of the separation of solid particles in the water treatment and waste water (sedimentation); an operating unit of the separation of solid particles through the porous media (filtration); biological processes for waste water treatment using suspended growth method, Stabilization Ponds and aerated Lagoons;); biological processes for waste water treatment using suspended growth method; unit operation and process in N and P removal; processing unit for organic sludge, chemical sludge; sludge from water treatment process; basic principle of adsorption, ion exchange and membrane.
Prerequisite:
Environmental Chemistry; Environmental Microbiology

Textbook Reference:

1. Rich, Linvil G : " Unit Operation for Sanitary Engineering"Management, McGraw Hill
2. Tom D. Reynolds and Paul Richards, Unit Operations and Process in Environmental Engineering Pws Series in Engineering; 1997

Environmental Laboratory
ENEV 605 003
3 credits
Expected Learning Outcomes (CLO):
ELO 4 Experiments
ELO 5 Modern Tools

Course Learning Outcomes (CLO):

1. Student are able to perform environmental sampling and analyze the result.
2. Student are able to apply the unit operation and process principle in operating the lab scale unit of water and wastewater treatment.
3. Student have the information about various modern laboratory equipment for testing the environmental sample

Syllabus:
The composition and characteristics of food waste and its impact to the environment; Food waste Sampling; Experimental design and data analysis; Sampling water in various water bodies; discrete process of particle sedimentation and flocculation;

Chlorination process and chlorine dosing determination in water treatment; Modelling of biological processes, and the utilization of modern analytical equipment such as GC and AAS.

Prerequisite:

Basic Chemistry, Environmental Chemistry

Textbook References:

1. Sawyer, McCarty, and Parkin. (2003). Chemistry for Environmental Engineering and Science. Singapore: McGrawHill
2. Douglas C. Montgomery. 1976. Design and Analysis of Experiments.Wiley

Integrated Solid Waste Management Planning

ENEV 605 004

3 credits

Expected Learning Outcomes (CLO):

ELO 3 Design

ELO 6 Engineering and Society

ELO 7 Sustainability

Course Learning Outcomes (CLO):

Students are able to plan a solid waste management system in engineering aspects starting from the waste sources to the final processing plant.

Learning Experiences:

Syllabus:

General solid waste management system and its functional elements; Solid waste management system in Indonesia, policies and laws, related regulations; classification of domestic solid waste based on source, type and composition; Physical, chemical and biological characteristics of domestic solid waste; applicable physical, chemical, and biological transformation process; Source, type and charateristic hazardous solid waste in domestic solid waste; measurement methods for domestic solid waste generation from various sources and the estimation for its generation; solid waste handling at the source; Solid waste collection methods; Separation, processing and transformation of solid waste; Transfer and transport of solid waste in the technique of collecting operations; Method of discharge of solid waste and predict land use; Plan a city integrated solid waste handling system.

Prerequisite:

Textbook Reference:

1. Flintoff FF., 1983, Management of Solid Wastes in Developing Countries.
2. Tchobanoglous, 1977, Engineering Principles and Management Issues.
3. Tchobanoglouss, 1993, Integrated Solid Waste Management.
4. Wentz, 1989, Hazardous Waste Management.

Structural Design for Environmental Engineering Infrastructure

ENEV 605 005

3 credits

Expected Learning Outcomes (CLO):

ELO 2 Problem Analysis

ELO 3 Design

Course Learning Outcomes (CLO):

Able to apply design criteria in calculating and analyzing dimension for environmental engineering infrastructure and its maintenance.

Learning Experiences:

Syllabus:

Role of building structure science in design process of environmental engineering infrastructure; Explaining the various buildings of environmental engineering; Explaining the objectives, the process of structural design and various planning methods; Explaining the form, type, placement, distribution, factors and combinations of loading in the planning of reinforced concrete for building environmental engineering; Explaining the aspects and parameters of reinforced concrete planning for environmental engineering infrastructure; Explaining the material properties and the mechanics of reinforced concrete cross-section, the elastic concept and boundary strength, the simplification of the Whitney tension block and the balanced collapse; Analyzing and designing square reinforced concrete beams, with single and double reinforcement and T cross-section beams with against bending and sliding; Analyzing and designing the reinforcement for one-way and two-way plates; Analyzing the strength of both short and slim columns as well as structural walls against bending and axial force; Understand the structure of reinforced concrete square tank and circular tank for building environmental engineering; Water-resistant aspect in buildings; Aspect of durability; Reinforced concrete degradation mechanism; Prevention of reinforced concrete corrosion; Repair of reinforced concrete structures;

Prerequisite:

Environmental Engineering Material Properties, Structural Mechanic 1, Structural Mechanics 2

Textbook References:

1. Persyaratan beton struktural untuk bangunan gedung, SNI 2847:2013, Badan Standarisai nasional
2. Mac Gregor, J.G, *Reinforced Concrete: Mechanics and Design*, 6th .edition, Prentice-Hall, 2012.
3. *Code Requirements for Environmental Engineering Concrete Structures and Commentary*, ACI 350-06, American Concrete Institute, 2006, Farmington Hill
4. Beban miminum untuk perancangan gedung dan struktur lainnya, SNI 1727:2013, BSN 2013.

5. Wahyudi & Syahril A.R., *Struktur Beton Bertulang*, Gramedia, 1997.
6. John F. Seidensticker, Edward S. Hoffman, *Sanitary Structures – Tanks and Reservoirs*, Chapter 18 Handbook Concrete Engineering, Second Edition, Edited by Mark Fintel, Van Nostrand Reinhold Company Inc, 1985.
7. Rectangular Concrete Tanks, Concrete Information IS003.03D, Portland Cement Association, 1969, Revised 1981.
8. Underground Concrete Tanks, Concrete Information Sheet IS071.03D, Portland Cement Association.
9. Circular Concrete Tanks without Prestressing, ISBN 0-89312-125-8, Portland Cement Association,1993
10. El-Reedy, M. A. (2018). Steel-Reinforced Concrete Structures: Assessment and Repair of Corrosion, 2nd edition. CRC Press: Taylor & Francis Group.

Occupational Health, Safety and Environmental Risk

ENEV 606 001

2 credits

Expected Learning Outcomes (CLO):

ELO 2 Problem Analysis

ELO 9 Individual and Teamwork

Course Learning Outcomes (CLO):

Student able to explain the risk and hazard of environmental pollutant in water, air, soil and workplace environment towards human safety and health and able to describe the appropriate protection method when faced environmental health and safety issue.

Learning Experiences:

Syllabus:

Water, soil, and air pollutant, introduction to environmental toxicology, environmental risk analysis, Introduction to occupational health and safety, hazard and safety in industrial solvent usage, industrial dust and debris hazard and safety, hazard and safety of noise, radiation safety, ergonomic, evaluation for occupational health and safety, occupational health and safety and environment management system,

Prerequisite: -

Textbook References:

1. Hemond, H. and Fechner, E.J., 1999. Chemical Fate and Transport in the Environment 2nd Edition
2. Frank M. Dunnivant, Elliot Anders. 2006. A basic introduction to pollutant fate and transport: an integrated approach with chemistry, modeling, risk assessment, and environmental legislation
3. Wentz, Charles A. Safety, Health, and Environmental Protection, Boston; McGraw-Hill Book Co, 1998.

Environmental Impact Assessment and ISO

ENEV 606 002

3 credits

Expected Learning Outcomes (CLO):

ELO 2 Problem Analysis

ELO 7 Sustainability

ELO 8 Ethics

Course Learning Outcomes (CLO):

Students are able to apply EIA method and ISO 14000:1 as parts of environmental management as well as aninputs for safeguards for human and natural resources

Learning Experiences:

Syllabus:

Background and policy regarding environmental management in Indonesia; definition, purpose & benefit of EIA; environmental law and EIA regulation; EIA procedure; filtering procedure; EIA document components ; project description; initial environmental condition; Societal involvement result; the potential environmental impact on specific activities; procedure and method for identifying & evaluating environmental impact; area boundary and time frame; data collection method and analysis; forecasting method for potential impact; holistic evaluation methods for environmental impact; EIA & RKL-RPL document structure and components; history, definition, purpose and function of ISO 14000:1; ISO 14000:1 (clausal 1-10) standard structure.

Prerequisite:

Textbook References:

1. Canter, L.W., *Environmental Impact Assesment*, New York, McGraw-Hill, 1996.
2. Richard K. Morgan, Environmental Impact Assessment: A Methodological Perspective, Boston, Kluwer Academic Publisher, 1998.
3. SNI ISO 14001:2015 Sistem Manajemen Lingkungan – Persyaratan & Panduan Untuk Penggunaan, 2015.
4. Soemarwoto, Otto., Analisis Mengenai Dampak Lingkungan, Yogyakarta, Gadjah Mada University Press, 2007.
5. Suratmo F. Gunarwan, *Analisis Mengenai Dampak Lingkungan*, Yogyakarta, Gajah Mada University Press, 2007.

Environmental Engineering Project Management

ENEV 606 003

3 credits

Expected Learning Outcomes (CLO):

ELO 9 Individual and Teamwork

ELO 10 Communication

ELO 11 Project Management

Course Learning Outcomes (CLO):

1. Able to select and plan project management from project initiation to project implementation and hand over works
2. Able to communicate and work in team
3. Able to deliver ideas verbally and written report

Learning Experiences:

Syllabus:

Project: environmental infrastructure, project initiation: project selection, Planning project: major activities and supporting activities; Implementation of the project: plan implementation, quality assurance, Healt, safety and environmental management, material procurement processes, equipment and services; Control of the project: project performance reporting, control activities, time, cost and quality; Closure of the project: the introduction of asset management / infrastructure

Prerequisite:

Textbook References:

1. Blank, L and Tarquin, A., Engineering Economy, McGrawHill, New York, 2002
2. Duffield, C.F and Trigunarsyah, B., Manajemen Proyek – dari Konsepsi sampai Penyelesaian, Engineering Education Australia, Melbourne, 1999
3. Europen Construction Institute, Total Project Management of Construction Safety, Health and Enviornment, Thoman Telford, London, 1995
4. Halpin, D, W and Woodhead, R.W., Costruction Management, 2nd ed., John Wiley & Sons Inc., New York, 1998
5. Project Management Institute, A Guide to the Project Management Body of Knowledge (PMBOK®Guide). PMI, USA 2000
6. Project Management Institute, A Guide to the Project Management Body of Knowledge (PMBOK®Guide). PMI, USA 2013
7. Slough, R.H., Sears, G.A. and Sears, S.K., Construction Project Management, 4th ed., John Wiley & Sons Inc., New York, 2000

Water Treatment Plant Design

ENEV 606 004

3 credits

Expected Learning Outcomes (CLO):

ELO 2 Problem Analysis

ELO 3 Design

Course Learning Outcomes (CLO):

1. Able to analyze raw water characteristic, water quality regulation, as well as technical and non-technical considerations to determine the type of water intake, water transmission and drinking water treatment system for a region or a city
2. Able to determine the design parameter, detail the component, dan calculate the dimension of water treatment unit based on technical and non-technical considerations.

Learning Experiences:

Syllabus:

Water supply systems and their components, raw water resource and its utilization, raw water and drinking water standard quality, selecting water resource; water catchments and water transmission and equipment, water treatment, physical treatment, chemicals treatment, reservoir, equipments of another installation, layout, hydraulic profile

Prerequisite:

Unit Operation and Process, Environmental Engineering Hydraulics, Urban Planningn and Sanitation

Textbook References:

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

Domestic Wastewater Treatment Plant Design

ENEV 606 005

3 credits

Expected Learning Outcomes (CLO):

ELO 2 Problem Analysis

ELO 3 Design

Course Learning Outcomes (CLO):

1. Able to analyze wastewater characteristic, water quality standard and regulation, as well as technical and non-technical considerations to determine the wastewater treatment system for a region or a city.
2. Able to determine the design parameter, detail the component, dan calculate the dimension of wasterwater treatment unit based on technical and non-technical considerations.

Learning Experiences:

Syllabus:

Problems and challenges of wastewater management; Sources and characteristics of wastewater; Environmental quality standards; Local and centralized systems; Alternative treatment; Processing level; removal efficiency; Non-technical aspects and environmental impacts of WWTP; Selection of process; Design criteria; filtration;

equalization; sand filtration and sedimentation; Suspended Growth Aerobic Treatment; Attached Growth Aerobic Treatment; Anaerobic Treatment; disinfection; sludge processing; layout, hydraulic profile.

Prerequisite:

Unit Operation and Process, Environmental Engineering Hydraulics, Urban Planning and Sanitation

Textbook References:

1. Metcalf and Eddy, Wastewater Engineering Treatment and Disposal, Reuse, Singapore, McGraw-Hill Inc, 2004.
2. Qasim, Syed R. Zhu, Guang. (2017). Wastewater Treatment and Reuse, Theory and Design Examples, Volume 1 Principles and Basic Treatment. CRC Press

Air Pollution

ENEV 606 006

3 credits

Expected Learning Outcomes (CLO):

ELO 2 Problem Analysis

Course Learning Outcomes (CLO):

1. Able to explain source, type and impact of air pollution and related air pollution policy
2. Able to explain meteorology factor and air pollution mechanism
3. Able to analyze appropriate technology for air pollution control
4. Able to examine gas and particulate pollutant from air

Learning Experiences:

Syllabus:

History of air pollution; standard and regulation about air pollution; air pollution impact; meteorology factor and air pollution mechanism; sulfur oxide; nitrogen oxide; particulate; volatile organic compounds; waste inventory and case study; indoor air pollutants; particulate and gas practicum; gas and particulate pollution control.

Prerequisite:

Environmental Laboratory; Domestic wastewater treatment

Textbook References:

1. Vallero, D.2008. Fundamentals of Air Pollution. Fourth Edition.Ap: USA.
2. De Nevers, N. 2000. Air Pollution Control Engineering. McGraw Hill: USA

Final Project on Environmental Engineering Infrastructure

ENEV 607 001

4 credits

Expected Learning Outcomes (CLO):

ELO 3 Design
ELO 9 Individual and Team Works
ELO 10 Communication
ELO 11 Project Management

Course Learning Outcomes (CLO):

Able to design a sustainable environmental engineering buildings/infrastructure and present it in the form of tender documents which include: i) detailed technical design drawings, ii) requirements work plans, iii) cost budget plans, and iv) other supporting documents and able to present these designs to the examiner.

Learning Experiences:

Syllabus:

Problem identification in accordance to the project terms of reference; negotiation for the planning component related to the scope of work and the scheduling; Formulation for the primary and secondary components of the environmental engineering building structure for analysis; Iteration of alternative solutions and decision making; Report of the study includes the planning concept, calculation methods, and implementation methods, by applying regulations, manuals and standards; Final report of the proposal including technical specifications, unit price calculations, details of the overall cost of work, and detail engineering drawings of the primary components and other supporting documents such as monitoring plans, maintenance to produce a sustainable building life cycle.

Prerequisite:

Student should have taken these courses: Structural Design for Environmental Engineering Infrastructure, Engineering Economics, Water Treatment Plant Design, Domestic Wastewater Treatment Plant

Textbook References:

1. Clive L Dym, Patrick Little, Elizabeth Orwin. (2014). Engineering Design, A Project-Based Instroduction 4th Edition. John Wiley & Sons, Inc.
2. SNI and other related national and international standard.

Hazardous dan Industrial Waste Treatment

ENEV 607 002

3 credits

Expected Learning Outcomes (CLO):

ELO 2 Problem Analysis
ELO 7 Sustainability
ELO 8 Ethics

Course Learning Outcomes (CLO):

Students are expected to implement processes and technology of industrial waste treatment within the framework of environmental pollution control and environmental work

Learning Experiences:

Syllabus :
Global Agenda 21 and Indonesia Agenda 21 in sustainable development especially in waste management; Policy and regulation regarding environmental management in industry; environmental support concept and environmental components in industrial waste management; source, type, and characteristic of industrial waste based on raw material, processs, and the product utilization; pollution impact (pollutant in form liquid, solid and gas), vibration and noise toward human health and the environment; pollution prevention and minimizing the industrial waste; process and technology for wastewater, solid waste and air pollution; case study in industrial waste management.
Prerequisite:
Textbook References:
1. La Grega (1994), 'Hazardous Waste Management' ERM, England
2. Nemerow (1992),'Industrial and Hazardous Waste Pollution Control', McGraw-Hll, Singapore
3. W.W. Eckenfelder (1989),'Industrial Water Polluiton Control', McGraw-Hill, Singapore

Writing and Presentation Technique
ENEV 607 003
2 credits
Expected Learning Outcomes (CLO):
ELO10 Communication.

Course Learning Outcomes (CLO):

1. Student are able to communicate effectively within the scope of academic activities such as reporting the result of field internship, research proposal and undergraduate thesis
2. Student able to present ideas when it is required using correct Bahasa Indonesia grammar in verbal presentation and written report
3. Student are able to prepare his/her curriculum vitae and motivation letter for job seeking purposes, scholarship, and/or pursuing higher education

Learning Experiences:
Syllabus:
Introduction: the importance of verbal and written communication; written communication using proper Bahasa Indonesia and English; data visualization using table, graph and chart; how to create a good presentation using power point; preparing a curriculum vitae; writing motivation letter
Prequisites: -
Textbooks:
Ruiz-Garrido, Miguel. Palmer-Silveira, Juan C., Fortanet-Gomez, Immaculada. English for Professional and Academic Purposes.

Field Internship
ENEV600 100
3 credits
Expected Learning Outcomes (CLO):
ELO 8 Ethics
ELO 9 Individual and Teamwork
ELO10 Communication
ELO 11 Project Management

Course Learning Outcomes (CLO):
Students are able to describe civil and environmental engineering job/project at internship site, identify problems, conduct analysis and possible solution, and reporting in written document which will be defended in front of examiner team.
Learning Experiences:
Syllabus:
Specify the work object to be studied and poured in the proposal; To perform an internship in a place that has been approved and in accordance with its interests; Learn and describe technical work processes, quality control, project management, project specifications, engineering drawings, and other aspects; technical problem identification at internship workplace, quality control, project management, project specification; engineering drawing and other aspects; problem analysis on every project stage; identify possible solution for ever project stage; final report describe the project; Problem Solving
Prerequisite:
1. Student is at Semester VI and have obtained > 75 SKS in accordance to Department of Civil Engineering regulation and/or Faculty of Engineering Universitas Indonesia regulation.
2. Have filled in IRS for Field Internship and have submit the field internship request to the Field Internship Coordinator at Department of Civil Engineering.
3. Student should have chosen prospective project or internship workplace.
4. Student should filled in and submit the field internship registration form to The Secretariat of Department of Civil Engineering

Textbooks:

Undergraduate Thesis
ENEV 600 400
5 credits
Expected Learning Outcomes (CLO):
ELO 4 Experiment
ELO 8 Ethics
ELO 10 Communication
ELO 12 Lifelong Learning

Course Learning Outcomes (CLO):

Student are able to chose an appropriate methods for the research, appropriately conduct research, write the thesis using a correct grammar and present the result in a scientific report and an oral presentation.

Learning Experiences:

Syllabus:

Problem formulation, study literature, research, data analysis, result interpretation, report writing and oral presentation.

Prerequisite: -

Textbook References:

ELECTIVE COURSE IN ENVIRONMENTAL ENGINEERING UNDERGRADUATE PROGRAMME

Elective Course in Environmental Engineering Undergraduate Programme

Service Learning
ENEV 600 300
1 credits
Expected Learning Outcomes (CLO):
ELO 12 Lifelong Learning

Course Learning Outcomes (CLO):
Able in indepedently managing time while being active participating extracurricular activities such as ; competition; seminar (national and international); social works; student organization; event organizer; etc. Actively participating in extracurricular activities will develop independency, critical thinking, social sensitivity, ability to work underpressure, and profesionalism.

Learning Experiences:

Syllabus :
Student participate extracurricular activities. The participation of each activity will be calculated of its equivalent point (score). Each student should obtain specific point (score) in accordance to the environmental engineering programme.

Prerequisite:
Student can claim the credit after obtaining certain minimum points.

Textbook References:
Term of Reference for Service-Learning Course in Curriculum of Department of Civil Engineering 2020

Applied Sanitation
ENEV 604 101
3 credits
Expected Learning Outcomes (CLO):
ELO 3 – Design

Course Learning Outcomes (CLO):
Able to analyze the applied sanitation needs in slum area with contextual consideration of social problem, health problem, safety problem, and in accordance to the local law and tradition.

Learning Experiences:

Syllabus:
Introduction to the development of clean water access and sanitation, basic concept, sanitation for the rich and the poor, global clean water and sanitation. Utility approach for the poor and slum dwellers in Indonesia. Water, sanitation, and disease related to sanitation. Funding for clean water access and sanitation. Decentralized water treatment and storage. On-site sanitation system. WWTP, Sanimas and Pamsimas Programme. Case study : Sanitation for slum area project.

Prerequisite:
Currently take or have taken course: Urban Planning and Sanitation

Textbook References:
1. Appropriate Technology for Water Supply and Sanitation, A.K.M. Nurul Islam and Hidetoshi Kitawaki (1996)
2. Progress on drinking-water and sanitation : special focus on sanitation, WHO/Unicef (2008)
3. Sustainable Water and Sanitation Services The Life-Cycle Cost Approach to Planning and Management, Routledge Taylor Francis (2013)

Internship A
ENEV 600 500
1 credits
Expected Learning Outcomes (CLO):
ELO 9 Individual and Team Work

Course Learning Outcomes (CLO):
Student are able to execute the delegated task by the internship supervisor professionally and able to show positive attitude in the workplace.

Learning Experiences:

Syllabus :
1. Able to accept input and instruction from supervisor or colleague
2. Able to accurately report and execute the delegated task
3. Able to finish the task on schedule
4. Able to adapt to the vision, mission and culture at the workplace
5. Have positive attitude towards the delegated task and with the colleague
6. Have initiative attitude
7. Be on time at the workplace
8. Participate in workplace activities in accordance to workplace ethics and cultures

Prerequisite: -

Textbook References :

Introduction to Environmental Economics
ENEV 605 102
3 credits
Expected Learning Outcomes (CLO):

ELO 11 Project Management

Course Learning Outcomes (CLO):
1. Able to describe how environmental problem can be explained and analyzed using economic theory approach
2. Able to communicate and work in team on how pollution in economic activities can be abated.

Learning Experiences:
Syllabus:
Definition of environmental economics, environment as raw material, environment and sustainable development, economic system and environmental function, types and source of pollution and pollution control, environmental valutation, policy instrument in environmental protection.
Textbook References: -
1. Ekonomi Lingkungan, 2000. Drs. Suparmoko. M.A., Ph.D, Maria R. Suparmoko, S.E.,M.A.
2. Ekonomika Pembangunan, 2002. Drs. Irawan, M.B.A., Drs. M. Suparmoko, M.A., Ph.D.
3. Natural Resource and Environmental Economics, 2011. Perman, R.,Y. Ma., J. McGilvray, and M. Common

Entrepreneurship
ENEV 606 005
2 credits
Expected Learning Outcomes (CLO):
ELO 6 Engineering and Society
ELO 13 Entrepreneurship

Course Learning Outcomes (CLO):

Students are able to explain the comparison of various entrepreneurial activity of civil / environmental engineering characterized by innovation and self-reliance based on ethics and able to communicate visually and verbally
Learning Experiences:
Syllabus:
Introductions and overview of entrepreneurship (definition of entrepreneurship; Entrepreneurship in environmental engineering field; Identify environmental issues as an entrepreneurial opportunity), Design Thinking concept and Value Preposition Canvas (Introduction to Design Thinking and Value Preposition Canvas; Identify problems related to the environmental engineering for potential customers; Identify VPC components for potential customers; Identification of present environmental engineering solutions in Indonesia), Business model canvas Concept (Introduction of Business model canvas; Potential business plan; Expenditure and income in the business plan; Definitions of resources, activities, and partners in a business plan; Definition of customer segments, relationships and channels in a business plan; Identify differences and similarities between BMC components; Assessment of advantages and disadvantages of each element of BMC)
Prerequisite: Integrated Character Building Course , Introduction to Environmental Engineering System, Urban Planning and Sanitation
Textbook References:
1. Alexander Osterwalder, Yves Pigneur, Gregory Bernarda, Alan Smith, John Wiley & Sons, 28 Jan 2015, Value Proposition Design: How to Create Products and Services Customers Want
2. Alexander Osterwalder; Yves Pigneur, Hoboken, N.J. : Wiley, ©2010, Business model generation : a handbook for visionaries, game changers, and challengers

Environmental Modelling
ENEV 605 104
2 credits
Expected Learning Outcomes (CLO):
ELO 2 Problem Analysis
ELO 5 Modern Tool

Course Learning Outcomes (CLO):

1. Students are able to explain ekokinetika polluters in the water environment (C2)

2. Students are able to simulate the process of pollutant fate and transport in a single-dimensional environment using the advanced calculus basis, fluid mechanics and environmental chemistry (C3)

Learning Experiences:
Syllabus:
Introduction to environmental modeling, the pollutant mass equilibrium principle in controlled volumes, advection and diffusion processes, pollutants reaction in the environment, the general solutions for pollutants dynamics in the environment, characterization of pollutants, specific solutions to the pollutant dynamics in the environment, numerical solutions of pollutants in the environment, environmental modeling applications.
Prerequisite:
Textbook References:
Steven C. Chapra, 1997, Surface Water-Quality Modeling. Waveland Press. Inc.

Environmental System Analysis
ENEV 606 105
3 credits
Expected Learning Outcomes (CLO):
ELO 2 Problem Analysis

Course Learning Outcomes (CLO):

1. Able to explain basic principle of environment as a system with the interaction between its component (social, natural, and artificial)
2. Able to simulate the amount, the concentration, the level of hazard and impact of pollutant in the environment

Learning Experiences:

Syllabus :

Definition of environmental system with its subsystem (natural, artificial, and social); the dynamics of environmental system (the principle of environmental sciences: interaction, interdependency, diversity, harmony, and continuity). Physical dynamics of environmental system (matter and energy cycles, hydrology cycles, food cycles, and disturbance caused by environmental pollution)l; Physical environmental management model (factor determination, media and physical component interaction); Social system management model (conflict management and environmental mediation); Physical case study and social case study.

Prerequisite: -

Textbook References:

1. Tyller Miller, Living in The Environment, McGraw-Hill, Singapore, 1994
2. Amy, The Polities of Environmental Mediation, Columbia University Press, 1987
3. Fisher dkk, Mengelola Konflik Ketrampilan dan Strategi Untuk Bertindak, The British Council, Jakarta, 2000

Internship B

ENEV 600 600

3 credits

Expected Learning Outcomes (CLO):

ELO 9 Individual and Team Work

Course Learning Outcomes (CLO):

Student are able to execute the delegated task by the internship supervisor professionally and able to show positive attitude in the workplace.

Learning Experiences:

Syllabus :

1. Able to accept input and instruction from supervisor or colleague
2. Able to accurately report and execute the delegated task
3. Able to finish the task on schedule
4. Able to adapt to the vision, mission and culture at the workplace
5. Have positive attitude towards the delegated task and with the colleague
6. Have initiative attitude
7. Be on time at the workplace
8. Participate in workplace activities in accordance to workplace ethics and cultures

Prerequisite: -

Textbook References :

Monitoring and Optimation of Water Treatment Plant

ENEV 607 106

2 credits

Expected Learning Outcomes (CLO):

ELO 4 Design.

Course Learning Outcomes (CLO):

Able to evaluate to performance of a water treatment plant based on treatment efficiency, criteria design, operation and maintenances and able to provide technical recommendation to improve the treatment capacity and its performance.

Learning Experiences:

Syllabus:

Water treatment process overview in WTP; the operational of treatment unit; monitoring the water quality in WTP; typical technical problem occurred in WTP and its troubleshooting; lab scale simulation in evaluating the treatment unit performance; design parameter evaluation; performance and the capacity optimation strategy, case study.

Prerequisite:

Water Treatment Plant Design, Domestic Wastewater Treatment Plant Design

Textbook References:

1. Mackenzie L. Davis. (2010). Water and Wastewater Engineering, Design Principles and Practice. McGraw-Hill Companies. ISBN: 978-0-07-171385-6
2. Warner, E. G. and Pinheiro, R. G. (2001). Upgrading Water Treatment Plants. World Health Organization. ISBN 0-203-34232-1

Emerging Topics on Environmental Engineering

ENEV 607 107

3 credits

Expected Learning Outcomes (CLO):

ELO 10 Communication

ELO 12 Life Long Learning

Course Learning Outcomes (CLO):

1. Able to examine the emergin topics in the system of engineering and examines current topics in systems engineering and environmental infrastructure through industrial and academic guest lectures, case studies and practical projects (C4)
2. Able to relate the latest topics in environmental engineering and infrastructure systems with the basic competencies of environmental engineering that they already have.

Learning Experiences:

Syllabus :

The world is developing rapidly, it provides a better

human life but also gives unwanted challenges. Various problem arise that require unconventional approach such as creativity and specific paragdim. In this course, student will learn about emerging issue from environmental engineering perspective. The topic will change during 2020 curriculum in accordance to the current world issues. In the year of 2020/2021, the topic is about the sanitation, clean water, waste water, and solid waste that are related to COVID-19 pandemic. The survival rate of this virus is high in the environment, especially in certain surface such as plastic, paper, sewage and even in fecal matter. This condition increases the possibility that the virus might thrives in domestic solid waste and domestic wastewater generated from the infected area. The waste might be a transmission media to the virus. This course aims to prepare the student in facing the pandemic crisis and able to provide an appropriate response from environmental engineering perspective.

Prerequisite:
Student have takaen 100 SKS
Textbooks References:
Shah, Vishal (Ed.), Emerging Environmental Technologies, Springer (2008).

Sludge processing and Valorization
ENEV 608 108
2 credits
Expected Learning Outcomes (CLO):
ELO 3 Design

Course Learning Outcomes (CLO):
Able to determine the system and its detail of sludge processing in accordance to technical and non-technical aspect and able to express alternative technology for sludge utilization.
Learning Experiences:
Sylllabus:
Background and purpose of sludge processing, source and characteristic of sludge, mass balance analysis, treatment system, primary treatment; sludge thickening; sludge stabilization; sludge conditioning; sludge drying; final disposal; advanced processing; sludge alternative utilization (as adsorbent, construction material, coagulant recovery, etc).
Prerequisite:
Water Treatment Plant Design; Domestic Wastewater Treatment Design;
Textbook References:
1. Qasim, S. R., Zhu, G. (2018). Wastewater treatment and reuse, theory and design examples. Volume 2, Post-treatment, reuse, and disposal. Taylor & Francis Group, LLC. CRC Press. ISBN: 13978-1-138-30094-1
2. SNI dan standar internasional yang terkait

Special Topic of Research Collaboration
ENEV 600 700
3 credits
Expected Learning Outcomes (CLO):
ELO 10 (Communication)
ELO 12 (Life Long Learning)

Course Learning Outcomes (CLO):
Able to apply environmental engineering knowledge to solve complex engineering solve through environmental engineering knowledge through research along with other engineering areas that follow a proper research methodology.
Learning Experiences:
Syllabus:
Conduct literature study, select research methodology, data analysis and interpretation, and draw a valid conclusion
Prerequisite:
Textbook References:

Pollution Prevention
ENEV 608 109
3 credits
Expected Learning Outcomes (CLO):
ELO 6 Engineer and Society

Course Learning Outcomes (CLO):
1. Students are able to explain pollution Prevention method in industry
2. Student are able to evaluate the effectiveness of industrial pollution prevention method

Learning Experiences:
Sylllabus :
ISO 14000:1 concept in the pollution prevention implementation (sustainability concept in pollution prevention policy and implementation, energy and conservation concept, concept of planning, implementation, monitoring, and policy evaluation, value stream mapping), pollution prevention method for every environmental aspect (Pollution prevention in Indonesia and global). The effectiveness of pollution prevention method (The Overview of pollution prevention effectiveness in industry, industrial waste treatment and recycle, good housekeeping method in industry, Chemical laboratory pollution prevention).
Prerequisite: -
Textbook References :
1. Paul L. Bishop, McGraw-Hill, 2000, Pollution Prevention: Fundamentals and Practice McGraw-Hill series in water resources and environmental engineering
2. Ryan Dupont, Kumar Ganesan, Louis Theodore, CRC Press, 2016, Pollution Prevention: Sustainability, Industrial Ecology, and Green Engineering, Second Edition

Course of Fast Track S1-S2 Environmental Engineering

Code	Subject	SKS
	1st Semester	
	Religion	2
	Academic English	**2**
ENGE 600 001	Calculus 1	3
ENGE 600 009	Basic Chemistry	2
ENCV 601 001	Physics (Mechanics and Thermal)	4
ENEV 601 001	Introduction to Environmental Engineering System	**3**
ENEV 601 002	Global Environmental Issues	2
ENEV 601 003	Basic Chemistry Laboratory	1
	Sub Total	**19**
	2nd Semester	
	Integrated Charater Building	5
ENGE 600 002	Calculus 2	3
ENGE 600 004	Linear Algebra	4
ENCV 603 003	Fluid Mechanics	3
ENEV 602 001	Earth Science and Mapping	2
ENEV 602 002	Construction Drawing for Environmental Engineer	2
ENEV 602 003	Environmental Biology	2
	Sub Total	**21**
	3rd Semester	
ENCV 603 004	Statistics and Probabilistic of Experimental Design	2
ENEV 603 001	Environmental Engineering Mathematic	3
ENEV 603 002	Environmental Microbiology	3
ENEV 603 003	Environmental Engineering Material	2
ENEV 603 004	Environmental Hydraulics	3
ENEV 603 005	Structural Mechanics I	2
ENEV 603 006	Urban Planning and Sanitation	3
ENEV 603 007	Effective Communication	2
	Sub Total	**20**
	4thSemester	
	5th Semester	
ENCV 606 005	Entrepreneurship	2
ENEV 605 001	Environmental Modelling	2
ENEV 605 002	Unit Operation and Process	4
ENEV 605 003	Environmental Laboratory	3
ENEV 605 004	Integrated Solid Waste Management Planning	3
ENEV 605 005	Structural Design for Environmental Engineering Infrastructure	3
	Elective/ Minor	**3**
	Sub Total	**20**
	6th Semester	
ENEV 606 001	Occupational Health, Safety and Environmental Risk	2
ENEV 606 002	Environmental Impact Assessment and ISO	3
ENEV 606 003	Environmental Engineering Project Management	3
ENEV 606 004	Water Treatment Plant Design	3
ENEV 606 005	Domestic Wastewater Treatment Plant Design	**3**
ENEV 606 006	Air Pollution	3
	Elective/ Minor	3
	Sub Total	**20**
	7th Semester	
ENEV 600 100	Field Internship	3
ENEV 607 001	Final Project on Environmental Engineering Infrastructure	4
ENEV 607 002	Hazardous and Industrial Waste Treatment	3
ENEV 607 003	Writing and Presentation Technique	2
ENEV 801 101	Environmental Data Analysis	3
ENEV 801 102	Environmental Risk Management	3
	Specialization Compulsary Course S2	3
	Sub Total	**21**

	8th Semester	
ENEV 600 300	Service Learning	1
ENEV 600 400	Undergraduate Thesis	5
ENCV 802 103	Research Method	3
ENEV 802 104	Environmental Engineering Special Topic	3
	Specialization Compulsary Course S2	3
	Sub Total	**15**
	9thSemester	
ENEV 800 104	Pra Thesis	2
	Specialization Compulsary/ Elective Course (S2)	3
	Specialization Compulsary/ Elective Course (S2)	3
	Specialization Compulsary/ Elective Course (S2)	3
	Sub Total	**11**
	10th Semester	
ENCV 800 105	Master Thesis	6
ENCV 800 106	Scientific Pub;lication	2
	Specialization Compulsary/ Elective Course (S2)	3
	Sub Total	**11**

CHAPTER 5

MASTER PROGRAM

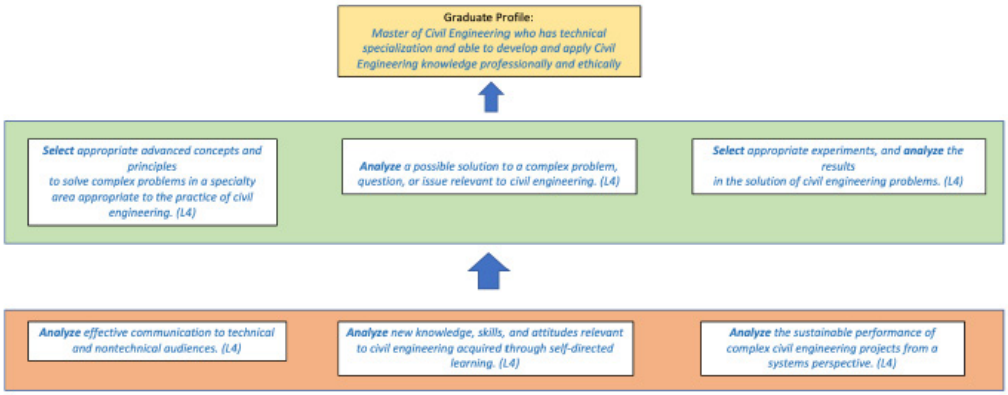
Master in Civil Engineering

Program Specification

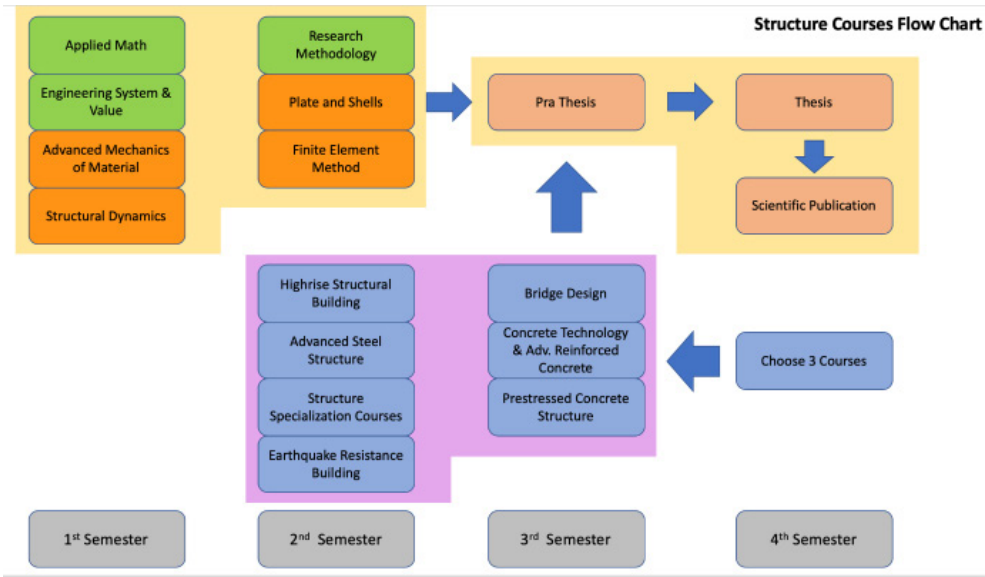
1.	**Awarding Institution**	Universitas Indonesia	
2.	**Teaching Institution**	Faculty of Engineering University Indonesia	
3.	**Programme Tittle**	Graduate Program in Civil Engineering	
4.	**Class**	Regular, Research	
5.	**Final Award**	Magister Teknik (M.T.)	
6 .	**Accreditation / Recognition**	LAM: Unggul (Excellent)	
7.	**Language(s) of Instruction**	Bahasa Indonesia and English	
8.	**Study Scheme (Full Time / Part Time)**	Full Time	
9.	**Entry Requirements**	Bachelor Degree (S1) – Engineering, Mathematics and Science; Pass the Master Degree Entrance Exam	
10.	**Study Duration**	Designed for 2 years	
	Type of Semester	Number of Semester	Number of weeks / semester
	Regular	4	16
	Short (optional)	1	8
11.	**Graduate Profiles:** Master of Civil Engineering who has technical specialization and able to develop and apply Civil Engineering knowledge professionally and ethically		
12.	**Expected Learning Outcomes:** 1. Problem Recognition and Solving: Select appropriate advanced concepts and principles to solve complex problems in a specialty area appropriate to the practice of civil engineering. (L4) 2. Experiment: **Select** appropriate experiments, and **analyze** the results in the solution of civil engineering problems. (L4) 3. Technical Specialization: **Select** appropriate advanced concepts and principles to solve complex problems in a specialty area appropriate to the practice of civil engineering. (L4) 4. Sustainability: **Analyze** the sustainable performance of complex civil engineering projects from a systems perspective. (L4) 5. Communication: **Analyze** effective communication to technical and nontechnical audiences. (L4) 6. Lifelong Learning: **Analyze** new knowledge, skills, and attitudes relevant to civil engineering acquired through self-directed learning. (L4)		

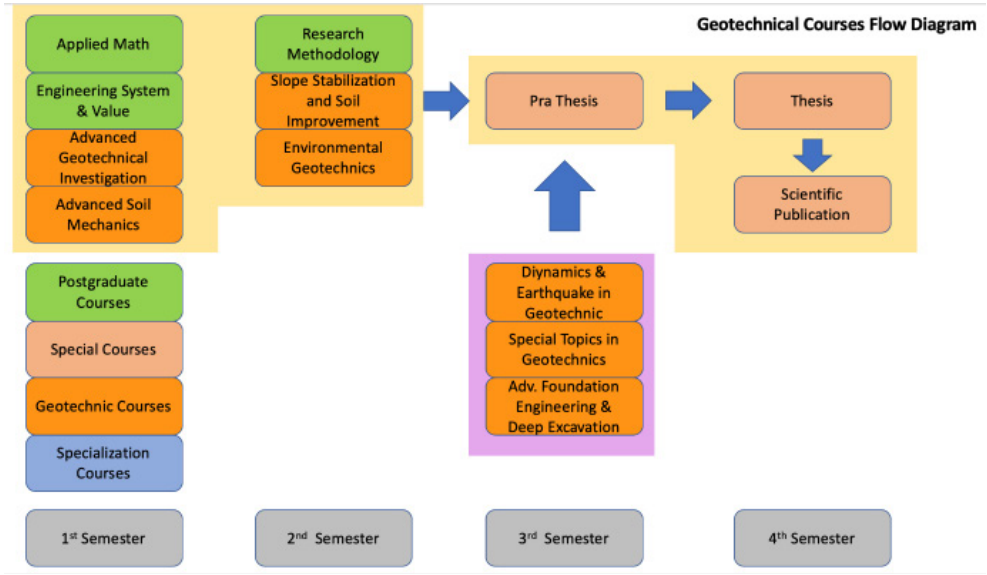
No.	Classification	Credit Hours (SKS)	Percentage
i	**Study Program Subjects**	**9**	**22%**
ii	**Specialization Subjects**	**12-21**	**30-53%**
iii	**Elective Subjects**	**3-9**	**7.5-22.5%**
iv	**Pre-Thesis, Thesis, Scientific Publications**	**10**	**25%**
	Total	**40**	**100 %**
	Total Credit Hours to Graduate		**40 Credits**

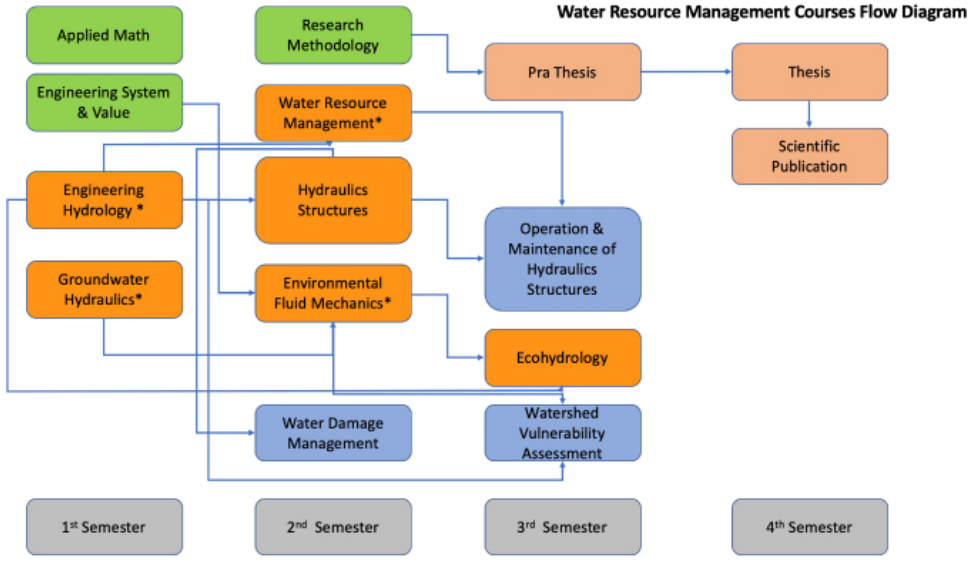
Learning Outcomes

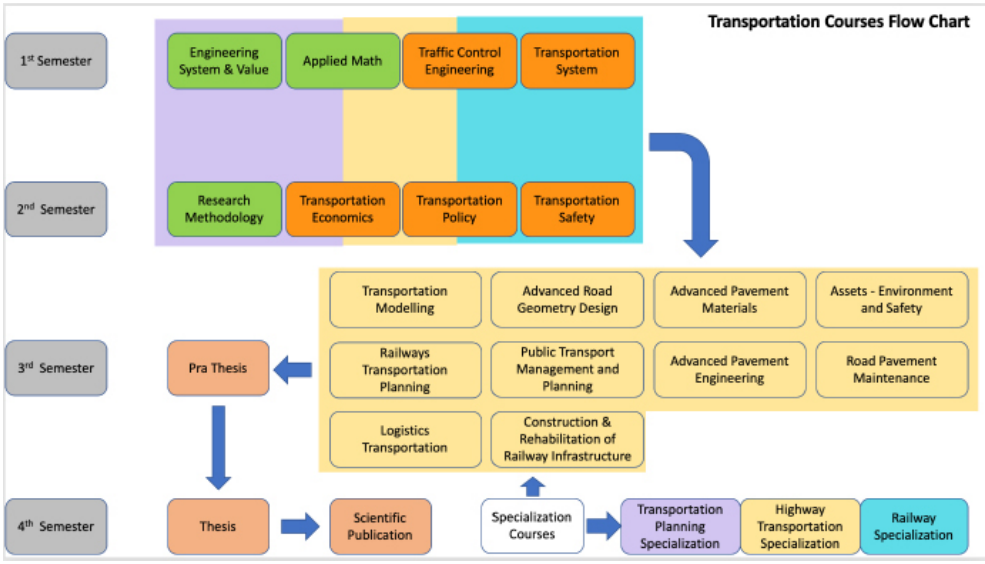


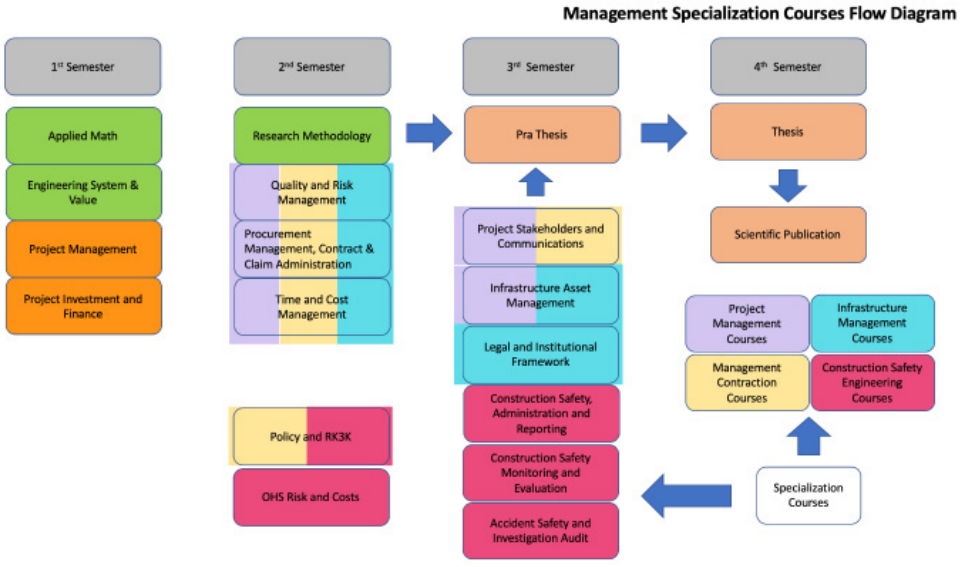
Flow Diagram of Subjects – Graduate Program on Civil Engineering




Geotechnical Courses Flow Diagram
Applied Math
Engineering System & Value
Advanced Geotechnical Investigation
Advanced Soil Mechanics
Research Methodology
Slope Stabilization and Soil Improvement
Environmental Geotechnics
Pra Thesis
Thesis
Scientific Publication
Diynamics & Earthquake in Geotechnic
Special Topics in Geotechnics
Adv. Foundation Engineering & Deep Excavation
Postgraduate Courses
Special Courses
Geotechnic Courses
Specialization Courses
1st Semester
2nd Semester
3rd Semester
4th Semester


Water Resource Management Courses Flow Diagram
Applied Math
Engineering System & Value
Engineering Hydrology *
Groundwater Hydraulics*
Research Methodology
Water Resource Management*
Hydraulics Structures
Environmental Fluid Mechanics*
Water Damage Management
Pra Thesis
Thesis
Scientific Publication
Operation & Maintenance of Hydraulics Structures
Ecohydrology
Watershed Vulnerability Assessment
1st Semester
2nd Semester
3rd Semester
4th Semester


Transportation Courses Flow Chart
1st Semester
Engineering System & Value
Applied Math
Traffic Control Engineering
Transportation System
2nd Semester
Research Methodology
Transportation Economics
Transportation Policy
Transportation Safety
3rd Semester
Pra Thesis
Transportation Modelling
Advanced Road Geometry Design
Advanced Pavement Materials
Assets - Environment and Safety
Railways Transportation Planning
Public Transport Management and Planning
Advanced Pavement Engineering
Road Pavement Maintenance
Logistics Transportation
Construction & Rehabilitation of Railway Infrastructure
4th Semester
Thesis
Scientific Publication
Specialization Courses
Transportation Planning Specialization
Highway Transportation Specialization
Railway Specialization


Management Specialization Courses Flow Diagram
1st Semester
Applied Math
Engineering System & Value
Project Management
Project Investment and Finance
2nd Semester
Research Methodology
Quality and Risk Management
Procurement Management, Contract & Claim Administration
Time and Cost Management
Policy and RK3K
OHS Risk and Costs
3rd Semester
Pra Thesis
Project Stakeholders and Communications
Infrastructure Asset Management
Legal and Institutional Framework
Construction Safety, Administration and Reporting
Construction Safety Monitoring and Evaluation
Accident Safety and Investigation Audit
4th Semester
Thesis
Scientific Publication
Project Management Courses
Infrastructure Management Courses
Management Contraction Courses
Construction Safety Engineering Courses
Specialization Courses

Curriculum Structure of Graduate Program on Civil Engineering

Code	Subject	SKS
	1st Semester	
ENCV 801 101	Applied Mathematics	3
ENCV 801 102	Engineering System and Value	3
Structural Courses		
ENCV 801 201	Advanced Material Mechanics	3
ENCV 801 202	Structural Dynamics	3
Geotechnical Courses		
ENCV 801 301	Advanced Soil Mechanics	3
ENCV 801 302	Advanced Geotechnic Investigation	3
Water Resource Management Courses		
ENCV 801 401	Groundwater Hydraulics	3
ENCV 801 402	Engineering Hydrology	3
Transportation Courses		
ENCV 801 501	Traffic Engineering and Control	3
ENCV 801 502	Transportation Systems	3
Construction Management Courses		
ENCV 801 601	Project Investment and Finance	3
ENCV 801 602	Project Management	3
	Total credits Semester 1 Major - Structure	12
	Total credits Semester 1 Major - Geotechnic	12
	Total credits Semester 1 Major - Water Resource Management	12
	Total credits Semester 1 Major - Transportation	12
	Total credits Semester 1 Major - PM / CM / IM / CSEM	12

	2nd Semester	
ENCV 802 103	Research Metodology	3
Structural Courses		
ENCV 802 201	Plate and Shell	3
ENCV 802 202	Finite Element Method	3
ENCV 802 203	High Rise Building Structure	3
ENCV 802 204	Advanced Steel Structure	3
ENCV 802 205	Special Topics on Structural Engineering	3
ENCV 802 206	Earthquake Resistance Building Structure	3
Geotechnical Courses		
ENCV 802 301	Slope Stabilization and Soil Improvement	3
ENCV 802 302	Environmental Geotechnics	3
ENCV 802 303	Numerical Methods in Geotechnical Engineering	3
Water Resource Management Courses		
ENCV 802 401	Water Resources Management	3
ENCV 802 402	Water Infrastructure Design	3
ENCV 802 403	Water Infrastructure Observation Maintenance Operational System	3
ENCV 802 404	Environmental Fluid Mechanics	3
Transportation Courses		
ENCV 802 501	Transportation Economics	3
ENCV 802 502	Transportation Planning and Policy	3
ENCV 802 503	Transportation Safety	3
Project Management Courses and Infrastructure Management Courses		
ENCV 802 601	Project Time and Cost Management	3
ENCV 802 602	Project Quality and Risk Management	3
ENCV 802 603	Procurement, Contract Administration and Claim	3
Construction Management Courses		
ENCV 802 601	Project Time and Cost Management	3

ENCV 802 602	Project Quality and Risk Management	3
ENCV 8026 03	Procurement, Contract Administration and Claim	3
ENCV 802 604	Policy and Safety plan in Construction	3
Construction Safety Engineering Management Courses		
ENCV 802 605	Risk and Cost of Safety	3
ENCV 802 604	Policy and Safety plan in Construction	3
	Total credits Semester 1 Major - Structure	12
	Total credits Semester 1 Major - Geotechnic	12
	Total credits Semester 1 Major - Water Resource Management	15
	Total credits Semester 1 Major - Transportation	12
	Total credits Semester 2 Major - Project Management	12
	Total credits Semester 2 Major - Construction Management	15
	Total credits Semester 2 Major - Infrastructure Management	12
	Total credits Semester 2 Major - Construction Safety Engineering Management	9
	Total credits Semester 2 Major - Environmental Engineering	12
	3rd Semester	
ENCV 800 104	Pre - Thesis	2
Structural Courses		
ENCV 803 201	Bridge Structure	3
ENCV 803 202	Advance Reinforce Concrete Technology	3
ENCV 803 203	Prestressed Concrete Structure	3
ENCV 803 204	Offshore Structure	3
Geotechnical Courses		
ENCV 803 301	Adv. Foundation Engineering & Deep Excavation	3
ENCV 803 302	Dynamics & Earthquake in Geotechnics	3
ENCV 803 303	Special Topics in Geotechnics	3
Water Resource Management Courses		
ENCV 803 401	Ecohydrology	3
ENCV 803 402	Watershed Vulnerability Assessment	3
ENCV 803 403	Water Damage Management	3
Transportation Courses		
ENCV 803 501	Transportation Model	3
ENCV 803 502	Public Transportation Planning and Control	3
ENCV 803 503	Advanced Road Geometric Design	3
ENCV 803 504	Advanced Road Pavement Engineering	3
ENCV 803 505	Advanced Road Pavement Materials	3
ENCV 803 506	Road Preservation Strategy	3
ENCV 803507	Railway Transportation Planning	3
ENCV 803 508	Logistic Transportation	3
ENCV 803 509	Environmental-Asset and Safety	3
ENCV 803 510	Railway Infrastructure Construction and Rehabilitation	3
Infrastructure Management Courses		
ENCV 803 601	Legal and Institutional Framework	3
ENCV 803 602	Infrastructure Asset Management	3
Construction Management Courses		
ENCV 803 603	Project Stakeholder and Communication	3
Construction Safety Engineering Management Courses		

ENCV 803 604	Construction Safety Plan, Administration and Report	3
ENCV 803 605	Construction Safety Monitoring and Control	3
ENCV 803 606	Safety Audit and Accident Investigation	3
	Total credits Semester 1 Major - Structure	10
	Total credits Semester 1 Major - Geotechnic	10
	Total credits Semester 1 Major - Water Resource Management	10
	Total credits Semester 1 Major - Transportation	10
	Total credits Semester 2 Major - Project Management	10
	Total credits Semester 2 Major - Construction Management	7
	Total credits Semester 2 Major - Infrastructure Management	10
	Total credits Semester 2 Major - Construction Safety Engineering Management	13
	Total credits Semester 2 Major - Environmental Engineering	7
	4th Semester	
ENCV 800 105	Thesis	6
ENCV 800 106	Scientific Publications	2
	Total credits Semester 1 Major - Structure	6
	Total credits Semester 1 Major - Geotechnic	6
	Total credits Semester 1 Major - Water Resource Management	6
	Total credits Semester 1 Major - Transportation	6
	Total credits Semester 1 Major - PM / CM / IM / CSEM	6
	Total	**40**

Master By Research

Code	Subject	SKS
	1st Semester	
ENEE800102	Research Proposal Examination	4
ENEE800101	Scientific Seminar	8
	2nd Semester	
ENEE800203	Proceeding Publication	4
ENEE800204	Research Result Examination	6
	3rd Semester	
ENEE800305	Journal Publication	8
	4th Semester	
ENEE800406	Master Thesis	10

Course Syllabus of Graduate Program on Civil Engineering

Applied Math

ENCV 801 101
3 Credits

Expected Learning Outcomes : Prior knowledge for problem recognation & solving

Course Learning Outcomes (CLO):

1. Students should be able to implement procedures to find solutions of differential equations, equations which are common in civil science discipline, both analytically and numerically

Syllabus: Introduction: Role of mathematics in the civil engineering disciplines, review procedures to solve systems of equations and numerical procedure for calculating differential and integral; Differential equations classification; Analytical solutions of linear differential equations; Ordinary differential equation numerical solution: Predictor-corrector method, Runge-Kutta Method; Partial differential equation numerical solution: finite difference method, finite element method.

Prerequisites:

Textbook References:

1. Erwin Kreyszig (2011) Advanced Engineering Mathematics Tenth Edition, John Wiley & Sons, Inc.
2. Chapra, Steven C.; Canale, Raymond P. (2015) Numerical Methods for Engineers, Seventh Edition, McGraw-Hill
3. Michael D. Greenberg (1998) Advanced Engineering Mathematics Second Edition, Prentice Hall

Engineering System & Value

ENCV 801 102
3 Credits
Expected Learning Outcomes : Prior knowledge for problem recognation & solving

Course Learning Outcomes (CLO): : Able to evaluate system engineering including analysing, simulating and optimizing to produce a better designed and more valuable system engineering.

Syllabus: Course Overview; Introduction to Systems Definitions & Concepts; Introduction to Sustainability Development; Optimization and Reliability, Design & Operation, Decision Making; Issues on Human, Organizational and Technology; Value Engineering and Innovation; New Product Development; System Dynamic and Simulation (MCS)

Prerequisites:

Textbook References:

1. M.A. Berawi, (2014), Aplikasi Value Engineering pada industri konstruksi, UI Press, Jakarta.
2. M.A. Berawi (2015), Rekayasa Inovasi Mega Proyek Infrastruktur, UI Press Jakarta.
3. Value World, Journal of Society of American Value Engineers (SAVE International), USA.
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. Ulrich, Karl T. and Eppinger, Steven D (2004) *Product Design and Development*, 3rd Edition, McGraw-Hill, New York

Research Methodology

ENCV 802 103
3 Credits

Expected Learning Outcomes : Prior knowledge for research/experiment dan WA10 (communication)

Course Learning Outcomes (CLO):

1. Able to explain the thinking concept of research method and apply them in selecting the appropriate research methodology and in preparing the research proposal
2. Able to explore the uniqueness and originality of the proposed research (uniqueness of civil engineering problems)

Syllabus: Methodological principles, research characteristic and process, quantitative and qualitative research paradigm, scientific method, problem statement, construct hypotheses, critical and logic thinking, research strategy, data collection techniques and analysis techniques, scientific paper, seminar drafting guidance with potential mentors

Prerequisites:

Textbook References:

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 Thesis, 2006
4. Yin.Robert k, Studi Kasus Desain dan Metode, Rajagrafindo Persada, 2008
5. Riduwan, Skala pengukuran variable-variabel penelitian, Alfabeta, 2002
6. Tan, W. (2008). *Practical Research Methods* (Third Edition ed.). Singapore: Prentice Hall

Pre-Thesis
ENCV 800 104
4 Credits

Expected Learning Outcomes : Prior knowledge for Research/Experiment, WA10 (communication) and WA12 (lifelong learning)

Course Learning Outcomes (CLO): Students should be able to apply the knowledge from the specificity / specialization that has been gained in through developing the research proposal and preliminary studies, analyze the results and describe it orally (presentation) and written (pre-thesis book)

Syllabus: -

Prerequisites: Research Methodology

Text Books : -

Thesis
ENCV 800 105
6 Credits

Expected Learning Outcomes : Prior knowledge for WA2 (problem analysis), WA3 (design/development of solutions) , WA5 (modern tool usage), WA6 (the engineer and society), WA7 (environment and sustainability), WA9 (individual and team work) dan WA10 (communication) and WA12 (lifelong learning)

Course Learning Outcomes (CLO) :
1. Able to integrate the knowledge specificity of Civil Engineering in the design and implementation stage of the research to solve a problem, able to analyze and interpret research data to obtain valid conclusions
2. Able to explain the results of the research in the form of a scientific paper (thesis) and presentation

Syllabus: -

Prerequisites: Research Methodology and Pre-Thesis

Textbook References:

Scientific Publication
ENCV 800 106
2 Credits

Expected Learning Outcomes : Prior knowledge for WA10 (communication)

Course Learning Outcomes (CLO):
1. Students should be able to explain the results of his/her research in the scientific literature using a proper Indonesian / English language according to the intended standard of writing journals / proceedings.

Syllabus: -

Prerequisites: Thesis

Textbook References:

Course Syllabus of Structure Specialization

Prestressed Concrete Structure
ENCV 803 203
3 Credits

Expected Learning Outcomes : Technical Specialization, Communication

Course Learning Outcomes (CLO):

1. Students should be able to design pre-stressed concrete according to the standard regulations, in buildings and long span bridges using factored Strength (Load and Resistance Factored Design, LRFD), serviceability

Syllabus:

Prestressed material review and how to design for bending based on Serviceability Limit State Design (SLSD) method. Load and factored strength design in the aspect of bending, shear and torsion. Serviceability limit on the aspect of deflection. Statically indeterminate structure. Loss of prestressing force due to friction and wobbling, Elastic shortening of concrete, anchor slip, creep and shrinkage of concrete, along with the relaxation of prestressing steel. Analysis of the columns and beams prestressed meeting point; analysis of prestressed anchor zone. Application in buildings and long span bridges. external prestressing, and special applications in cable stayed bridge.

Prerequisites: -

Textbook References:
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.

Structural Dynamics

ENCV 801 202
3 Credits

Expected Learning Outcomes : Technical Specialization

Course Learning Outcomes (CLO): Students should be able to analyze civil engineering buildings subjected to dynamic forces.

Syllabus: Dynamic load types, structures and responses; structural modeling as a single-degree-of-freedom (SDOF) system; SDOF free vibration; SDOF Forced vibration: harmonic dynamic loads, periodic and erratic loads; Response analysis to SDOF using numerical integration method; generalization of SDOF; modelling of Multi-Degrees-of-Freedom (MDOF), static condensation applications; eigen problem; forced vibration on harmonic loading, spectra responses.

Prerequisites:

Textbook References:

1. Chopra A.K., Dynamics of Structures, Prentice Hall, 1995
2. Clough R.W. Penzien J., Dynamic of Structures, McGraw-Hill, 1993

Earthquake Resistance Building

ENCV 802 206
3 Credits

Expected Learning Outcomes : Technical Specialization

Course Learning Outcomes (CLO): Students should be able to analyze the effect of earthquakes on civil engineering buildings and able to design earthquake proof buildings

Syllabus: Introduction : aspects of earthquake, causes, fault, wave, damage mechanism, size of the earthquake; Characteristics of ground motion and response spectrum; Architectural Considerations on the earthquake resistant structural system; Building dynamic response; Equivalent Static Analysis: The principle of equivalent static seismic forces, Equivalent static procedure according to SNI standard; Advanced Equivalent Static Analysis: The principle of equivalent static seismic forces; Equivalent static procedure according to SNI standard; Lateral stability and drift design; Seismic design of floor diaphragms; The design concept of capacity and ductility in earthquake planning; Portal structural seismic design and detailing: beams, columns, beam-column joint; Advanced seismic Structure Design & detailing portal: beams, columns, beam-column joint; Advanced seismic Structure Design & detailing portal : beams, columns, beam-column joint; Shear wall structure seismic design and detailing; Advanced shear wall structure seismic design and detailing; Double structural seismic design and detailing: portal and sliding walls

Prerequisites:

Textbook References:

1. Farzad Naeim, the Seismic Design Handbook, 1989
2. Paulay and Priestly, Seismic Design of Reinforced Concrete and Masonry Buildings, 1992.
3. Chopra, Dynamic of Structures, 1995.
4. BSN, Tata Cara Perencanaan Ketahanan Gempa untuk Bangunan Gedung, SNI 03-1726-2002
5. BSN, Tata Cara Perencanaan Struktur Beton untuk Bangunan Gedung, SNI 03-2843-2002
6. BSN, Tata Cara Perencanaan Struktur Baja untuk Bangunan Gedung, SNI 03-1729-2002

Finite Element Method

ENCV 802 202
3 Credits

Expected Learning Outcomes : Technical Specialization

Course Learning Outcomes (CLO):
1. Able to apply finite element method (FEM) for

3-dimension elastic problem and 2-dimension solid elastic (plane stress and strain)
2. Able to use finite element method package, and create sub routine matrix of element strength.

Syllabus:

Introduction, FEM definition and concept, variation methods, Galerkin and Ritz solution, shape function, model displacement and mixed, one-dimensional element (ID) bars and beam of Euler Bernoulli, 2D isoperimetric element (plane stress, plain strain), 3D isoperimetric element, stiffness and time matrix, Gauss and Hammer numeric integration, application programming packages in 2D and 3D elastic problem, task of making subroutine elements (2D and 3D) and their incorporation in a PCFEAP (Personal Computer Finite element Analysis program) main program.

Prerequisite: Applied Mathematics

Textbook References:

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

Advanced Mechanics of Material

ENCV 801 201
3 Credits

Expected Learning Outcomes : Technical Specialization

Course Learning Outcomes (CLO):

Able to deeply analyze the structure response due to static load or temperature with considering material and structure properties in elastic and inelastic condition.

Syllabus: Mechanical properties of materials; Stress-strain theory; Temperature- stress strain relationship; Inelastic material properties; Application methods of energy; Torque; Asymmetric moment on straight beam; Central shear on beam with a cross section of thin walls; Curved beams; Beam over elastic foundation.

Prerequisite:

Textbook References:

1. Boresi A.P. et all, Advance 1. Mechanics of Material, John Wiley & Sons, Inc, 1993
2. R.C. Hibbeler, Mechanics of Materials, Prentice Hall, 2002

Advanced Steel Structure

ENCV 802 204
3 Credits

Expected Learning Outcomes : Technical Specialization

Course Learning Outcomes (CLO):

Able to design steel structure component that includes connection design, girder plate, portal and composite structure on simple high-rise building using elastic and plastic method.

Syllabus: The calculation of continuous means with plastic method. Beam-Columns. Theory and Analysis of girders plate on building. Advance connection techniques. Portal and gable frame design. Steel composite structure and steel-concrete composite structures in simple high-rise buildings. Pre-stressed steel-concrete composite structures and application of Preflex system in building. Cold form section / Light Gage Member.

Prerequisite:

Textbook References:

1. Salmon C.G. and 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. SNI-03-1729-2021, Badan Standarisasi Indonesia, Tata Cara Perencanan Struktur Baja untuk Bangunan Gedung, Standar, 2002

Concrete Technology & Adv. Reinforced Concrete

ENCV 803 202
3 Credits

Expected Learning Outcomes : Problem Recognition and Solving, Technical Specialization

Course Learning Outcomes (CLO):
1. Able to identify modern and future concrete technology, especially high-performance and/or high-grade concrete,
2. Able to design high quality concrete mix to achieve specific performance according to applicable legislation, to be applied in high-rise buildings and long span bridges.
3. Able to design reinforced concrete structural components include shear walls, beams coupling, boundary elements, beam-column panel connection.

Syllabus:
- Modern and future concrete, technology, engi-

neering and behavior according to SNI (DOE) and ACI; Abrams-FXS formulation; Feret and Bolomey formulations. Concrete rheology; FXS model for concrete rheology; Visco elastic behavior of concrete rheology and its application in creep and shrinkage of concrete; FXS models of non-Newtonian.

- Reinforced concrete design for bending, axial, shear and torsion and confined concrete structure.
- Various research and developments; comparison of conditions based on SNI, ACI and NZS
- Design: Ductile structure wall, beam coupling, boundary elements, connection panel of portal beams and columns; shear strength, adhesion and stiffness of connection panel; Mechanisms and behavior of elastic and inelastic. Diagonal press field theory; Modified compression field theory.
- Models strut and tie; and applications in the design of concrete structures.

Prerequisite:

Textbook References:

1. ACI: "ACI Manual of Concrete Practice", American Concrete Institute, 2015.
2. ACI Committee Report 363 R-92: "State of the Art Report on High Strength Concrete", 1992.
3. Ken W. Day: "Concrete Mix Design, Quality Control and Specification", E & FN Spon, 1995.
4. Krishna Raju: "Design of Concrete Mixes", CBS Publishers, 1985.
5. A.M. Paillere: "Application of Admixtures in Concrete", E & FN Spon, 1995.
6. 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.
7. J.B. Mander: "Seismic Design of Bridge Piers", A Thesis submitted in partial fulfillment of the requirements for the Degree of Doctor of Philosophy in Civil Engineering at the University of Canterbury, University of Canterbury, Christchurch, New Zealand, 1983.
8. ACI Committee 318: "Building Code Requirements for Structural Concrete, ACI 318-14", American Concrete Institute, Detroit, 2014.
9. "International Building Code", International Code Council, 2015
10. Persyaratan beton structural untuk bangunan gedung, SNI 2847 : 2013
11. Beban minimum untuk perancangan bangunan gedung dan struktur lain, SNI 1727 : 2013
12. 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.
13. M.P. Collins and D. Mitchell: "Prestressed Concrete Structures" Prentice Hall, Englewood Cliffs, New Jersey, 1991.
14. Mac Gregor, J.G., Reinforced Concrete: Mechanics and Design, 6th. Edition, Pearson, 2012

Offshore Structure

ENCV 803 204
3 Credits

Expected Learning Outcomes : Technical Specialization

Course Learning Outcomes (CLO):

Able to design offshore buildings structures.

Syllabus: Types of offshore buildings; Construction and Structures of offshore building; Fixed and floating design, Strength and force calculations of offshore building; Safety requirements; Semi-submersible construction; Single Buoy Mooring; FPSO; Maintenance and Repair of offshore building.

Prerequisite: -

Textbook References:

1. Subrata Chakrabarti, Handbook of Offshore Engineering, Elsevier Science, 2005
2. Yong Bai, Marine Structural Design, Elsevier Science, 2003
3. Cliff Gerwick, Construction of Marine and Off-shore Structures, CRC Press 1999

Bridge Design

ENCV 803 201
3 Credits

Expected Learning Outcomes : Technical Specialization

Course Learning Outcomes (CLO):

1. Able to analyze the development of bridge structure that includes determining the location and layout, know the structural system and types of steel and concrete bridge.
2. Able to design upper and lower bridge structure and plan the bridge construction method.

Syllabus: The development and history of bridge; Bridge location and layout; Load regulation on highways and railways; Bridge structural system: top and bottom structure and foundation and support, bridge type geometry; wooden bridge; steel bridge: rolled and plate girders, composite, orthotropic deck, bridge frame, arch, suspension, cable stay; concrete bridges: bridge plate, deck girder, box girder, pre-stressed segmental bridges, reinforced concrete

frame, frame, arch, cable stay and pre-stressed bridge; substructures, pier and abutment; analysis and design of bridges: bridge load, load distribution on stringers, longitudinal beams and floor beams, pre-stressing effects, structural analysis and design; load on the substructure, soil pressure, seismic design; Design placement.

Prerequisite:

Textbook References:

1. MS Troisky, Planning and Design of Bridges, John Wiley & Sons, Inc, New York, 1994
2. SNI No. 1725-1989-F, Departemen Pekerjaan Umum, Pedoman Perencanaan Pembebanan Jembatan Jalan Raya
3. Departemen Pekerjaan Umum, Peraturan Perencanaan Teknik Jembatan – Bridge Management Systems, 1992,
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

Highrise Structural Building

ENCV 802 203
3 Credits

Expected Learning Outcomes : Technical Specialization

Course Learning Outcomes (CLO):

1. Able to apply the procedures for design and technology of pre-stressed concrete according to the standard regulations that apply to buildings and long span bridge.
2. Able to apply procedures for the design-based methods of Load Design and PBKT factored strength, Load and Resistance Factored Design (LRFD), as well as the limits of serviceability on various aspects of strength, stability and deflections, as well as pre-stressed anchor zones.

Syllabus:

Definition, history, and basic concept of pre-stressed concrete; Typical use of pre-and posttensioning technology; Material properties of concrete and soft reinforcing steel and pre-stress. Pre-stresses losses; Analysis of bending due to the workload (section are not linear elastic fractured); Ultimate strength of pre-stressed concrete cross section; Design of pre-stressed concrete cross section; Design of flexible cross section; Camber and deflection; Pre-stressed continuous beam analysis; Shear strength in pre-stressed beams; Bond and anchorage of pre-stressing steel; Applications for pre-stressed concrete slab. Application of pre-stressed concrete on bridge. Criteria for design of high-rise buildings; Load: gravity, wind and earthquakes; System Structure: Retention of gravity and lateral bracing; Modeling and Analysis. Frame planning (concrete and steel) and sliding walls and double system.

Prerequisite:

Textbook References:

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

Plate and Shells

ENCV 802 201
3 Credits

Expected Learning Outcomes : Technical Specialization

Course Learning Outcomes (CLO):

1. Able to apply finite element method to analyze and designing of plate and shells structure.

Syllabus: Plates: Plates formulation; Plate element

with shear deformation; Kirchoff element; Test validation and performance of plate element; Shell: geometric description, the principle of virtual work and forms variation, isoperimetric elements, facet-plan element type; Design and analysis of shell structure; concept of plate and shell structures, type and shape of the structure shells, Some aspects of FEA for shell structure, Design and analysis: roof structure; cylindrical shell, gable HP, Folded Plate, Dome; Structure of tank with circular pre-stressing; silos and bunkers**.**

Prerequisite: -

Textbook References:

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

Special Topics in Structural Engineering

ENCV 802 205
3 Credits

Expected Learning Outcomes : Technical Specialization

Course Learning Outcomes (CLO):

1. Knowing the latest technology or topics on structure specificity as well as the development of structural knowledge in the future.

Syllabus: Selected topics in structure specificity.

Prerequisite:

Textbook References: Selected Journal/Book

Course Syllabus of Geotechnics Specialization

Advanced Soil Mechanics

ENCV 801 301
3 Credits

Expected Learning Outcomes : Problem Recognition and Solving

Course Learning Outcomes (CLO): Able to formulate the behavior of kinds of soil and soil condition.

Syllabus:

Critical state of soil mechanics; Effects of testing on soil shear strength; Effective stress and total stress approach; Loading and unloading; Short-term and long-term behavior; Further consolidation; The use of horizontal drainage. Unsaturated soil mechanics; Differences in behavior of saturated and unsaturated soil; Soil constitutive model.

Prerequisite:

Textbook References:

1. Soil Mechanics, 7th Ed., R.F. Craig, 2004.
2. Muni Budhu. Soil Mechanics 3rd Edition. 2011
3. Braja M. Das. Principal of Geotechnical Engineering 6th Edition. 2010
4. Potts & Zdravkovic, Finite Element in Geotechnical Engineering. 1999.

Advanced Geotechnical Investigation

ENCV 801 302
3 Credits

Expected Learning Outcomes : Problem Recognition and Solving, Experiment/Research

Course Learning Outcomes (CLO):

1. Able to formulate complex geotechnical investigation program

Syllabus:

General introduction of Advanced Experimental Laboratory that associated with Geotechnics; introduction, understanding and usage of test results using a Dilatometer, Pressuremeter, Plat Bearing, Swelling, Geotechnical instrumentation, Centrifuge, Triaxial UU/CU/CD, Long-Term Consolidation, Triaxial Cyclic. Further introduction and testing in the laboratory by means of triaxial CU and swelling; as well as field tests with Pressuremeter.

Prerequisite:

Textbook References:

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, 7th Ed., R.F. Craig, 2004.

Slope Stabilization and Soil Improvement

ENCV 802 301
3 Credits

Expected Learning Outcomes : Problem Recognition & Solving; Experiments/Research, Technical Specialization, Sustainability.

Course Learning Outcomes (CLO):

1. Able to create synthesis of complex slope stabilization solution and the necessary strengthening.

Syllabus: Slope stability analysis of finite and infinite with method of fellinius, bishops, and other methods; Analysis of avalanches by using software; Avalanche hazard analysis and slope improvement / strengthening: soil nailing; strengthening retaining

wall structure; Soil improvement: stabilization by mechanical means (dynamic compaction, vibro flotation / compaction) vertical drainage with sand post (sand pile and sand drained), stabilization with chemicals, injection method.

Prerequisite: Soil Mechanics

Textbook References:

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, 3rd Ed., John Wiley & Sons. Inc, 2011.
4. Soil Mechanics, 7th Ed., R.F. Craig, 2004.
5. Duncan & Wright, Soil Strength and Slope Stability. John Wiley and Sons. 2005.
6. Abramson, et al., Slope Stability and Stabilization Methods, 2nd Ed. John Wiley and Sons. 2002.

Environmental Geotechnics

ENCV 802 302
3 Credits

Expected Learning Outcomes : Problem Recognition & Solving, Sustainability; Technical Specialization

Course Learning Outcomes (CLO):

1. Able to make synthesis of geotechnical solution from complex environmental issue.

Syllabus:

Geotechnical aspects: landfill geotechnical structure, behavior and properties of garbage, geosynthetic applications for landfill, cover land, landfill geotechnical analysis and design, long-term behavior of landfills; Type of soil and groundwater pollution, contaminated soil sampling, transfer of contaminants in ground water, type of soil and groundwater containment, type of soil and groundwater remediation.

Prerequisite:

Textbook References:

1. Oweis, I.S., "Geotechnology of Waste Management, 2nd Ed." PWS Publishing Company, 1998.
2. Abramson, et al., Slope Stability and Stabilization Methods, 2nd Ed. John Wiley and Sons. 2002.

Numerical Method in Geotechnical Engineering

ENCV 802 203
3 Credits

Expected Learning Outcomes : Problem Recognition and Solving, Experiments and Research

Course Learning Outcomes (CLO):

1. Able to determine, executing, and analyzing the result of complex geotechnics issue.

Syllabus:

Introduction to numerical methods in geotechnical engineering; Geotechnical considerations; Constitutive law for geological media; Finite element in linear and non-linear material; Stress strain law in elastic-plastic and elasto-visco-plastic condition; Soil mechanics model with critical conditions (critical states); Completion of finite difference method and finite element in the beam foundation and elastic plate; Analysis of consolidation on soft ground and seepage; Some historical case. Geotechnical case analysis using numerical methods, and interpret the analysis result.

Prerequisite: -

Textbook References:

1. Bowles, J.E., Foundation Analysis and Design, McGraw-Hill Book Co., Singapore.
2. PottS, 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.

Adv. Foundation Engineering & Deep Excavation

ENCV 803 301
3 Credits

Expected Learning Outcomes : Problem Recognition and Solving, Experiment/Research, Technical Specialization.

Course Learning Outcomes (CLO):

1. Able to make synthesis of complex deep excavation solution

Syllabus:

Lateral deep foundations; Construction and analysis of diaphragm walls; Constitutive soil models and characteristics of compressible soil; Mat foundation application; The construction methods for large diameter bored pile; Interpretation result of loading test; Deep foundations lateral capacity; construction and analysis of diaphragm walls; Geotechnical work surveillance method.

Prerequisite:

Textbook References:

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, 1997.
4. Foundation Engineering Handbook; Winterkorn, H.F. & Fang, H.Y., van Nostrand Reinhold, Ltd. 1975.
5. Analytical and Computer Methods 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.
7. Smith & Paul. Soil Mechanics & Foundation

Diynamics & Earthquake in Geotechnic

ENCV 803 302
3 Credits

Expected Learning Outcomes : Problem Recognition and Solving, Sustainability, Technical Specialization.

Course Learning Outcomes (CLO):
1. Able to create synthesis solution of various problem of geotechnics against earthquake and able to formulate machine foundation solution.

Syllabus: Dynamic on soil; Basic vibration; Wave in elastic medium; Dynamic soil properties; Vibration foundation; Effect of earthquake on the ground; Seismic lateral earth pressure; Liquefaction; Engine foundation above pole; Vibration theory; Waves in an elastic medium; Dynamic properties of the soil; foundations and vibration. Introduction to the probabilistic analysis of earthquake hazard; Amplification analysis of ground earthquake; Liquefaction phenomenon; Slope stability analysis of earthquake; Analysis of lateral earth pressure due to earthquake. The introduction of soil improvement methods in order to lower the vibration and earthquake effects on the ground.

Prerequisite:

Textbook References:
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, Prentice Hall, 1995

Special Topics in Geotechnics

ENCV 803 303
3 Credits

Expected Learning Outcomes : Problem Recognition & Solving, Experiments/Research, Technical Specialization**.**

Course Learning Outcomes (CLO):
1. Able to formulate solutions for complex soil-structure interaction.
2. Able to formulate the behavior of different kinds of rocks and rock mass conditions.
3. Able to formulate solutions for slope stability of rock mass.

Syllabus:

General introduction: Soil Structure Interaction; Buried structure and sheet pile wall and shallow foundation; SSI modelling in Plaxis 3D program; 3D plaxis application on the sheet pile wall and pile group; The use of geotextile in high vacuum to accelerate the consolidation process; The use of other additives to enhance the strength of the soil; The use of high pressure to perform injection for structure test strength associated with the sub structure.

Prerequisite:

Textbook References:
1. Journal ASCE, yang berkaitan dengan Soil Strucuture Interaction
2. Canadian Geotechnical Journal yang berkaitan dengan Soil Structure Interaction
3. Journal ASCE yang berkaitan dengan Stabilisasi Tanah
4. Canadian Geotechnical Journal yang berkaitan dengan stabilisasi tanah
5. Non-destructive test

Course Syllabus of Transportation Specialization

Traffic Control Engineering

ENCV 801 501
3 Credits

Expected Learning Outcomes : Technical Specialization

Course Learning Outcomes (CLO):
1. 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; Characteristics of Humans; Vehicles and traffic infrastructure in traffic analysis; Junction control; Traffic flow surveys; Volume of traffic characteristic. Characteristics of traffic flow speed. Analysis of traffic flow density. Queues analysis and bottle neck theory. Models of traffic flow; Analysis of shock wave traffic management.

Prerequisite:

Textbook References:
1. Mannering, F. and Kilareski, W., 1998. *Principle of Highway Engineering and Traffic Analysis*,

Willey & Sons.
2. May, A.D., 1990. *Traffic Flow Fundamental*, United State of America: Prentice-Hall, Inc.
3. McShane, W., Roess, R. and Prassas, E., 1998. *Traffic Engineering*, Prentice-Hall, Inc.
4. Taylor, M.A.P. and Young, W., 1988. *Traffic Analysis: New Technology and New Solutions*, Hodder Arnold.
5. MKJI, 1997. *Manual Kapasitas Jalan Indonesia*, Kementrian Pekerjaan Umum.
6. Wohl, M. and Martin, B., 1967. *Traffic System Analysis for Engineers and Planners*, McGraw-Hill.

Transportation System

ENCV 801 502
3 Credits

Expected Learning Outcomes : Problem Recognition and Solving

Course Learning Outcomes (CLO):
1. Able to analyze the components of transport system from various dimensions, as well as the latest issues related to the Indonesian and global transport system.
2. Able to design a transportation system that includes an operating system, which meets the demand and supply aspects of sustainability.

Syllabus: Transportation system overview. Characterization and categorization of transportation system for single and dual mode. (Influence) Factors in the transportation system (planning, design, investment, operation, maintenance). System Demand. Supply systems. Issues of equality, accessibility, environmental, economic and disability.

Prerequisite: Transportation Engineering

Textbook References:
1. Grava, S., 2003. *Urban Transportation System*, McGraw-Hill.
2. Manheim, M., 1979. *Fundamentals of Transportation Systems Analysis. Vol 1: Basic Concept* 1st ed., The MIT Press.
3. Blunden, W. and Black, J., 1984. *The Land-Use / Transport System* 2nd ed., Pergamon-Press

Transportation Economics

ENCV 802 501
3 Credits

Expected Learning Outcomes : Problem Recognition and Solving, Sustainability

Course Learning Outcomes (CLO):
1. Able to use economy, social impact, in the process of problem solving of complex transportation.
2. Able to analyze the demand and supply of transport systems based on economic theory and behavior of the traveler.
3. Able to analyze the economic investment of transportation short-term and long-term project including measurement of the cost of externalities and financing aspects.

Syllabus:

Introduction to transport economics; Concept of demand and supply of transport systems. Spatial problems: movement, transport and location. Transport demand, costs and direct benefits of transport and recovery costs. External costs of transport: congestion, pollution, accidents and social impact. Transportation investment: the basics of pricing, subsidy, competence between transportation systems, understanding investment decisions (BCR, IRR and NPV).

Prerequisite:

Textbook References:
1. Kenneth Button, 2010., Transport Economics 3rd edition, Edward Elgar Publisher.
2. Stuart Cole, 2005, Applied 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
4. McCarthy, P. 2007, Transportation Economics Theory and Practice: A Case Study Approach, 2nd edition, Blackwell Publishing

Transportation Planning and Policy

ENCV 802 502
3 Credits

Expected Learning Outcomes : Experiment/ Research, Technical

Course Learning Outcomes (CLO):
1. Able to bring the uniqueness and originality from suggestion of transportation policy arrangement.
2. Able to recommend and propose transportation policies taking into account the dimensions of equality, environment and economy

Syllabus: Transport Policy Formulation; framework for assessing transport policy - land use, accessibility, air pollution, noise, accidents, and sustainability. Planning and transport policies and interaction with layout. Institutional arrangements for transportation planning and management. Risks, uncertainties and complexities in setting transportation policy. Transport policy at the local, regional, metropolitan and national; logistics transport policy.

Prerequisite:

Textbook References:

1. Shciller, P., Bruunm, E. and Kenworthy, J., 2010. *An Introduction to Sustainable Transportation: Policy, Planning* 1st ed., Routledge.
2. Morichi, S. and Acharya, S.R., 2013. *Transport Development in Asian Megacities: A New Perspective*, Springer.
3. Rodrigue, J.-P., Comtois, C. and Slack, B., 2009. *The Geography of Transport Systems* 3rd ed., Routledge.
4. Stopher, P. and Stanley, J., 2014. *Introduction to Transport Policy: A Public Policy View*, Edward Elgar Pub.

Transportation Safety

ENCV 802 503
3 Credits

Expected Learning Outcomes : Problem Recognition and Solving, Sustainability

Course Learning Outcomes (CLO):

1. Students able to design prevention program and transportation safety measures, road transportation (C5) and perform simple road transport audit.

Syllabus:

Introduction: The problem of road safety in Indonesia, road safety policy, and the introduction of road safety engineering. Data accidents: Development of road traffic accident data. The factors that cause accidents: factors of road users, vehicles factor and road and environment factor. Analytical approaches: starting point, macroscopic study, multivariate study and evaluation of the effectiveness of efforts to improve road safety. Handling of road engineering: the roadside hazard management, the protection system, safety at road works and the introduction of a road safety audit. Transport safety: the safety of railways, air transport safety and the safety of shipping.

Prerequisite: Has already taken Road Geometric Design or following matriculation subjects of Road Geometric Design in Strata 1.

Textbook References:

1. Fricker, J. and Whitford, R., 2004. Fundamentalsof Transportation Engineering: A Multimodal System Approach
2. Evans, L., 2004. *Traffic Safety*, Science Serving Society
3. Tjahjono, T., 2011. *Analisa Keselamatan Lalu Lintas Jalan*, Lubuk Agung.
4. Serial Rekayasa Keselamatan Jalan. Panduan Teknis 1. Rekayasa Keselamatan Jalan; Panduan Teknis 2. Manajemen Hazard Sisis Jalan; Panduan Teknis 3. Keselamatan di Lokasi Pekerjaan Jalan. Direktorat Jenderal Bina Marga, Kementerian Pekerjaan Umum Republik Indonesia. Tahun 2012

Transportation Modelling

ENCV 803 501
3 Credits

Expected Learning Outcomes : Problem Recognition and Solving

Course Learning Outcomes (CLO):

1. Able to make a model based on transportation infrastructure network.

Syllabus:

Human characteristics; Vehicle and infrastructure in transportation analysis; Junction control; Traffic flow survey; Characteristics of: volume of traffic flow, traffic flow speed and density; Analysis of queue and bottlenecks theory; Traffic flow models; Shock wave analysis; Traffic Management.

Prerequisite: -

Textbook References: -

Public Transport Management and Planning

ENCV 803 502
3 Credits

Expected Learning Outcomes : Technical Specialization

Course Learning Outcomes (CLO):

1. Students are able to plan and design public transport system operation.

Syllabus:

Overview of public transport systems. Regulatory Framework, Public Transport Category and Mode of Technology, Components of public transportation system. Modern and efficient public transport system. Institutional Aspects. Planning of public transport networks. Route and Corridor Selection of public transportation. Operational Design. Financial planning and pricing. Contract system mechanism

Prerequisite: Transportation Engineering, Transportation System

Textbook References:

1. Giannopoulos, G., 1990. *Bus Planning and Operation in Urban Areas: A Practical Guide*, Gower Pub Co.
2. Vuchic, V., 2005. *Urban Urban Transit; Operation, Planning and Economics.*, Willey & Sons.
3. Bunting, M., 2004. *Makling Public Transport Work*, McGill-Queen's University Press.
4. ITDP, 2007. *Bus Rapid Transit Planning Guide*, Institute for Transportation & Development

Policy

Advanced Road Geometry Design

ENCV 803 503[
3 Credits

Expected Learning Outcomes : Technical Specialization

Course Learning Outcomes (CLO):

1. Able to design road geometry, road supporting facility, junction, geometric and parking facility with considering certain aspects regarding road safety.

Syllabus: Introduction: basic of road geometric design associated with cross-section of the road, visibility, horizontal alignment, vertical alignment and alignment harmonization. Special aspects of road design: climbing lane, safety ramp (escape ramp), crossing lane on railways. Crossroads: Design consideration, Priority crossing, roundabout, Intersection with traffic signal control devices and non-level intersection. Signs, markings and delineation: design considerations, sign design, markings and delineation. Safety fence: design considerations, types of safety fence, rigid safety fence design, semi-rigid and flexible. Termination railing and fencing transition, crash cushion / attenuator. Parking and terminal: design considerations, Parking design, public transport passenger terminal and cargo terminal.

Prerequisite: Has already taken Road Geometric Design or following matriculation subjects of Road Geometric Design in Strata 1.

Textbook References:

1. AASHTO, 2004. *A Policy on Geometric Design of Highways and Streets*, Amerincan Association of State and Highway Transportation Officials.
2. Lamm, R., 1999. *Highway Design and Traffic Engineering Handbook*, McGraw-Hill.
3. Tjahjono, T., 2011. *Analisa Keselamatan Lalu Lintas Jalan*, Lubuk Agung.
4. DMRB, 2006b. *Geometric Design of Major/Minor Priority Junction*, Department for Transport, UK: Design Manual for Roads and Bridges, Vol 6, Sec 1.
5. DMRB, 2006c. *Geometric Design of Roundabout*, Department for Transport, UK: Design Manual for Roads and Bridges, Vol 6, Sec 1.
6. DMRB, 2006d. *Geometric Layout of Signal Controlled Junctions and Signalised Roundabouts*, Department for Transport, UK: Design Manual for Roads and Bridges, Vol 6, Sec 1.
7. DMRB, 2006e. *Layout of Grade Seperation Junction*, Department for Transport, UK: Design Manual for Roads and Bridges, Vol 6, Sec 2.
8. AusRoads, 2003. *Rural Road Design: A Guide to the Geometric Design of Rural Roads*, Australian Roads.
9. AusRoads, 2007. *Urban Road Design: A Guide to the Geometric Design of Major Urban Roads.*, Australian Roads.
10. NCHRP, 1992. *NCHRP Report 350: Recommended Procedure for the Safety Performance Evaluation of Highway Features*, National Cooperative Highway Research Program.
11. DIER Tasmania, 2005. *Road Safety Barrier Design: Guide Part A and B*, Transport Tasmania.

Advanced Pavement Engineering

ENCV 802 504
3 Credits

Expected Learning Outcomes : Technical Specialization

Course Learning Outcomes (CLO):

1. Able to investigate and conduct flexible road pavement and rigid pavement experiments
2. Able to calculate the thickness of the pavement based on the principle of Mechanistic-Empirical Pavement Design by considering the nature and rheology of the material due to traffic loading and natural conditions in order to have a Long-Term Pavement Performance (LTPP)

Syllabus:

1. Review of various types of road pavement in terms of approach and basic planning analysis, various forming materials related to the nature and basic characteristics, the main factor of planning Strain stress analysis for bending pavement;
2. Stress and strain analysis for rigid pavement; Material characterization is based on modulus, physical characteristics and deformation;
3. Loading and types and characteristics of loading;
4. Use software to calculate pavement thickness. Flexible pavement design based on Empirical and Mechanistic principles;
5. Rigid pavement design

Prerequisite: Material Properties, Pavement Design

Textbook References:

1. Direktorat Jenderal Bina Marga, 2013. *Manual Desain Perkerasan Jalan. No 02/BM/2013*, Kementrian Pekerjaan Umum.
2. Huang, Y., 2004. *Pavement Analysis and Design* 2nd ed., Prentice-Hall, Inc.
3. Dawson, A., 2004. *Pavement Unbound*, Taylor and Francis.

4. Papagiannakis, A. and Masad, E., 2008. *Pavement Design and Materials*, Willey & Sons.
5. Correia, A. ed., 1993. Flexible Pavements. *Proceedings of the European Symposium Euroflex*

Advanced Pavement Materials

ENCV 803 505
3 Credits

Expected Learning Outcomes : Technical Specialization

Course Learning Outcomes (CLO):

1. Being able to analyze the nature and characteristics of the material due to stress and strain as well as the technology of road pavement materials

Syllabus:

1. Asphalt concrete modeling: pavement response model and performance model.
2. Asphalt rheology: mixed asphalt rheology model, rheology of asphalt binding material characterization of damage resistance; Stiffness characterization: modulus characterization of asphalt and asphalt concrete materials;
3. Concrete asphalt damage models: deflection model, fatigue model;
4. Characteristics of asphalt concrete mixes :;
5. Stiffness characteristics, Deflection / wave characteristics;
6. Characteristics of fatigue and water content, load and temperature effects. The rheological model of asphalt binder and the use of modified binder;
7. Use of additives for improving the quality of asphalt and asphalt concrete: polymers, recycled materials. Waste and by product materials. Complex and resilient modulus of indirect tensile test, a developmental model in making concrete asphalt models

Prerequisite: Material properties, Pavement Structure Design

Textbook References:

1. Correia, A. ed., 1993. Flexible Pavements. Proceedings of the European Symposium Euroflex.
2. Huang, Y., 2004. Pavement Analysis and Design 2nd ed., Prentice-Hall, Inc.
3. oung, J., Mindness, S., Bentur, A. and Gray, R., 1997. The Science and Technology of Civil Engineering Materials, Prentice-Hall, Inc.
4. Kim, Y., 2008. Modeling of Asphalt Concrete 1st ed., McGraw-Hill

Road Pavement Maintenance

ENCV 803 506
3 Credits

Expected Learning Outcomes : Technical Specialization

Course Learning Outcomes (CLO):

1. Students able to design road maintenance programs based on road and bridge preservation models on a network or regional scale through knowledge of inspection, evaluation, and pavement management.

Syllabus:

1. Problems in road maintenance
2. The description and definition of road maintenance uses a field manual to identify all types of pavement problems and their causes to get an accurate pavement evaluation.
3. Analysis and evaluation for project and network level pavement management and procedures for implementation
4. The method for calculating road conditions, pavement condition prediction
5. Road maintenance methods and criteria with project and network approaches and service cost analysis
6. Preventive maintenance programs or road preservation; asset management: frameworks, tools, programs, systems of sustainability,
7. Pavement maintenance and road maintenance management programs.
8. New technology in maintenance and materials for road maintenance.

Prerequisite: Pavement Structure Planning

Textbook References:

1. Shahin, M Yo, (2004), Pavement Management for Airports, Roads, and Parking Lots, Springer, 2007 isbn 0387234659, 9780387234656 Springer, 2007
2. David G. Peshkin, Todd E. Hoerner, Kathryn A. Zimmerman ,(2004), Optimal Timing of Pavement Preventive Maintenance Treatment Applications, Report 523, Transportation Research Board.

3. Garber, NJ., Hoel, LA., (2009), Traffic and Highway Engineering, Cengange Laerning, Canada.

4. Fwa, TF., (2004), The Handbook of Highway Engineering, CRC Press Taylor and Francis Group,

Railways Transportation Planning

ENCV 803 507
3 Credits

Expected Learning Outcomes : Technical Specialization

Course Learning Outcomes (CLO):

1. Able to plan and design the construction of buildings above and below railways and at the base of the bridge.
2. Able to plan railways geometric
3. Know the strategy in constructing railways and its equipment with support from transportation and construction knowledge.

Syllabus: Introduction to the history of technological development of railways and train transportation system. Planning criteria; Speed and double load, classification and space limits the room for railways, railways structure (superstructure and substructure), Terms and conditions for level crossings. Geometric design of railways; width and gauge widening, connections, wedel, curved requirements and rail elevation. Equipment, retrofitting, ventilating equipment and other works in tunnel construction. Function of signs, signals, telecommunications, CTC, operational (one lane or two lanes, station design, goods emplacement and containers, classification, signals and traffic control systems, emplacement and station supporting facilities.

Prerequisite:

Textbook References:

1. Bonnett, C., 2005. *Practical Railway Engineering* 2nd ed., Imperial College Press
2. Subarkah, I., 1981. *Jalan Kereta Api*, Idea Dharma.
3. PJKA, 1985. *Perencanaan Konstruksi Jalan Rel: Peraturan Dinas No. 10*, Perusahaan Jawatan Kereta Api

Logistics Transportation

ENCV 803 508
3 Credits

Expected Learning Outcomes : Technical Specialization

Course Learning Outcomes (CLO):

1. Able to assess the system of allocation and selection of logistics facility locations using knowledge of the planning framework of the transportation system of goods; and
2. Able to identify the city's logistics system and its regulatory strategy.

Syllabus: Introduction to logistics and distribution (logistics system components, logistics evolution, the role of logistics, national logistics systems); framework of logistics and distribution planning (modes of transportation, commodities, planning horizon, planning framework, integrated systems, maritime logistics, and intermodal transportation; distribution channels (physical vs trading distribution channels, channel types and structures, channel selection, physical networks, operational networks , strategic networks, logistics costs, theories about planning transportation demand for goods with a four step model, location model theories, theories about city logistics, last mile delivery.

Prerequisite:

Textbook References:

1. Rodrigue, J.P. (Copy right 1998-2013). The Geography of Transport Systems. http://people.hofstra.edu/geotrans
2. Daskin, M.S. (1995). Network and discrete location. Models, algorithms, and applications. John Wiley & Sons,Inc
3. Rushton, A., Croucher,P. and Baker, P. (2006). The Handbook of logistics and distribution management. United Kingdom: Kogan Page Limited
4. Goulias, K.G. (2003). Transportation Systems Planning. Methods and Applications. CRC Press
5. K.W. Ogden. (1992). Urban Goods Movement. A Guide to Policy and Planning. Ashgate Publishing Limited
6. Taniguchi , E. and Thompson, R. G. (2008). Innovations in City Logistics. Nova Science Publishers, Inc
7. Taniguchi, E., Thompson, R.G., Yamada,T. dan Duin, V.R. (2001). City logistics. Network modelling and intelligent transport systems. Oxford,UK : Pergamon

Assets - Environment and Safety

ENCV 803 509
3 Credits

Expected Learning Outcomes : WA1 (engineering knowledge), WA2 (problem analysis), dan WA4 (investigation)

Course Learning Outcomes (CLO):

Students able to identify railway assets through understanding subsystems: the required infrastructure and facilities are linked to the operation of urban, inter-urban and freight / logistics railroads. Capable of analyzing the application of safety management systems including occupational health and the environment

Syllabus:

1. History of Railways
2. Introduction
3. Safety
4. Asset Management

Next is elaborated in the following lectures:

1. Infrastructure
2. Natural characteristic of Railway
3. Basic Operations of Railway (Train Planning and Scheduling, Signaling)
4. Business Process
5. Infrastructure and Facilities

Prerequisite:

Textbook References:

Construction & Rehabilitation of Railway Infrastructure

ENCV 803 510
3 Credits

Expected Learning Outcomes : Technical Specialization

Course Learning Outcomes (CLO):

1. Know the construction method for railways repair, able to monitor and assess the necessary repair and maintenance of railways.

Syllabus:

Railways infrastructure construction: Geo technology for subgrade, embankment, train lane, and mechanization for track construction; Maintenance and repair of railways; General aspects in the maintenance of railways infrastructure, rail grinding and re-profiling, tamping machines, stone blowing, ballast profiling and stabilization, mechanized track maintenance train, ballast cleaner, formation rehabilitation technologies; Inspection methods, methods of monitoring and detection methods; Monitoring substructure, vehicle for recording railways conditions, railways condition recording system.

Prerequisite

Textbook References:

1. EAPA, 2014. *Asphalt in Railway Tracks*, European Ashpalt Pavement Association.
2. Gomes Correia, A., Momoya, Y. and Tatsuoka, F., 2007. *Design and Construction of Pavements and Rail Tracks – Geotechnical Aspects and Processed Materials*, Taylor and Francis (CRC Press).
3. Coenraad, E., 2001. *Modern Railway Track* 2nd ed., MRT-Production.
4. Waters, J. and Selig, E., 1995. *Track Geotechnology and Substructure Management*, Thomas Telford Publishing

Course Syllabus of Water Resources Management Specialization

Engineering Hydrology

ENCV 801 402
3 Credits

Expected Learning Outcomes : Technical Specialization, Communication, Lifelong Learning

Course Learning Outcomes (CLO):

1. Assess the effectiveness of flood mitigation infrastructure in controlling water destructive force, based on the analysis of the results of reconstruction of hydrological design using deterministic and stochastic hydrological model (C5).
2. Self-organizing in independent and groups work, so as to demonstrate the mastery of course competencies in the form of a systematic written document and oral presentations that are effective and efficient (A4).

Syllabus:

Hydrological model system and classification; Hydrological phenomena in volume control, Work equation for various hydrological processes on volume control in the atmosphere; Work equation for various hydrological processes in the subsurface; Work equation for various hydrological processes on the surface; Basic and applied principles of hydrograph; Flood tracking through the dam; Flood tracking through channels; Hydrological statistics; Frequency analysis; Hydrology design; Hydrologic design reconstruction of water damage control infrastructure; Hydrology design effectiveness of water damage control infrastructure.

Prerequisite: Fluid Mechanics

Textbook References:

1. Bedient, Philip B. and Huber, Wayne C., 2002. Hydrology and Floodplain Analysis. Third Edition. Prentice-Hall, Inc. USA.
2. Chow, Ven Te, Maidment, David R. and Mays,

Larry W., 1988. Applied Hydrology. McGraw-Hill Book Company, Singapore.

Groundwater Hydraulics

ENCV 801 401
3 Credits

Expected Learning Outcomes : Experiment/ Research, Technical Specialization, Communication, Lifelong learning.

Course Learning Outcomes (CLO):

1. Able to weighing the alternatives of land use establishment based on the formulation of the recharge / discharge characteristic and spatial distribution pattern of groundwater in an area.
2. Able to prepare a paper on the alternative of land use establishment in a region with the characteristics of the groundwater flow in the known area, and present it orally.

Syllabus: Concept of groundwater conservation; Role of groundwater flows quantification for civil engineering for conservation; Hydraulic head; Hydraulic conductivity; Calculation of flux (q) using Darcy's law; The law of mass conservation in a controlled volume space; Land property; General equation of groundwater flow, Radial flow formulation; Effect of pump network pumping on limited aquifer; Calculation of K and S value based on data from pumping tests; Formulations of the basic flow net theory equation; Flow net classical method application; Flowline concept application on the field; Regional groundwater; Numerical solution for differential equations; MODFLOW package usage; Project task

Prerequisite:

Textbook References:

1. Groundwater 3rd Edition, R. Allan Freeze and John A. Cherry, Prentice Hall, 1990
2. Applied Hydrogeology 2nd Edition, C.W. Fretter, Merril Publishing Co, 1988
3. Hidrolika Aliran pada Media Berpori, Hand out, Herr Soeryantono, 2014
4. Manual SEEP2D, ASRI
5. Manual Modflow, ASRI
6. Dynamics of Porous Media Edisi 1, Jacob Bear, Dover, 1988
7. Chapra, Steven C.; Canale, Raymond P. (2015) Numerical Methods for Engineers, Seventh Edition, McGraw-Hill

Environmental Fluid Mechanics

ENCV 802 404
3 Credits

Expected Learning Outcomes : Technical Specialization, Sustainability, Communication, Lifelong learning.

Course Learning Outcomes (CLO):

1. Able to formulate equations of advection dispersion that accommodate chemical decay and precipitation in physics (sink / source),
2. Able to write a paper about the model of dispersion of pollutants in water surface and underground, and present it orally.

Syllabus:

Chemical and physical properties of contaminants and water; Conservative form of mass conservation equations; General solutions; Particular solution; Advection dispersion equation that change in space and time for perfectly mixed systems; Analytic solution system advection dispersion equations changing space and time for the system perfectly mixed systems; Numerical finite difference method; Numerical solution of advection dispersion equations that change in space and time for perfectly mixed systems; Advection dispersion equation system varies with time and space for the imperfect mixed system; Advection dispersion analytic equation solution that change in space and time for an imperfect mixed system; Numerical solution of advection dispersion equations that change in space and time for an imperfect mixed system.

Prerequisite:

Textbook References:

1. Chapra, Steven C. (1997) Surface Water-Quality Modeling, International Edition, McGraw-Hill
2. Fischer, Hugo B.; List, E. John; Koh, Robert C. Y.; Imberger, Jorge; Brooks, Norman H. (1979) Mixing in Inland and Coastal Waters, Academic Press, Inc.
3. Chapra, Steven C.; Canale, Raymond P. (2015) Numerical Methods for Engineers, Seventh Edition, McGraw-Hill

Water Resource Management

ENCV 802 401
3 Credits

Expected Learning Outcomes : Problem Recognition and Solving, Sustainability, Communication, Lifelong Learning.

Course Learning Outcomes (CLO):

1. Able to work independently and in teams to assess (evaluate the process or complex design results) various aspects of Water Resources Management (MSDA) in solving the problem of water resources and is able to present the results of the assessment in the form of a written systematic document and able to present it verbally.

Syllabus:

Students are given the provision to understand: 1. The principles aspect and policy of water resources management (in Indonesia) and its development; 2. Aspects and models of Integrated Water Resources Management/IWRM for both national and international scale; 3. Management aspect based on regulation and government policy related to three (3) pillars of water resource management which is utilization, water destructive force controlling, and conservation; 4. Supporting aspects of water resources management which includes hydro economy; 5. Case management of water resources (or project) inside a Water Resource Management Area or basin.

Prerequisite: -

Textbook References:

1. Peraturan Menteri Pekerjaan Umum. Nomor: 11A/PRT/M/2006 tentang Kriteria dan Penetapan Wilayah Sungai.
2. IWRM Resources. http://www.gwp.org/en/The-Challenge/IWRM-Resources/
3. GWP IWRM Toolbox: Useful Tool for Academia. http://www.gwp.org/gwp-inaction/news-and-Activities/GWP-IWRM-ToolBox-A-useful-tool-for-academia-/
4. Mays, Larry W., 1996. Water Resources Handbook. McGraw-Hill.
5. Loucks, Eric D., 1998. Water Resources and the Urban Environment. ASCE.
6. Beberapa Peraturan dan Kebijakan Nasional, Provinsi, dan Daerah terkait Pengelolaan Sumber Daya Air.

Hydraulics Structures

ENCV 802 402
3 Credits

Expected Learning Outcomes : Problem Recognition and Solving, Communication, Lifelong Learning.

Course Learning Outcomes (CLO):

1. Students are able to calculate the dimensions needed, evaluating the strength and stability of important waterworks that are in suppletion system through open channel, drainage and small reservoir and calculating the physical model dimension for various scale.

Syllabus: 1. Scope and definitions; 2. Suppletion system work principle through open channels: - weirs design, sluice gate, measuring building, dividing building; 3. The principle of drainage channels system; - Micro drainage channel network design; -Highway drainage design; 4. The design of complementary waterworks: Crossworks, diversions, drop structures), embankments, strengthening of the cliff and bridge wing (wing wall); 5. Type and working system of reservoirs: dimension requirements design, ogee and siphon spillway, pump; 6. Scale model and similitude.

Prerequisite: Fluid Mechanics, Hydraulics, Water Engineering 1, Water Engineering 2

Textbook References:

1. Ven T. Chow (1959) Open Channel Hydraulics (reprinted 2009)
2. Bureau of Reclamation (1987) Design of Small Dams, United States Department of The Interior

Ecohydrology

ENCV 803 401
3 Credits

Expected Learning Outcomes : Problem Recognition and Solving, Sustainability, Communication, Lifelong Learning.

Course Learning Outcomes (CLO):

1. Able to assess the harmony between existing condition with green infrastructure concept, eco urban village, and environmental construction (Low Impact Development – LID).
2. Able to give recommendation based on 3 green infrastructure integration, eco urban village, and environmental construction (Low Impact Development – LID).

Syllabus: Green Infrastructure, Eco Urban Village, Low Impact Development

Prerequisite:

Textbook References:

Water Damage Management

ENCV 803 403
3 Credits

Expected Learning Outcomes : Experimentation, Sustainability Introduction & Troubleshooting; Continuity; Communication

Course Learning Outcomes (CLO):

Students who are able to work independently also in groups to conduct an assessment of various aspects related to damaged water (water related disasters) and are able to provide the results of the assessment in the form of written documents that are installed and able to communicate them verbally. (C5)

Syllabus:

1. Able to improve the life cycle
2. Able to repair types of disasters due to air damaging power
3. Able to analyze disaster risk

4. Able to determine the level of damage due to air damaging force
5. Able to determine mitigation methods to reduce the risk of catastrophic air disasters
6. Students who are able to determine efforts to control the destructive force of the air
7. Students who are able to manage damaged air

Prerequisite:

Textbook References:

Watershed Vulnerability Assessment
ENCV 803 402
3 Credits

Expected Learning Outcomes : Problem Recognition and Solving, Sustainability, Communication, Lifelong Learning.

Course Learning Outcomes (CLO):
1. Able to apply health rapid assessment device of a watershed based on Center Method for Watershed Protection.
2. Able to categorize the health status of the watershed based on waterproof land cover, water quality, and macrobentos diversity, and
3. Able to provide recommendations for further action to improve the health of the watershed.

Syllabus: 1. Land use planning, 2. Soil Conservation, 3. Border Bodies of Water, 4. Ideal Design Tread, 5. Erosion & Sedimentation Control, 6. Rain Management, 7. Liquid Waste Management, 8. Stakeholders Concern

Prerequisite:

Textbook References:

Operation & Maintenance of Hydraulics Structures ENCV 802 403
3 Credits

Expected Learning Outcomes : Problem Recognition and Solving, Sustainability, Communication, Lifelong learning.

Course Learning Outcomes (CLO):
1. Able to perform waterworks technical audit that produce physical condition of waterworks.
2. Able to give follow up recommendation to expedite the operational of waterworks and preserve its sustainability.

Syllabus:

Students are given the provision of: 1. Suppletion system audit that covers: dam, sluice gate, measuring building, dividing building; 2. Drainage channel system audit that covers: micro drainage channel network; - road drainage; 3. Complimentary building that related to river audit: levee, retrofitting bridge cliff and wing, cross-structure, dodging-structure, threshold, crib; 4. Polder work system audit that includes reservoir, spillway and pump.

Prerequisite:

Textbook References:
1. Je Van Zyl (2014) Introduction to Operation and Maintenance of Water Distribution Systems EDITION 1, Water Research Commission
2. Suyono Sosrodarsono, Masateru Tominaga, 1994, Perbaikan dan Pengaturan Sungai, Pradnya Paramita, Jakarta
3. Desain of small (1987), United States Department of the Interior
4. Buku pedoman manual OP bendungan besar

Course Syllabus of Construction/ Project/Infrastructure / Construction Safety Engineering Specialization

Project Investment and Finance
ENCV 801 601
3 Credits

Expected Learning Outcomes : Problem Recognition and Solving

Course Learning Outcomes (CLO):

1. Able to implement the principle of project funding in analyzing the risks associated with the projects financing and evaluate project funding.
2. Able to analyze cases of investment and projects financing in real world.

Syllabus:

Basics of engineering economics; Basics of engineering economic analysis; Decision-making in engineering economics; Inflation, depreciation, tax and sensitivity analysis; introduction of project funding; Structure of project funding; Sources of project funding; Risks in project financing; Project funding modelling; Introduction of sharia-based project funding.

Prerequisite:

Textbook References:
1. Leland Blank-Anthony Tarquin. Engineering Economy, 7th edition. McGraw Hill. 2012
2. Finnerty, J. D. (2007). Project Financing: Asset-Based Financial Engineering. John Wiley & Sons, Inc., ISBN-13: 978-0-470-08624-7
3. Gatti, S. (2008). Project Finance in Theory and

Practice. Elsevier. Academic Press

Project Management

ENCV 801 602
3 Credits

Expected Learning Outcomes : Problem Recognition and Solving

Course Learning Outcomes (CLO):

1. Ability to make synthesis (identification, evaluation, and implementation strategy) solution of the problems associated with the entire group knowledge on project management.
2. Able to applying the knowledge of concept of thinking in project management to analyze the problem in the project, acquire the solution and implement it.

Syllabus: Project management overview; Initiation and scope management; Time management; Cost management; Human Resource Management; Quality management; Communications management; Risk management; Management of procurement of goods and services; Execution & Control; Control & Closing.

Prerequisite:

Textbook R**efer**ences:

1. Kerzner, Harold, Project Management, John Wiley & Sons, Inc., 2006.
2. Project Management Institute, A Guide to Project Management Body of Knowledge, 2013
3. Baguley, Philip, Managing Successful Projects, Pitsman Publishing, 1995.
4. Barker, Stephen and Cole, Rob, Brilliant Project Management, Pearson Education Limited, 2007.
5. Barkley, Bruce T. and Saylor, James H., Customer-driven Project Management, McGraw-Hill, Inc., 1994.
6. Cleland, David I., Project Management – Strategic Design & Implementation, McGraw Hill, 1999.
7. Cleland, David I. ND King, William R. (ed), Project Management Handbook, Van Nostrand Reinhold, 1988.
8. Gilbreath, Robert D., Winning at Project Management, John Willey & Sons, Inc, 1986.
9. Grey, Stephen, Practical Risk Assessment for Project Management, John Willey & Sons, Inc., 1995.
10. Hollick, Malcolm, An Introduction to Project Evaluation, Longman Cheshire Pty Limited, 1993.
11. McGhee, Pamela and McAliney, Peter, Painless Project Management, John Willey & Sons, Inc., 2007.
12. Newton, Richard, Project Management Step by Step, Pearson Education Limited, 2006.
13. Nicholas, John M., Managing Business & Engineering Projects, Prentice-Hall, Inc., 1990.
14. O'Connell, Fergus, Fast Projects, Pearson Education Limited, 2007.
15. Project Management Institute, Project Management Journals.
16. Verma, Vijay K., Human Resource Skills for the Project Manager, Project Management Institute, 1996.
17. Verma Vijay K., Organizing Projects for Success, Project Management Institute, 1995.

Time and Cost Management

ENCV 802 601
3 Credits

Expected Learning Outcomes : Problem Recognition and Solving, Technical Specialization

Course Learning Outcomes (CLO):

1. Able to make synthesis (identification, evaluation, and implementation strategy) solution of problems related to the management of time and costs in construction projects.
2. Able to arrange project scheduling, critical path analysis and how to manage the critical path.
3. Able to estimate the cost and arrange budget structure of a project, controlling, optimizing cash flow and calculating profit and loss in a project.

Syllabus:

Time Management:

Defining activities based on WBS and work packages; Relationship between activity, Activity sequence; Determining the activity of which may be done in parallel and must be done sequentially; Definition of the resources required to perform activities, including the competencies required; Time duration used for completing activities, Developing project schedule.

Cost Management:

Quantity surveyor task and cost estimator, Estimation process, budgeting, controlling, and earned value management (EMV).

Prerequisite: Have knowledge of: 1) Project integration management (project lifecycle, project change management, 2) Project scope management (scope statement, WBS, RAM, etc.)

Textbook References:

1. Skill and Knowledge of Cost Engineering, AACE 2004
2. Hougan, Gregory Effective Work Breakdown

Structure, Management Concepts , ,
3. Boussabaine Halim A., Whole Life-cycle Costing, Risk and Risk Responses, , Blackwell Publishing
4. Potts, Keith, Construction Cost Management, , Taylor & Francis
5. Cost and Value Management in Projects, Ray R.Venkataraman, John Wiley and Sons
6. PMBOK, PMI, 5th edition, 2012, PMI
7. Control of Risk, A guide to the systematic management of Risk from Construction, CIRIA
8. Dell'Isola Alphonse Value Engineering Practical Application for design, construction, maintenance and Operation, RS Mean
9. Brooks, Martin, Estimating and tendering for construction works, Elsevier
10. Practice Standard for Earned Value Management, PMI
11. Smith, Jim & Jaggar, David Building Cost Planning for the design Team, , Elsevier, Butterworth-Heinemann
12. Kerzner, Harold, Project Management, John Wiley & Sons, Inc., 2006.
13. Project Management Institute, A Guide to Project Management Body of Knowledge, 2013

Quality and Risk Management

ENCV 802 602
3 Credits

Expected Learning Outcomes : Problem Recognition and Solving, Technical Specialization

Course Learning Outcomes (CLO):

1. Able to make synthesis (Identification, Evaluation, and strategic implementation) solution of issue regarding quality and risk management in construction project.

Syllabus:

Definition and benefits of quality and risk management, as well as the influence of risk in achieving the quality of the project; Quality of the project which includes the identification of needs and standards so as to achieve the expected quality; Documenting project implementation process and evaluate the process and work result in accordance to plan; Evaluation of the project results and provide the innovation and know the issues regarding quality management; Risks that could cause failure in project quality achievement; Planning and potential risk identification during the project; Various methods and software to analyze the identified risks priorities; identification of various actions (risk response) in order to minimize the impact of risk; Supervision to know the indication of deviation with risk management approach; Application of risk management that has been used on various types of projects.

Prerequisite:

Textbook References:

1. Project Management Institute (2013), *A Guide to Project Management Body of Knowledge*, 5th edition.
2. Wideman, R.M., *Risk Management. A Guide to Managing Project Risk and Opportunities*, 1992, Project Management Institute
3. AS/NZS ISO 3100:2009. *Risk Management – Principles and guidelines*. 2009. Standards New Zealand.
4. Kerzner, Harold (2010). Project Management Best Practices: Achieving Global Excellence, 2nd Edition. Hoboken, New Jersey: John Wiley & Sons, Inc.
5. Flanagan, R, George Norman. (1993). Risk Management and Construction. Oxford, Blackwell Scientific Publication.
6. Total Quality Management Handbook

Procurement Management, Contract & Claim Administration

ENCV 802 603
3 Credits

Expected Learning Outcomes : Problem Recognition and Solving, Technical Specialization

Course Learning Outcomes (CLO):

1. Able to make synthesis (identification, evaluation, and implementation strategy) solution of problems related to procurement management, contract administration and claims on construction projects.
2. Able to manage project procurement as well as able to make the project contract.

Syllabus: Planning and procurement strategy; Contract planning; Tender evaluation and selection; Selection and arrangement of procurement procedures strategy; Type of contracts and arrangement of agreement in work contract; Contracts closing and litigation; Legal and regulatory aspects involved in procurement process; Legal and regulatory aspects involved in the process of contract administration; Validation of work contracts.

Prerequisite:

Textbook References:

1. Project Management Institute. (2013). *A Guide to the Project Management Body of Knowledge:* (4th ed.). Project Management Institute.
2. Huston, C. H., "Management of Project Procurement", McGraw-Hill, New York, 1996
3. Bower, D., "Management of Procurement". Thomas Telford, London, 2003
4. Clough, R.H "Construction Contracting" John Wiley and Sons, 1994

5. Lysons, K. "Purchasing", Pitman Publishing, 1996

Legal and Institutional Framework

ENCV 803 601
3 Credits

Expected Learning Outcomes : Problem Recognition and Solving

Course Learning Outcomes (CLO):

1. Able to apply knowledge of various regulations and policies in the field of infrastructure to resolve the legal issues in the case of infrastructure projects.

Syllabus: State institutions related to infrastructure; Laws and regulations related to infrastructure; Authority of central and regional government; Contract law; Land law (the provision of land for construction of public interest), Law of corporation; GCG and corruption; Supporting law/related (business ethics, business competition, etc.); Case study of legal aspects related to infrastructure.

Prerequisite:

Textbook R**efer**ences:

1. UUD 1945 and Amendments;
2. Jimly Asshidiqie, *Konstitusi Ekonomi*, Penerbit Kompas, Jakarta, 2010.
3. Kementerian Perencanaan Pembangunan Nasional/Badan perencanaan Pembangunan Nasional, *Kumpulan Peraturan Terkait Kerjasama Pemerintah dan Swasta (KPS),* Direktorat Pengembangan Kerjasama Pemerintah dan Swasta, Jakarta, 2012.
4. Fred B.G Tumbuan, *Indonesian Unincorporated Business Entities and the Limited Liability Company*, Penerbit PT. Eles Media Komputindo-Kompas Gramedia, Jakarta 2011.
5. Taryana Soenandar, *Prinsip-prinsip Unidroit sebagai Hukum Kontrak dan Penyelesaian Sengketa Bisnis Internasional*, Penerbit Sinar Grafika, Jakarta, 2004

Project Stakeholders and Communications

ENCV 803 603
3 Credits

Expected Learning Outcomes : Technical Specialization, Communication

Course Learning Outcomes (CLO):

1. Able to identify and analyze the process of HR management and communication of construction projects

2. Able to manage the organization and human resources needed during the project;

Syllabus:

1. HRM organizational functions;
2. The scope and depth of HRM;
3. HR planning;
4. Develop the Human Resource Plan;
5. Project Organization;
6. Job Des, RAM / RACI, Job Analysis, Job value / position weight;
7. Acquire project team (Get the project team);
8. Procurement and placement of human resources;
9. Develop project team (Developing the project team);
10. The process of increasing competence;
11. Manage project team (Manage project teams);
12. Project Team Performance Evaluation;
13. Communication Management, Process, Document Flow; Project Performance Report;
14. Stakeholders Management;
15. Measurement and evaluation of project performance; Calculate Project Overhead Cost

Prerequisite:

Textbook R**efer**ences:

1. Project Management Institute (2013), A Guide to Project Management Body of Knowledge, 5th edition.
2. Kerzner, Harold (2010). Project Management Best Practices: Achieving Global Excellence, 2nd Edition. Hoboken, New Jersey: John Wiley & Sons, Inc.
3. Szymanski, Robert A. Szymanski, Donald P. Pulschen, Donna M. (1995) Computers and Information Systems.
4. Armstrong, Michael (2008), Strategic Human Resources Management; A Guide to Action, 4th Edition, London: Kogan Page.

Infrastructure Asset Management

ENCV 803 602
3 Credits

Expected Learning Outcomes : Technical Specialization

Course Learning Outcomes (CLO):

1. Able to identify and analyze the process of infrastructure asset management
2. Able to describe infrastructure asset

management and give an illustration in implementations of asset management in an infrastructure to achieve sustainability in the infrastructure sector.

Syllabus: Infrastructure Asset Management, Asset evaluation, Asset valuation, Optimization in asset management, Asset allocation, Risk management in infrastructure assets.

Textbook References:

1. Rice, M. R, DiMeo, R.A., Porter, M.P. (2012) Nonprofit Asset Management. John Wiley & Sons, Inc.
2. Schneeweis, T., Crowder, G. B., Kazemi, H. (2010) The New Science of Asset Allocation. John Wiley & Sons, In

Construction Safety, Administration and Reporting

ENCV 803 604
3 Credits

Competence in the curriculum: Technical Specialization

Course Learning Outcomes (CLO) :

1. Able to develop a strategy for implementing the Construction Safety Plan
2. Able to create a construction safety administration and reporting system

Syllabus:

1. Able to commit to the implementation of RK3K
2. Being able to determine the scope
3. Able to set indicators for implementation of RK3K
4. Able to determine the tasks and responsibilities of the work group implementing RK3K
5. Able to determine the resources needed
6. Able to develop a strategy for implementing RK3K
7. Can determine the format of the report
8. Able to prepare report results
9. Able to distribute report results

Prerequisite: -

Reference Book

1. Textbook : Sistem Manajemen Keselamatan pada Proyek Konstruksi
2. UU No 1 Tahun 1970
3. UU No 2 Tahun 2017
4. Permen PU No 21 / 2019
5. SE Mentri PU No 11 / 2019

Accident Safety and Investigation Audit

ENCV 803 606
3 Credits

Competence in the curriculum: Technical Specialization

Course Learning Outcomes (CLO) :

1. Able to carry out audits on construction / infrastructure projects based on the prepared RK3K
2. Able to carry out K3 accident investigations
3. Able to prepare OHS Audit and Investigation documents

Syllabus:

1. Able to determine the objectives, scope and criteria of the audit Able to determine the scope
2. Able to determine the auditor officer
3. Able to review documents and audit preparations
4. Able to carry out audits
5. Able to prepare and communicate audit reports
6. Able to follow up on Audit results
7. Able to Identify K3 Construction investigation procedures
8. Able to identify unsafe actions on construction projects
9. Able to identify unsafe conditions of construction projects
10. Able to carry out K3 Construction inspection in accordance with agreed procedures
11. Able to prepare K3 Audit documents
12. Can compile K3 investigation documents

Prerequisite: -

Reference Book

1. Textbook : Sistem Manajemen Keselamatan pada Proyek Konstruksi
2. UU No 1 Tahun 1970
3. UU No 2 Tahun 2017
4. Permen PU No 21 / 2019
5. SE Mentri PU No 11 / 2019

Construction Safety Monitoring and Evaluation

ENCV 803 605
3 Credits

Competence in the curriculum: Technical Specialization

Course Learning Outcomes (CLO) :

1. Able to carry out observation / monitoring strategies for K3 implementation in the Construction / Infrastructure Project based on the RK3K that has been prepared
2. Able to evaluate the K3 implementation process based on the approved RK3K
3. Able to document the approved RK3K monitoring and evaluation activities

Syllabus:

1. Able to set standards and indicators to assess the process of implementing OHS programs
2. Being able to collect data and make observations of the implementation of the activities / processes of the selected activities to be compared with the standards / indicators (both qualitative and quantitative) that have been determined
3. Able to observe changes in the environment and collect data for the assessment of the influence of the environment on the activities being carried out
4. Able to carry out data analysis and results sentiment to make judgments and conclusions about the process of implementing OHS
5. Able to take decisions to take action (including corrections and adjustments to activities, as well as re-planning).
6. Able to convey all the results of monitoring, control and follow-up to the parties concerned as a form of accountability and further decision making process.
7. Able to evaluate the K3 Construction implementation program
8. Able to check the completeness of the K3 Construction program
9. Able to reassess the appropriateness of the K3 Construction program
10. Able to review the suitability of the methods and systems used in the implementation of K3 Construction
11. Able to document the approved RK3K monitoring and evaluation activities

Prerequisite: -

Reference Book

1. Textbook : Sistem Manajemen Keselamatan pada Proyek Konstruksi
2. UU No 1 Tahun 1970
3. UU No 2 Tahun 2017
4. Permen PU No 21 / 2019
5. SE Mentri PU No 11 / 2019

OHS Risk and Costs

ENCV 802 605
3 Credits

Expected Learning Outcomes : Technical Specialization, Suitainability

Course Learning Outcomes (CLO) :

1. Able to evaluate the structure of WBS structural structures in complex civil / infrastructure construction buildings
2. Able to do an analysis of risks and potential hazards that occur / have an impact on workplace accidents, and plan for control
3. Able to analyze targets and programs based on selected risk controls
4. Able to analyze resource requirements based on program goals that have been prepared
5. Able to analyze the costs required based on the goals of the K3 program
6. Able to make safety plan documents along with K3 costs

Syllabus:

1. Able to identify the system structure of WBS
2. Able to evaluate the WBS structural system
3. Able to develop a WBS structural system
4. Able to identify potential hazards and OHS risks
5. Able to analyze potential hazards and risks
6. Able to carry out risk control
7. Able to make targets of each risk control
8. Able to make a program of each target that is formed
9. Can identify the resources of each target and program that has been prepared

10. Able to analyze the resources of each target and program that has been prepared
11. Being able to analyze the unit price of resources that have been determined from the target program formed
12. Able to create a K3 cost structure
13. Able to make details of K3 costs
14. Able to make K3K plan documents and K3 costs

Prerequisite: -

Reference Book

1. Textbook : Sistem Manajemen Keselamatan pada Proyek Konstruksi
2. UU No 1 Tahun 1970
3. UU No 2 Tahun 2017
4. Permen PU No 21 / 2019
5. SE Mentri PU No 11 / 2019

Policy and RK3K

ENCV 802 604
3 Credits

Competence in the curriculum: Technical Specialization, Communication

Course Learning Outcomes (CLO) :

1. Able to evaluate the application of SMK3 policies
2. Able to evaluate the WBS structural structure of complex civil engineering construction buildings
3. Able to analyze risks and potential hazards that occur / have an impact on workplace accidents, as well as plan their control
4. Able to analyze risks and potential hazards that occur / have an impact on workplace accidents, and plan for control

Syllabus:

1. Able to evaluate OHS policies based on Law No 1/1970
2. Able to evaluate OHS policies based on UUJK No 2/2017
3. Able to evaluate OHS policies based on ISO and OHSAS
4. Able to evaluate the policy guidelines for K3 standard procedures at the level of the construction company
5. Able to evaluate the WBS structural system

Graduate (Master) Program on Environmental Engineering

Program Specification

1.	**Awarding Institution**	Universitas Indonesia	
2.	**Teaching Institution**	Faculty of Engineering University Indonesia	
3.	**Programme Tittle**	Graduate Programme in Environmental Engineering	
4.	**Class**	Regular	
5.	**Final Award**	Graduate (Master) Program in Environmental Engineering (M.T)	
6 .	**Accreditation / Recognition**	Good	
7.	**Language(s) of Instruction**	Bahasa Indonesia	
8.	**Study Scheme (Full Time / Part Time)**	Full Time	
9.	**Entry Requirements**	Undergraduate (S1) or DIV graduates from university or Polytechnique with B accreditation from BAN-PT specified from science and technology major: A. Environmental Engineering B. Civil Engineering C. Chemical Engineering/ Bioprocess Engineering D. Chemistry E. Biology F. Nuclear Engineering G. Metallurgy Engineering H. HSE (Public Health)	
10.	**Study Duration**	Designed for 2 years	
	Type of Semester	Number of Semester	Number of weeks / semester
	Regular	4	16
	Short (optional)	1	8
11.	**Aims of the programme is :** to produce environmental engineering master graduate that able analyze in depth, designing complex product, process or system in the field of water engineering, solid waste, air pollution, also contributing in fulfilling the Sustainable Development Goals		
12.	**Profile of Graduates:** 1. Environmental Engineering Master graduate who has a career in planning, design, implementation, evaluation, and environmental engineering system to support Sustainable Development Goals (SDGs) 2. Environmental Engineering Master graduate with ethics, professionalism, and capable develop their abilities in response to the dynamic development environmental engineering field.		

13.	**Expected Learning Outcomes (ELO):** 1. Analyze a possible solution to a complex, question, or issue relevant to environmental engineering (L4) 2. Select appropriate experiments and analyze the result in the solution of environmental engineering problem (L4) 3. Select appropriate advanced concepts and principles to solve complex problem in a specialty area appropriate to the practice of environmental engineering (L4) 4. Analyze the sustainable performance of complex environmental engineering project from a system perspective (L4) 5. Analyze effective communication to technical and nontechnical audiences (L5) 6. Analyze new knowledge, skills, and attitudes relevant to environmental engineering acquired through self-directed learning (l4)
14.	**Classification of Subjects**

No.	Classification	Credit Hours (SKS)	Percentage
i	**University General Subjects**	-	-
ii	**Basic Engineering Subjects**	-	-
iii	**Core Subjects**	12	30.0%
iv	**Mata Kuliah Specialization**	15	37.5%
v	**Elective**	3	7.5%
vi	**Scientific Publication, Pre Master Thesis, Master Thesis**	10	25.0%
	Total	40	100 %
	Total Credit Hours to Graduate		40 SKS

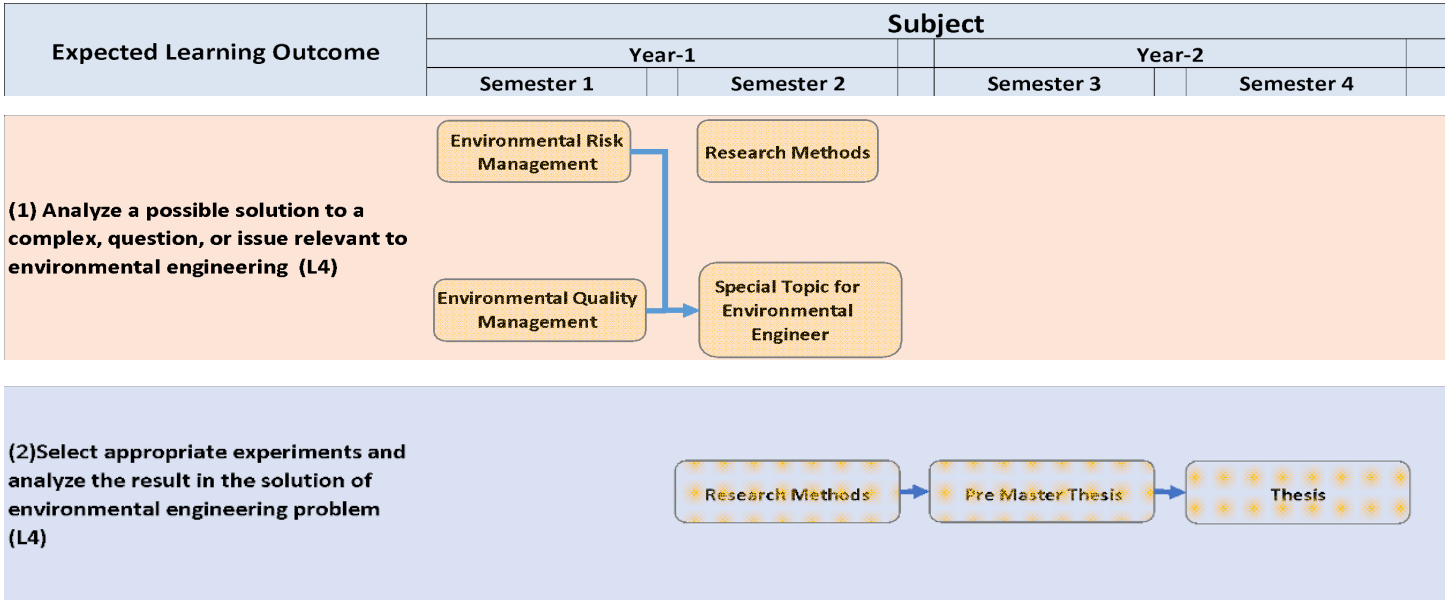
Flow Diagram Of Subject to Reach ELO in Environmental Engineering Master Programme specialization : Water Quality Technology and Engineering

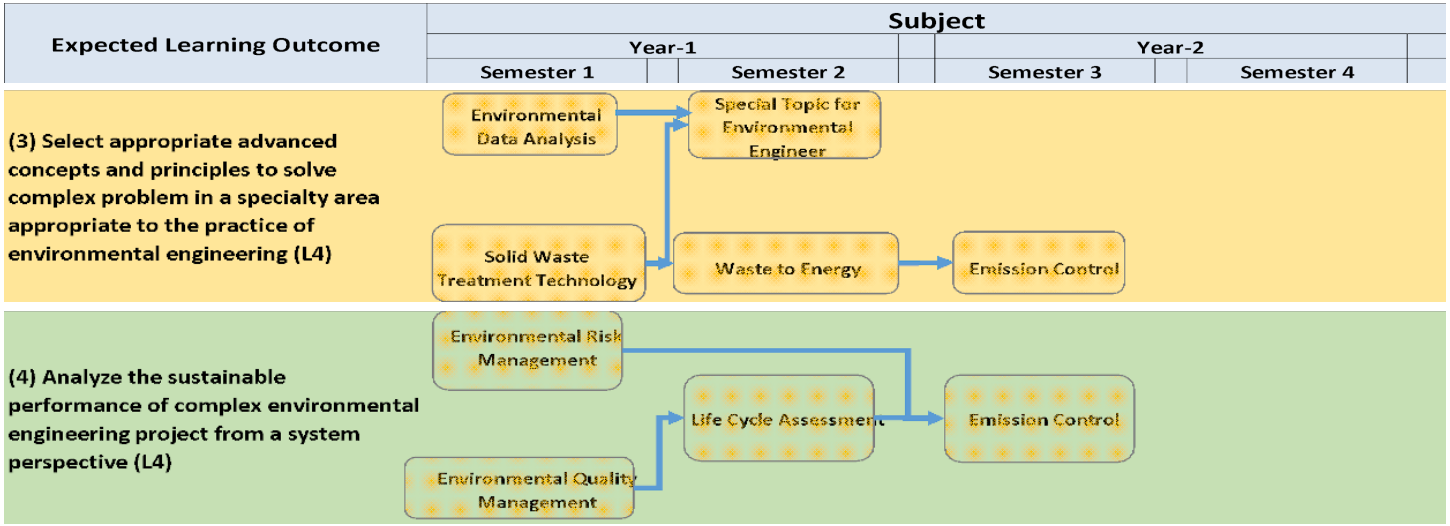
Expected Learning Outcome	Subject			
	Year-1		Year-2	
	Semester 1	Semester 2	Semester 3	Semester 4
(1) Analyze a possible solution to a complex, question, or issue relevant to environmental engineering (L4)	Environmental Risk Management → Special Topic for Environmental Engineer Research Method			
(2)Select appropriate experiments and analyze the result in the solution of environmental engineering problem (L4)	Research Method	→ Pre Master Thesis	→ Master Thesis	

Expected Learning Outcome	Subject							
	Year-1				Year-2			
	Semester 1			Semester 2		Semester 3		Semester 4
(3) Select appropriate advanced concepts and principles to solve complex problem in a specialty area appropriate to the practice of environmental engineering (L4)	Environmental Data Analysis Advanced Water Engineering			Special Topic for Environmental Engineer Sustainable Environmental Infrastructure		Contamination and Environmental Remediation		
(4) Analyze the sustainable performance of complex environmental engineering project from a system perspective (L4)	Environmental Risk Management Instrumentation and Measurement of Environmental Quality			Urban Wastewater Quality Management		Contamination and Environmental Remediation		

Expected Learning Outcome	Subject			
	Year-1		Year-2	
	Semester 1	Semester 2	Semester 3	Semester 4
(5). Analyze effective communication to technical and nontechnical audiences	Environmental Data Analysis		Pre Master Thesis	Scientific Publication
(6) Analyze new knowledge, skills, and attitudes relevant to environmental engineering acquired through self-directed learning (L4).			Pre Master Thesis	Master Thesis

Flow Diagram Of Subject to Reach ELO in Environmental Engineering Master Programme specialization: Environmental Quality Management

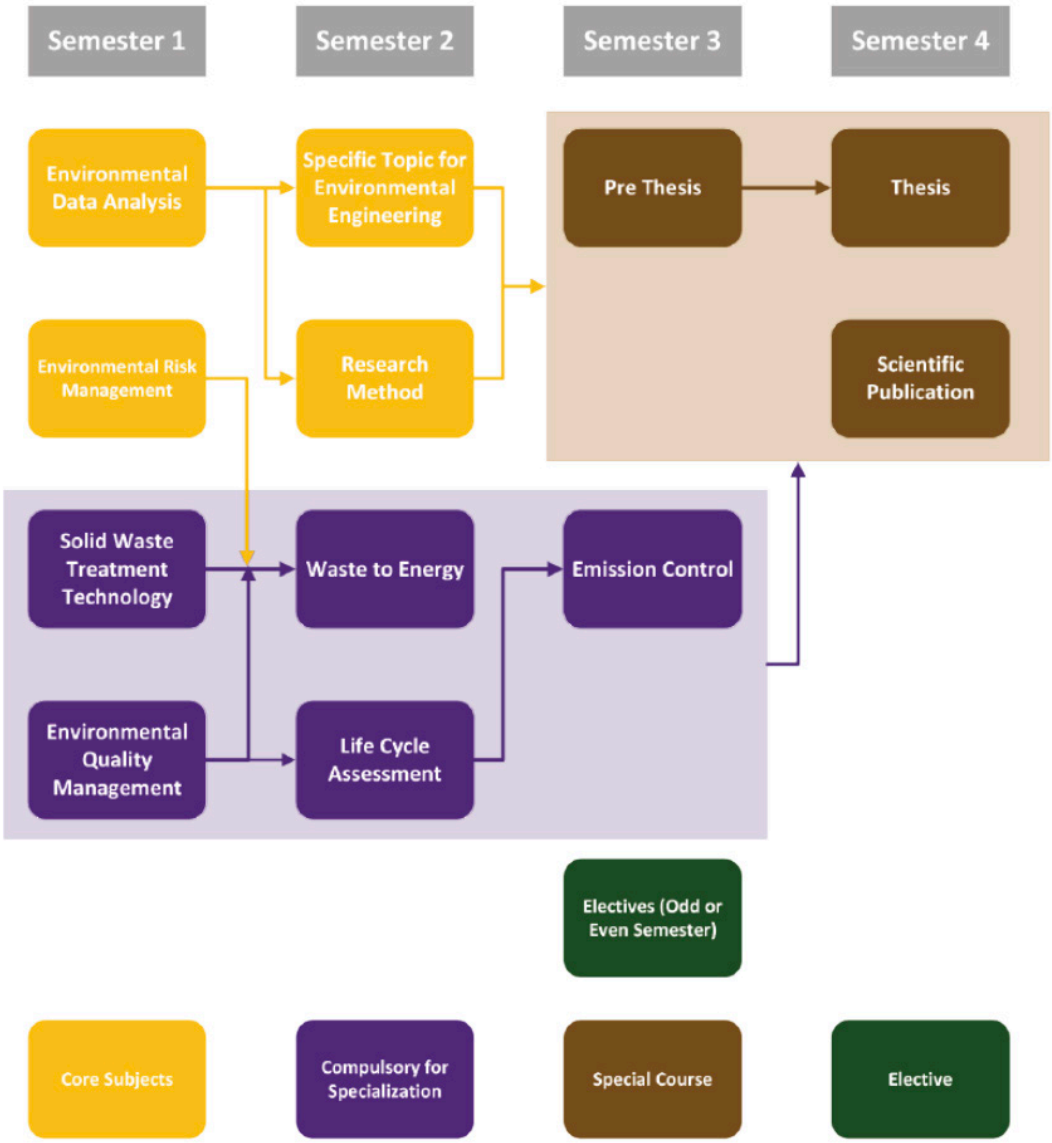



Expected Learning Outcome
Subject
Year-1
Year-2
Semester 1
Semester 2
Semester 3
Semester 4
(3) Select appropriate advanced concepts and principles to solve complex problem in a specialty area appropriate to the practice of environmental engineering (L4)
Environmental Data Analysis
Special Topic for Environmental Engineer
Solid Waste Treatment Technology
Waste to Energy
Emission Control
(4) Analyze the sustainable performance of complex environmental engineering project from a system perspective (L4)
Environmental Risk Management
Life Cycle Assessment
Emission Control
Environmental Quality Management

Expected Learning Outcome	Subject			
	Year-1		Year-2	
	Semester 1	Semester 2	Semester 3	Semester 4
(5). Analyze effective communication to technical and nontechnical audiences	Environmental Data Analysis		Pre Master Thesis	Scientific Publication
(6) Analyze new knowledge, skills, and attitudes relevant to environmental engineering acquired through self-directed learning (L4).			Pre Master Thesis	Master Thesis

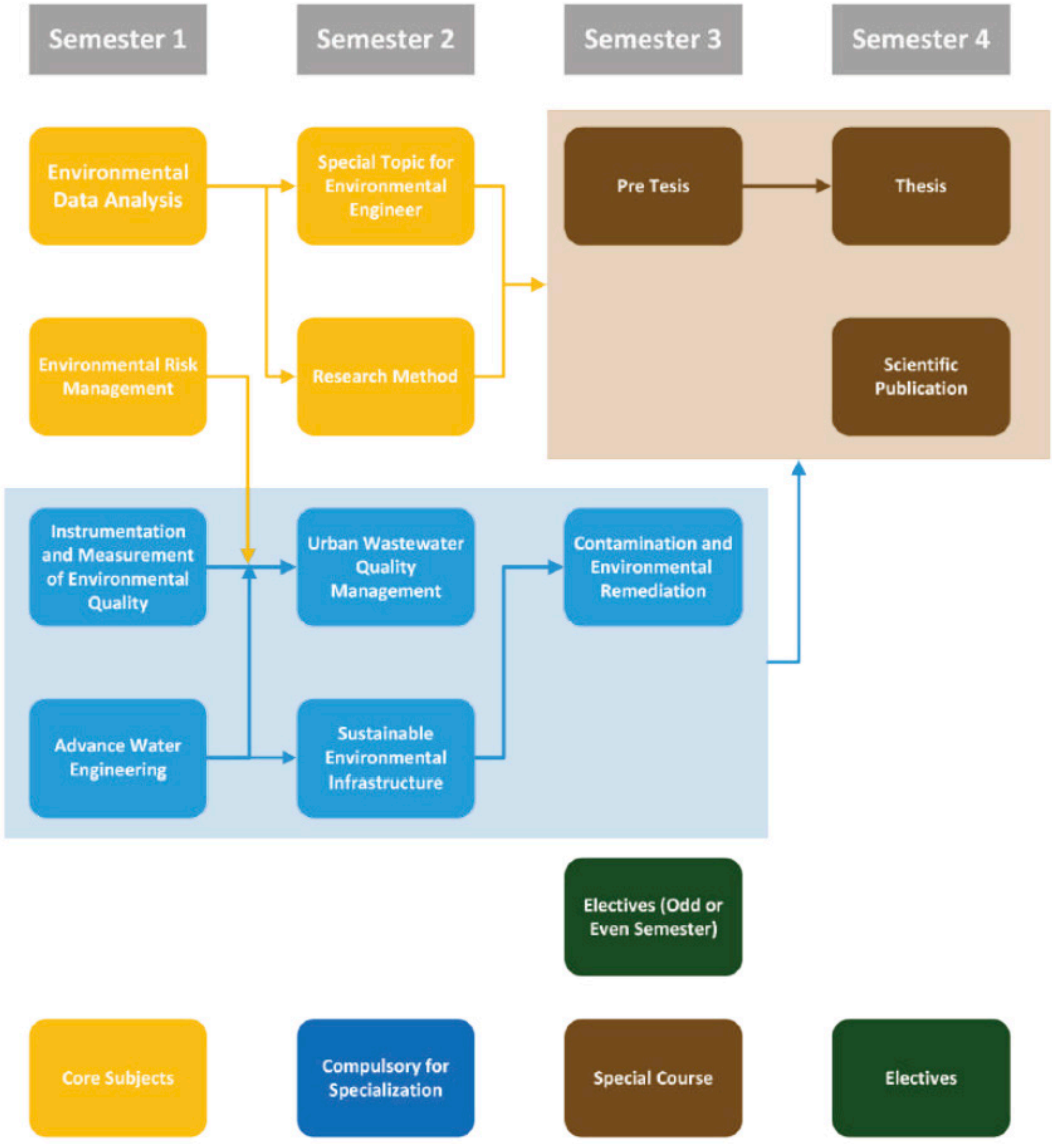
Flow Diagram of Subjects in Environmental Engineering Master Programme

Environmental Quality Management specialization



Flow Diagram of Subjects in Environmental Engineering Master Programme

Water Quality Technology and Engineering specialization



Curriculum Structure in Environmental Engineering Master Programme

Subjects Code	Semester 1	SKS MKL	SKS TRKA
ENEV 801 101	Environmental Data Analysis	3	3
ENEV 801 102	Environmental Risk Management	3	3
ENEV 801 201	Environmental Quality Management	3	P
ENEV 801 202	Solid Waste Treatment Technology	3	P
ENEV 801 301	Advanced Water Engineering	P	3
ENEV 801 302	Instrumentation and Measurement of Environmental Quality	P	3
	Compulsory Course Environmental Quality Management	12	
	Compulsory Course Water Quality Technology and Engineering		12
Subjects Code	**Semester 2**	**SKS MKL**	**SKS TRKA**
ENEV 802 103	Research Method	3	3
ENEV 802 104	Special Topic for Environmental Engineer	3	3
ENEV 802 201	Waste to Energy	3	P
ENEV 802 202	Advanced Water Engineering	3	P
ENEV 802 301	Urban Wastewater Quality Management	P	3
ENEV 802 302	Sustainable Environmental Infrastructure	P	3
	Compulsory Course Environmental Quality Management	12	
	Compulsory Course Water Quality Technology and Engineering		12
Subjects Code	**Semester 3**	**SKS MKL**	**SKS TRKA**
ENEV 800 105	Pre Master Thesis	2	2
ENEV 803 201	Emission Control	3	P
ENEV 803 301	Contamination and Environmental Remediation	P	3
	Compulsory Course Environmental Quality Management	5	
	Compulsory Course Water Quality Technology and Engineering		5
	Elective	3	3
	Total	8	8
Subjects Code	**Semester 4**	**SKS MKL**	**SKS TRKA**
ENEV 800 106	Master Thesis	6	6
ENEV 800 107	Scientific Publication	2	2
	Total	8	8

Information :

MKL : Environmental Quality Management Specialization

TRKA : Water Quality Technology and Engineering

Elective Courses

Subjects Code	Elective Courser Odd Semester	SKS
ENEV 803 106	Environmental System Dynamics	3
Subjects Code	**Elective Courser Even Semester**	**SKS**
ENEV 802 105	Environmental Audit	3

Master By Research

Code	Subject	SKS
	1st Semester	
ENEV800102	Research Proposal Examination	4
ENEV800101	Scientific Seminar	8
	2nd Semester	
ENEV800203	Proceeding Publication	4
ENEV800204	Research Result Examination	6
	3rd Semester	
ENEV800305	Journal Publication	8
	4th Semester	
ENEV800406	Master Thesis	10

Syllabus of Master Program on Environmental Engineering

Environmental Data Analysis

ENEV 801 101

3 Credits

Learning Outcomes:

1. Able to analyze environmental data by applying probabilistic distribution and Monte Carlo methods.
2. Able to correlate three variables or more by analyzing the multivariate in order to explain environmental phenomenon.

Expected Learning Outcomes :

1. Able to determine advanced concepts and appropriate principles to provide solutions to complex problems in Environmental Engineering field (ELO 3),
2. Conducting an analysis of effective communication to technical and non-technical audiences (ELO 5)

Syllabus:

Probability Distribution (1) probability distribution (discrete and continuous): normal distribution, Central Limit theorem, t-distribution and Fisher's F-distribution, gamma and other distributions. (2) Application of data analysis on the probability of distribution to the environment, such as the distribution of particle size, the detection limit of environmental analysis; Hypothesis test (1) Type I error, Type II error, level of significance, (2) Final test one and final test two. Parametric tests of significance to non-parametric tests and the Monte Carlo method (3) Application of hypothesis testing in the analysis of environmental data, such as adjusting environmental standards and so on; Regression analysis (1) Multiple regression - calculations from the field of regression, partial correlation and multiple correlation (2) nonlinear regression (3) Application of regression analysis in environmental data, such as calibration of environmental analysis; Time series (1) Introduction-meaning of the stochastic process: the whole random process, the balanced process, the auto-regression process and the unbalanced process; Principles of Component Analysis (1) Introduction to Analysis of Main-rotated components and complex empirical orthogonal functions, Uncommon decomposition values, Analysis of official relationships (2) Application of PCA in complex environmental data, such as identification of air pollution sources

Prerequisite:

Basic Statistic

References:

1. Linfield C. Brown and Paul Mac Berthouex, Jan 29, 2002, Statistics for Environmental Engineers
2. Ralph R B Von Frese, John W Olesik, CRC Press, Taylor & Francis Group, 2019, Introduction to Environmental Data Analysis for Scientists and Engineers
3. D.R. Helsel and R.M. Hirsch, September 2002, Statistical Methods in Water Resources

Environmental Risk Management

ENEV 801 102

3 Credits

Learning Outcomes:

Able to conclude and propose risk reduction strategies based on the diagnosis results of human health risks and ecological risks from the sources of activities that emit pollutants. The diagnosis is based on the concepts of toxicology, chemistry, ecology, statistics and epidemiology

Expected Learning Outcomes :

1. Able to analyze possible solutions to problems, questions or complex issues relevant to environmental engineering (ELO 1)
2. Able to carry out continuous performance analysis of work in the Environmental Engineering field from a systemic point of view (ELO 4)

Syllabus:

Introduction to Environmental Risk (Concepts, principles and uses of environmental risks; Typology of risks and their management methods; Techniques and methods of risk calculation; Integrated risk assessment), Ecological Risk Assessment (ERA) - Ecotoxicology (Introduction of ERA; ERA techniques and calculation methods), Human Risk Assessment (HRA) - Toxicology (Introduction of HRA; Techniques and calculation methods), Application of Environmental Risk Assessment in Industry (Chemical risk assessment in the environment; Application of environmental risk in cases of pollution in soil, water, air; Use of pollutant fate transport software)

Prerequisite: Environmental Chemistry

References:

1. Easton, Thomas. 2013. Taking Sides: Clashing Views on Environmental Issues 15th Edition. McGraw-Hill/Dushkin.
2. Simon, Ted, 2016, Environmental Risk Assessment: A Toxicological Approach 1st Edition, CRC Press; 1 edition

3. EPA's Framework for Human Health Risk Assessment to Inform Decision Making, 2014
4. EPA's Risk-Screening Environmental Indicators (RSEI) Methodology, Version 2.3.4. 2015
5. Landis, W. Et.al., 2010. Introduction to Environmental Toxicology: Molecular Substructures to Ecological Landscapes, Fourth Edition 4th Edition.CRC Press
6. Hemond, H. and Fechner, E.J., 1999. Chemical Fate and Transport in the Environment 2nd Edition
7. Dupont, R. 2016. Pollution Prevention: Sustainability, Industrial Ecology, and Green Engineering, Second Edition 2nd Edition

Research Method

ENEV 802 103
3 Credits
Learning Outcomes:

1. Able to explain the concept of thinking in research methods and apply it on choosing the right research methodology and on preparing research proposals
2. Able to explore the uniqueness and originality of research proposals (uniqueness of civil engineering problems)

Expected Learning Outcomes :

1. Able to analyze possible solutions to problems, questions or complex issues relevant to environmental engineering (ELO 1)
2. Able determine the appropriate form of experimentation, and analyze the solutions of environmental

Syllabus: Methodology principles, characteristics and research processes, quantitative and qualitative research paradigms, scientific methods, problem statements, preparing hypotheses, logical and critical thinking, research strategies, data collection techniques and analytical techniques, scientific writing, guidance on the preparation of draft seminars with prospective supervisors.

Prerequisite:

References:

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. Yin.Robert k, Studi Kasus Desain dan Metode, Rajagrafindo Persada, 2008
5. Riduwan, Skala pengukuran variable-variabel penelitian,Alfabeta, 2002
6. Tan, W. (2008). Practical Research Methods (Third Edition ed.). Singapore: Prentice Hall

Special Topic for Environmental Engineer

ENEV 802 104
3 Credits
Learning Outcomes:

1. Able to explore (C4) the latest specific advanced environmental engineering problems through secondary data and / or primary data (observations, interviews, measurements, discussions, etc.) by considering public policies, social impacts and / or business objectives
2. Able to predict (C5) sustainable environmental engineering solutions to environmental engineering problems that are explored critically and innovatively

Expected Learning Outcomes :

1. Able to analyze possible solutions to problems, questions or complex issues relevant to environmental engineering (ELO 1)
2. Able to determine advanced concepts and principles that are appropriate to provide solutions to complex problems in the Environmental Engineering field (ELO 3)

Syllabus: Environmental problems on a global, regional and national scale, current air, water, solid waste and land management technologies, decision support support systems in technology selection, modeling use in decision making.

Prerequisite: Environmental Quality Management

References:

According to the selected advanced environmental engineering issues

Mandatory Courses of Environmental Quality Management

Environmental Quality Management

ENEV 801 201
3 Credits

Learning Outcomes: Able to assess and predict the environmental quality of water, air and soil and decide the appropriate method of environmental quality protection for environmental pollution problem (C5)

Expected Learning Outcomes :

1. Able to analyze possible solutions to problems, questions or complex issues relevant to environmental engineering (ELO 1)
2. Able to carry out continuous performance analysis of work in the Environmental Engineering field from a systemic point of view (ELO 4)

Syllabus: Physical and chemical aspects of pollutants in the aquatic environment, parameters and water quality standards (stream standard, effluent standard), index of aquatic environmental quality (Pollution Index, WQI, Storet), transport of pollutants in the aquatic environment (advection, diffusion, reaction,]] water quality protection methods.

Physical and chemical aspects of air pollutants, air quality parameters and quality standards (emission standards, ambient standards), air quality index (ISPU, AQI), air pollutant transport (gaussian method), air quality protection methods

Physical and chemical aspects of soil pollutants, polluted soil criteria, polluted soil index (Average Quality Index, Nemerow Pollution Index, Enrichment Factor), soil quality protection methods

Prerequisite: -

References:

1. Mary K. Theodore, Louis Theodore. 2010. Introduction to Environmental Management. CRC Press

Solid Waste Treatment Technology

ENEV 801 202
3 Credits

Learning Outcomes:

1. Able to apply the knowledge about solid waste treatment in the design process and processing operations
2. Able to communicate and work in the team

Expected Learning Outcomes : Able to determine advanced concepts and principles that are appropriate to provide solutions to complex problems in Environmental Engineering the field (ELO 3)

Syllabus:

Overview of Integrated Solid Waste Management: the concept of sustainable solid waste management, the development of IWMS (case studies and analysis), elements of IWM; physical, chemical, biological and solid waste generation characteristics; biological, mechanical, mechanical-biological processing; thermal processing, landfilling and coating technology; solid waste recirculation; field surveys, structural design and planning for operating units.

Prerequisite:

Integrated Solid Waste Management Planning

References:

1. Integrated Solid Waste Management, Geroge Tchobanoglous, Hilary Theisen, Samuel A. Vigil, McGraw Hill International Edition, 1993.
2. Handbook of Solid Waste Management, George Tchobanoglous, Frank Kreith, McGraw Hill, 2002.

Waste to Energy

ENEV 802 201
3 Credits

Learning Outcomes:

Able to identify problems related to energy in Indonesia, and analyze the use of waste as an energy source in order to determine the waste-to-energy technology.

Expected Learning Outcomes :

Able to determine advanced concepts and principles that are appropriate to provide solutions to complex problems in Environmental Engineering the field (ELO 3)

Syllabus:

Energy requirements and solid waste management; Characteristics of Solid Waste and Feedstock Preparation for Waste to Energy; Impact of Waste into energy on the environment and social; Biological Treatment Mechanical Technology and Mechanical Recovery Facility; Waste to energy technology (Thermal, physicochemical, biological); Air Pollution Control; Utilization of gas in the landfill as an energy source; LandGem Method

Prerequisite: -

References:

1. McBean, E.A., Rovers, F.A., Farquhar, G.J. 1995. Solid Waste Landfill Engineering and Design. Prentice Hall: USA.
2. Tschobanoglous, G. dan Kreith, F. 2002. Handbook of Solid Waste management. 2nd ed. McGraw-Hill USA.
3. Tschobanoglous, G; Theisen, H., dan Vigil, S. 1993. Integrated Solid Waste Management. McGraw-Hill USA.

4. Haug. R.T. 1993. The Practical Handbook of Compost Engineering. Lewis Publisher: USA.

5. Damanhuri,E. dan Padmi, T. 2016. Pengelolaan Sampah Terpadu. Penerbit ITB: Bandung, Indonesia.

Life Cycle Assessment

ENEV 802 202
3 Credits

Learning Outcomes:

Able to use a set of models to carry out an assessment of sustainable solid waste management.

Expected Learning Outcomes :

Able to carry out continuous performance analysis of work in the Environmental Engineering field from a systemic point of view (ELO 4)

Syllabus:

Overview Integrated Solid waste Management, sustainable solid waste management, IWMS development (case studies and analysis), elements of IWM, solid waste generation and composition, waste collection, central sorting, biological treatment, thermal treatment, landfilling, material recycling, models: STAN 2, Prognosis, and IWM 2

Prerequisite:

Integrated Solid Waste Management Planning

References:

1. Integrated Solid Waste Management, Geroge Tchobanoglous, Hilary Theisen, Samuel A. Vigil, McGraw Hill International Edition, 1993.

2. Handbook of Solid Waste Management, George Tchobanoglous, Frank Kreith, McGraw Hill, 2002.

3. Integrated Solid Waste Management: a Life Cycle Inventory, Forbes McDougall, Peter White, Marina Franke, Peter Hindle, Blackwell Science, 2001.

4. Integrated Solid Waste management : a Life Cycle Inventory, Forbes R. McDougall, Peter R. White, Marina Franke, Peter Hindle, The Blackwell Science, 2001.

Emission Control

ENEV 803 201
3 Credits

Learning Outcomes:

Able to analyze and evaluate the types and sources of greenhouse gas emissions caused by solid waste management activities and the methods to control them.

Expected Learning Outcomes :

1. Able to determine advanced concepts and principles that are appropriate to provide solutions to complex problems in the Environmental Engineering field (ELO 3)

2. Able to carry out continuous performance analysis of work in the Environmental Engineering field from a systemic point of view (ELO 4)

Syllabus:

Processes in managing solid waste that produce emissions, Greenhouse Gases, Inventory emissions, Control of emissions at the final waste processing site, landfill design for emissions control, control of emissions by using technology. Learning is done through interactive lectures, assignments and assistance. Learning activities are also conducted based on research. The scope of the study are solid waste and its management, emissions produced, and its prevention. Indonesian and English are used during the learning process.

Prerequisite:

Air Pollution

References:

1. Tchobanoglous, G., Thiessen, H., & Vigil, S. (2003). Integrated Solid Waste Management: Engineering Principles and Management Issues. Singapore: McGraw-Hill Inc.

2. Nevers, N.D., Air Pollution Engineering, McGraw-Hill, USA, 2000

3. US Environmental Protection Agency. (2015). LFG Energy Project Development Handbook

Mandatory Courses of Water Quality Technology and Engineering Specialization

Advanced Water Engineering

ENEV 801 301
3 Credits

Learning Outcomes: Able to choose and specify the types of physical, chemical, and / or biological treatment needed to recycle water or wastewater with nutrient removal / recovery as well as refractory / priority / emerging pollutant removal.

Expected Learning Outcomes :

Able to determine advanced concepts and principles

that are appropriate to provide solutions to complex problems in the Environmental Engineering field (ELO 3)

Syllabus:

Development of water treatment technology; Challenges, trends and perspectives in the field of water treatment; Quality standards and impacts of nutrients (organic nitrogen, ammonia, nitrites and nitrates, phosphorus) in the environment; Alternative allowance and recovery nutrient technology; Biological nutrient recovery processes; constructed wetlands; Water recycling; Potential and risks of water recycling; Regulation and quality of recycled water; Refractory / priority / emerging pollutant; Adsorption process; Membrane filtration process; Advanced oxidation processes (AOPs); Hybrid process for sustainable water treatment; System and processing level; Technology selection; Aspects of people's attitudes and perceptions; Techno-economic aspects.

Prerequisite:

References:

1. Qasim, S. R., Zhu, G. (2018). Wastewater treatment and reuse, theory and design examples. Volume 1, Post-treatment, reuse, and disposal. Taylor & Francis Group, LLC. CRC Press. ISBN: 13978-1-138-30094-1
2. Diaz-Elsayed, N., Rezaei, N., Guo, T., Mohebbi, S., & Zhang, Q. (2019). Wastewater-based resource recovery technologies across scale: A review. Resources, Conservation and Recycling, 145, 94–112. https://doi.org/10.1016/j.resconrec.2018.12.035
3. Grandclément, C., Seyssiecq, I., Piram, A., Wong-Wah-Chung, P., Vanot, G., Tiliacos, N., … Doumenq, P. (2017). From the conventional biological wastewater treatment to hybrid processes, the evaluation of organic micropollutant removal: A review. Water Research, 111, 297–317. https://doi.org/10.1016/j.watres.2017.01.005

Instrumentation and Measurement of Environmental Quality

ENEV 801 302
3 Credits

Learning Outcomes:

Able to choose the sampling method and instrumentation in appropriately analyzing environmental quality based on examples of environmental media and pollutant substances.

Expected Learning Outcomes :

Able to carry out continuous performance analysis of work in the Environmental Engineering field from a systemic point of view (ELO 4)

Syllabus:

Composite water samples, automatic water sampler, air sampling, high volume sampler, passive sampler, particulate matter measurement, noise measurement, gas concentration measurement, metal measurement using AAS and ICP-MS, measurement of organic pollutants with gas chromatography, morphological characterization of material environment (SEM, etc), analysis of interrelated environment parameters.

Prerequisite:

References: -

Urban Wastewater Quality Management

ENEV 802 301
3 Credits

Learning Outcomes:

Able to compare the effectiveness of various urban wastewater management strategies by using mathematical water quality modeling as a decision support system to maintain or improve water quality.

Expected Learning Outcomes :

Able to carry out continuous performance analysis of work in the Environmental Engineering field from a systemic point of view (ELO 4)

Syllabus:

Introduction to urban water management in spatial planning and urban infrastructure; Types of resources, designation of water, and availability of water; Statistical water quality; The role of water statistics in the management and modeling of water body quality; Critical water quality and water use in an infrastructure perspective; Water quality and urban waste loads in relation to causality and health risks; Calculation of pollution load of solid waste and liquid waste; Effectiveness of water pollution control plans; Determination of capacity and load in surface water; Calculation of Total Maximum Daily Load (TMDL) in water bodies; Technology and policy interventions in controlling the quality of urban water and waste; Capacity prediction with water quality modeling (QUAL2E, Epanet, Aquatox); Application of water quality management cases for urban areas using software

Prerequisite:

Environmental Chemistry, Domestic Wastewater Treatment Plant Design, Environmental Data Analysis

References:

1. Steven C. Chapra, Waveland Press, 2008, Surface Water-Quality Modeling
2. Roger A. Falconer, Routledge, 2018, Water Quality Modelling

Sustainable Environmental Infrastructure

ENEV 802 302
3 Credits

Learning Outcomes:

Able to understand and apply the principle of sustainability in the planning and management of natural resources, infrastructure and problem solving in the field of environmental engineering.

Expected Learning Outcomes :

Able to determine advanced concepts and principles that are appropriate to provide solutions to complex problems in the Environmental Engineering field (ELO 3)

Syllabus:

Various issues and trends in environmental management; History, background, targets and indicators of Sustainable development; The principle of sustainable infrastructure; Sustainable paradigms in the design process; Pillars / frameworks for sustainable infrastructure development; Green building concepts and criteria; Water supply and appropriate sanitation; Conservation and efficiency of water use; Water footprint; Water balance; Low impact development; Greenhouse Energy and Gas; Renewable energy; Energy efficiency; Green materials; Planning for a sustainable infrastructure cycle; Tools for measuring sustainability

Prerequisite:

References:

1. Ferrer, A. L. C., Thomé, A. M. T., & Scavarda, A. J. (2018). Sustainable urban infrastructure: A review. Resources, Conservation and Recycling, 128, 360–372. https://doi.org/10.1016/j.resconrec.2016.07.017
2. Charles J. Kibert.(2016). Sustainable Construction: Green Building Design and Delivery 4th edition. John Wilye & Sons, Inc.
3. S. Bry Sarte. (2010). Sustainable infrastructure: The Guide to Green Engineerng and Design. John Wiley & Sons, Inc.

Contamination and Environmental Remediation

ENEV 803 301
3 Credits

Learning Outcomes:

Able to prepare a design program for land remediation that is contaminated by the industrial activities or accidents

Expected Learning Outcomes :

1. Able to determine advanced concepts and principles that are appropriate to provide solutions to complex problems in the Environmental Engineering field (ELO 3)
2. Able to carry out continuous performance analysis of work in the Environmental Engineering field from a systemic point of view (ELO 4)

Syllabus:

Potential activities of contamination of B3 material to the environment (soil and groundwater); The types and forms of B3 pollutants; The pattern and characteristics of the trip and the spread of contaminants in the soil; Impacts and risks of pollutants to the environment; the method of eliminating the spread of contaminants in the soil; Methods for recovering land contaminated with B3 material; Physical, Chemical and Biochemical Recovery; Technical design of land and groundwater remediation; Economic and financial aspects for remediation projects; and examples of the case studies in the field.

Prerequisite:

Environmental Laboratory, Environmental Microbiology, Unit Operation and Process, Hazardous dan Industrial Waste Treatment

References:

1. Remediation Engineering: Design Concept, Suthan S., CRC Lewis Publisher, 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. Pengantar Prinsip Pengelolaan Limbah B3, Firdaus Ali,Global Enviro. 2011

Elective Courses

Environmental Audit

ENEV 802 105
3 Credits

Learning Outcomes:

Able to conduct audits and prepare environmental

audit reports

Expected Learning Outcomes :

Able to carry out continuous performance analysis of work in the Environmental Engineering field from a systemic point of view (ELO 4)

Syllabus:

Definition, principles, concepts and environmental policies in the Environmental Audit. Legal Basis for Environmental Policy and Regulations. AL Principle (Determine the main issues and scope of the audit). ISO 1400 Understanding: Enhancing Environmental Management and Sustainable Development. Study on Environmental Management Plan / RKL and Environmental Management Plan / RPL. Basic Audit Principles (Basic principles, procedures, hierarchy and processes in environmental auditing). Types of Audits (Obedience Audit, Waste Audit, Process Audit). Audit Method (procedures for determining, weighting, importance and valuation in an environmental audit). Audit Documents. Audit Case Study (review of case documents).

Prerequisite:

References:

1. ”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
2. ”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.
3. “Panduan Audit Sistem Manajemen Mutu dan/ atau Lingkungan”; SNI 19-19011-2005. Badan Standarisasi Nasional.

Environmental System Dynamics

ENEV 803 106
3 Credits

Learning Outcomes:

1. Able to analyze the basic principles of the environment as a system with the interaction of environmental components (social, natural and artificial) (C4)
2. Able to predict the amount, concentration, level of danger and the impact of pollutants in the environment (C3)

Expected Learning Outcomes :

Able to carry out continuous performance analysis of work in the Environmental Engineering field from a systemic point of view (ELO 4)

Syllabus:

Basic understanding of environmental systems with natural, artificial and social environmental subsystems; The dynamics of the environmental system (integration of the basic principles of environmental science: interaction, interpedence, diversity, harmony and sustainability); The dynamics of the physical environment system (material and energy cycle, hydrological cycle, food chain and environmental pollution disturbance); Management model of the physical environment system (determining factors, media and the interaction of physical components of the environment in the environmental system); Social system management models (conflict management and environmental mediation); Systems theory (General Theoretical Distinctions, Misunderstandings, Strengths of Systems Theory, Systems Framework, General Systems Theory Principles, System Characteristics, Contingency Theory, The Learning Organization, Application of system dynamics), Dynamics Theory (Basic system behaviour, Exponential growth, Goal seeking, Oscillation, S-shaped growth, S-shaped with overshoot, Overshoot and collapse, Application of system dynamics) Theory Modeling System, (Model classification, Dynamical Systems, System analysis-System dynamics and thinking, Open Systems, General Systems Theory (GST), GST Traits, System Classification, Systems Analysis and Modelling, Activity Modelling (IDEFo), Case Study.

Prerequisite:

References:

1. FTyller Miller, Living in The Environment, McGraw-Hill, Singapore, 1994
2. Amy, The Polities of Environmental Mediation, Columbia University Press, 1987
3. Fisher dkk, Mengelola Konflik Ketrampilan dan Strategi Untuk Bertindak, The British Council, Jakarta, 2000

Special Courses

Pre Master Thesis

ENEV 800 105
2 Credits

Learning Outcomes:

Able to apply specificity knowledge / specialization that has been obtained in conducting initial research, analyzing the results and describing them verbally

through presentation and seminar books

Expected Learning Outcomes :

Experiment, Communication, Lifelong Learning

Syllabus:

Prerequisite: Research Method

References:

Master Thesis

ENEV 800 106
6 Credits

Learning Outcomes:

1. Able to integrate Environmental Engineering knowledge in designing and conducting research in order to solve problems, analyze and interpret research data to obtain valid conclusions
2. Able to analyze and interpret research data to obtain valid conclusions
3. Able to describe and present the results of research in the form of scientific papers (Master Thesis)

Expected Learning Outcomes :

Research/Experiment, Communication, Lifelong Learning

Prerequisite: Research Method and Pre Master Thesis

References: -

Scientific Publication

ENEV 800 107
2 Credits

Learning Outcomes:

Able to explain the results of research in scientific writing using Indonesian / English that is good and correct according to the standards of writing journals / proceedings intended

Expected Learning Outcomes :

Conducting an analysis of effective communication to technical and non-technical audiences (ELO 5)

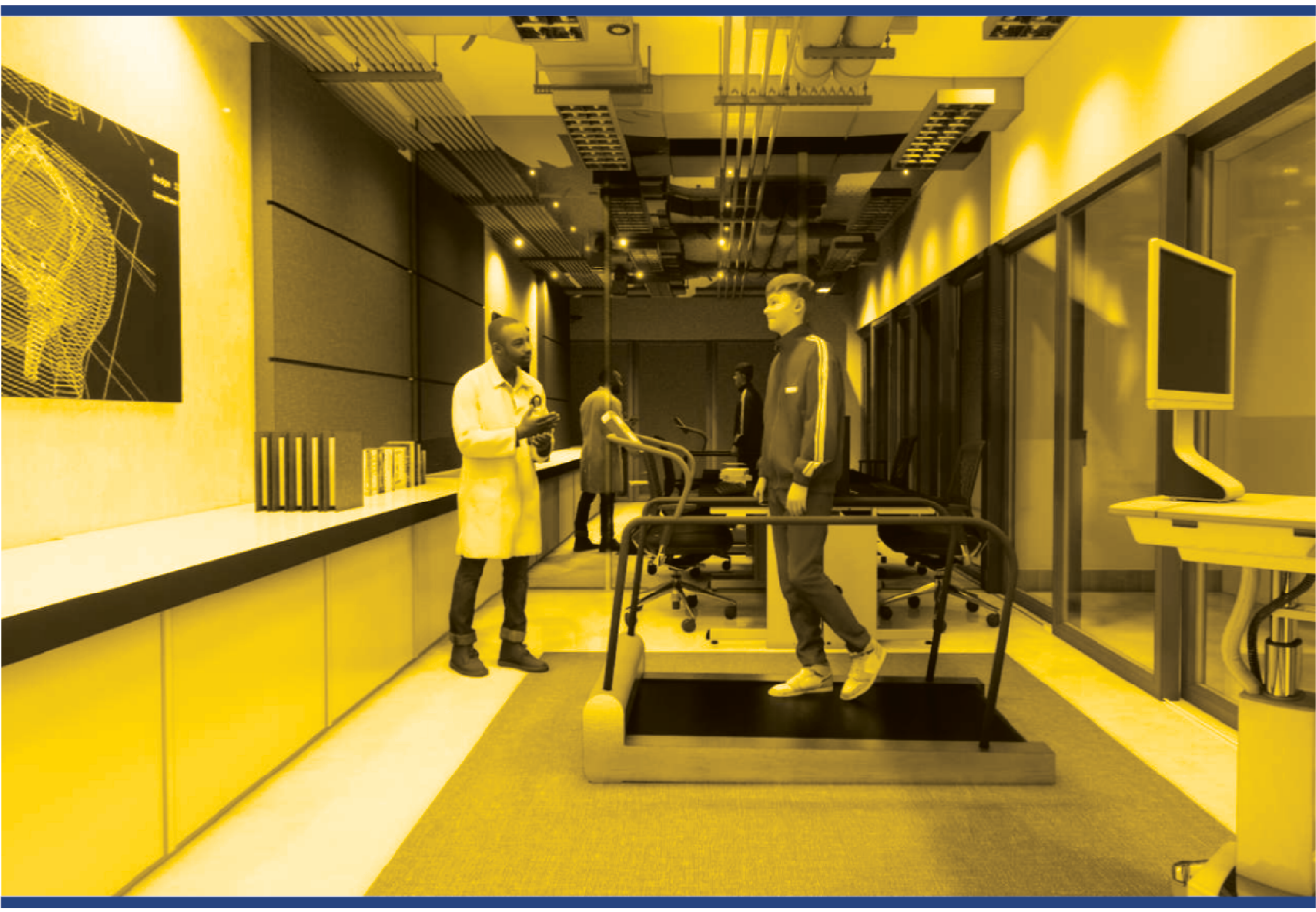
Syllabus: academic writing and effective writing

Prerequisite: Master Thesis

References: Relevant references to the research topic in the Master Thesis

CHAPTER 6

DOCTORAL PROGRAM



Doctoral Program

FTUI holds Doctoral Program for the seven following study programs:

1. Civil Engineering
2. Mechanical Engineering
3. Electrical Engineering
4. Metallurgy & Material Engineering
5. Chemical Engineering
6. Architecture
7. Industrial Engineering

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.

Currently, the Doctoral Program is held in two ways: Lecture & Research; and Research.

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, and for the last five years has produced at the latest: one scientific paper in an accredited national journal or a reputable international journal; or one other form of scientific product which is acknowledge by a group of experts set up by the Academic Senate of 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, and has a relevant expertise in the field with the student's dissertation topic. 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 Specifications

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 Architecture Doctoral Program in Chemical Engineering 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: 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 A from BAN-PT Industrial Engineering Doctoral Program: Accreditation A from BAN-PT	
7.	**Language(s) of Instruction**	Bahasa 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**	Programmed for 3 years	
	Type of Semester	Number of Semester	Number of weeks / semester
	Regular	6	14-17
	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 fields of specialization: • 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 several research focus areas: 1. Manufacturing Systems Engineering • Industrial Policy and Analysis • Value Chain and Logistics • Quality and Reliability • Product/Process Design and Innovation 2. Service Systems Engineering • Product - Service - System • Service Design • Service Quality & Improvement • Decisions, Uncertainty & Risk 3. Optimization and Data Analytics • Operations Research • Data analytics and Forecasting • Real-time optimization
11..	**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. The FTUI Doctoral Program prepares student to work in academic and research in accordance to their own stream; dedicate their expertise in research laboratory, industry or government institution; or create a business based on their innovation. 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.

12..	**Graduates Competencies:** The aim of Doctoral Program in FTUI is in line with the Doctoral Program of Universitas Indonesia, to produce quality graduates with the following competence: 1. Able to independently update their knowledge on science and technology in engineering or architecture through research based innovation breakthrough. 2. Able to show professionalism in their field of study that can be accountable towards the development of science and technology. 3. Able to write a scientific paper in engineering or architecture and convey the result of their research to the public both orally or written in an international scientific activity. 4. Able to recommend a solution for a complex problem faced by society in the field of engineering or architecture through inter, multi and trans discipline approach. 5. Able to lead a working or research team to solve problem in the field of engineering or architecture that can be of benefit for the good of mankind. 6. Able to develop and maintain a network of cooperation with fellow researcher and research community in the field of engineering and architecture both in national and international level.
13.	**Course Composition (Course & Research)**

No.	Classification	Credit Hours (SKS)	Percentage
i	Course Component	16	32%
ii	Research Component	34	68%
	Total	50	100%

14.	Classification of Subjects. (Research)		
No.	**Classification**	**Credit Hours (SKS)**	**Percentage**
i	Course Component	0	0 %
ii	Research Component	50	100 %
	Total	50	100%
	Total Credit Hours to Graduate	50 CP	

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, ENIE for Industrial Engineering

The FTUI Doctoral Program is held in two program: Course and Research and Research.

Doctoral Program (Course & Research)

The following is the curriculum structure for Course & Research Doctoral Program in Table 1.

Table 1. The Curriculum Structure – Doctoral Program in Course and Research

Code	Subject	SKS
	1st Semester	
ENGE901001	Advanced Research Method	6
ENXX900001	Special Subject I	3
	Sub Total	**9**
	2nd Semester	
ENGE902002	Qualitative & Quantitative Analysis	4
ENXX900002	Special Subject II	3
ENXX900004	Research Proposal	6
	Sub Total	**13**
	3rd Semester	
ENXX900006	Publication – International Conference	4
	Sub Total	**4**
	4th Semester	
ENXX900008	Research Result Examination	10
	Sub Total	**10**
	5th Semester	
ENXX900010	Publication International Journal	8
	Sub Total	**8**
	6th Semester	
ENXX900012	Promotion Examination	6
	Sub Total	**6**
	Total	**50**

The Lecture Component includes four subjects:

a. Advanced Research Method, 6 sks
b. Qualitative and Quantitative Analysis, 4 sks
c. Special Subject I, 3 SKS.
d. Special Subject II, 3 SKS.

The Research Component includes:

1. Research Proposal, 6 SKS
2. Publication – International Conference, 4 SKS
3. Research Result Examination, 10 SKS
4. Publication – International Journal, 8 SKS
5. Promotion Exam, 6 SKS

Doctoral Program (Research)

The following is the curriculum structure for Research Doctoral Program in Table 2.

Table 2. The Curriculum Structure – Doctoral Program in Research

Code	Subject	SKS
	1st Semester	
ENXX900003	Research Group Periodic Seminar	6
	Sub Total	**6**
	2nd Semester	
ENXX900005	Research Proposal	6
	Sub Total	**6**
	3rd Semester	
ENXX900007	Publication I – International Conference	6
	Sub Total	**6**
	4th Semester	
ENXX900008	Research Result Examination	10
	Sub Total	**10**
	5th Semester	
ENXX900009	Publication II – National Journal	8
	Sub Total	**8**

	6th Semester	
ENXX900011	Publication III – International Journal	8
ENXX900012	Promotion Examination	6
	Sub Total	**14**
	Total	**50**

Description of Subjects

Advanced Research Method

ENGE901001
6 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, (c) can map research result from the latest international journal in their field and understand the state-of-the-art from their research topic, and can determine the knowledge gap yet explored in the international level for further research in their Doctoral Program.

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

Qualitative and Quantitative Analysis

ENGE902002
4 SKS

Learning Objective(s): Discuss the qualitative and quantitative in data analysis and exploring specific data analysis areas. After participating in this subject which discuss the qualitative and quantitative approach in data analysis in exploring specific areas of data analysis. Students are expected to be able to build the following learning outcome: (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)

Special Subject 1

ENXX900001
4 SKS

Special Subject 2

ENXX900002
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:

1. 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.
2. Students are also allowed to take courses from other study programs within the Faculty of

1. Engineering Universitas Indonesia or courses from other faculties in UI as stated in the Guidance Book or the Master/Doctoral Program Catalog.
2. Students are allowed to take classes in other Master Program in the Faculty of Engineering Universitas Indonesia or other faculties within the Universitas Indonesia as deemed necessary by their Academic Advisor
3. In the event where neither conditions is viable for the students, the Academic Advisor is allowed to conduct a class of said course.

Research Group Periodic Seminar
ENXX900003
6 SKS

Research Group Periodic Seminar is an early activity of research in the Doctoral Program in Research where students conduct literature study in relation to the materials for their research. This literature study must be done intensively by mapping out the research results from the latest international journals in related field. The final aim was so that students have a state-of-the-art understanding of their research topic, and can determine the knowledge gap previously unexplored in the international level for further research in their Doctoral Program. The result of this literature study is compiled in a literature study report presented in the Research Group Periodic Seminar to be examined by a panel comprises of future Promoter/ Academic Advisor and Examiners from related field of study. Students will passed this Research Group Periodic Seminar if they received a minimum grade of B.

Research Proposal
ENXX900005
6 SKS

Research Proposal is the continuous activity of the literature study, where after gaining a state-of-the-art knowledge of their research topic, students can formulize the scope of their Doctoral research and determine which research method will be use. The result of this activity is a comprehensive research proposal which include: goals, background and data analysis from early study or experiments done. Included in this research proposal is plan of work for each semester and its publication goals. At this level, it is expected for students to begin experiment activity or early study which can show the direction of their research is feasible and recent in his field. The early experiment or study result, the literature study and the whole research plan is then compiled in a Research Proposal Report to be presented and examined in a Research Proposal Examination. Students will passed this Research Proposal if they received a minimum grade of B.

Research Result Examination
ENXX900008
10 SKS

At this stage, students are expected to have a research output with a minimum of 75% from their research plan. Doctorate candidate are expected to have reach a research outcome which is the main part of the originally planned contribution. The outcome of this research is measured through the Research Output Examination. The examination committee is appointed through the Dean's Decree based on the Head of Department's proposal. These examiners consist of experts related in the field of study of the Doctorate candidate with at least one examiner from an institution outside of Universitas Indonesia. Doctor Candidate will passed this Research Output Examination if they received a minimum grade of B. At this stage, a Doctor Candidate are allowed to design a scientific article framework to be published in an indexed International Journal and determine which International Journal they will send the article to.

Publication – International Conference
ENXX900006
4 SKS

Publication I – International Conference
ENXX900007
6 SKS

At this stage, students are expected to have an experiment result or study to focused on in their research topic and clarify their research direction. The result of the experiment must also show innovation or breakthrough, mastery of knowledge on their stream in relation to their research topic, the depth of their research materials, and the mastery of the state of the art development in their field or research interest, originality, and the contribution towards science and/or its implementation. Once presented in front of their promoter and co-promoter, the whole research result at this stage will be deemed worthy for international conference publication.

Publication II – International Journal
ENXX900009
8 SKS

Publication III – National Journal
ENXX900011
8 SKS

The scientific publication is an integral part of research activity and a prerequisite in participating in a Promotion Examination. International Journal meant here is an English language journal which its

editorial board consists of member from at least three different countries or more. A mandatory publication must have an "Accepted" status before the Promotion Examination. FTUI itself publish their own international journal, the International Journal of Technology (IJTech), which students can utilize as one of the international journal to publish their Doctoral research.

Promotion Examination

ENXX900012
6 SKS

Before deemed fit to participate in a Promotion Examination. Doctor Candidate are required to conduct additional research as a follow up from the Research Output Examination. The inputs and revisions given during the Research Output Examination must be completed and revised through a series of final research. At this stage, the Doctor Candidate must prove the authencity and originality of their research as new contribution to the scientific world. Thus, at this stage, the Doctor Candidate is required to have an "Accepted" for their international Journal, they are also required to complete their dissertation paper ready to be tested during the Promotion Examination.

Dissertation is an academic scientific paper study output and/or in depth research done independently and contained new contribution to issues that are temporary already known the answer or new questions ask on issues that are seen to have been established in the field of science and technology by the Doctor Candidate under the guidance of his Academic Advisor. A Doctor Candidate that has completed the revision of their dissertation are required to submit a completed version of their dissertation in five hard cover books and original approval form that has been signed by their advisors and submitted to PAF FTUI signifying the end of their study. The format for writing and binding the Dissertation should follow the writing and binding guidelines in the Technical Guidelines of Final Project Writing for Students of Universitas Indonesia that can be downloaded at http://www.ui.ac.id/download.

Promotion Examination is a scheduled academic activity as a medium of evaluation for the Doctor Candidate Dissertation as a requirement to obtain the highest academic title, Doctor. The requirements and provision for Promotion Examination are as follow:

- Promotion Examination can be done if all the scientific publication requirements are completed by the Doctor Candidate: a minimum of one publication in an International Scientific Journal (in "Accepted" status) in relation to their dissertation research. The Publication is required to state Faculty of Engineering Universitas Indonesia as one of the affiliation institution.
- Promoter and Co-Promoter gave a written approval on the dissertation as a sign that the dissertation can move forward to the Promotion Examination.
- The Promotion Examination is carried out by the Committee of Promotion Examination which is appointed with a Rector's Decree based on a proposal from the Head of Department and the Dean of the Faculty of Engineering Universitas Indonesia.
- The Committee of the Promotion Examination comprises of: (a) Promoter and Co-Promoter, (b) The Examiners, (c) a minimum of one examiner from outside of Universitas Indonesia.
- Examiners consist of experts from related field of study. In a special circumstances, an expert that is not from the academic community can be invited as part of the examiners team.
- The Promotion Examination is led by the Head of the Examiners Committee that is also a member of the committee outside of the Promoter/ Co-Promoter and outside examiner. If the Head of the Examiners Committee is unavailable, his/her position can be replaced by one of the member of the examiner team.
- The Promotion Examination is held as an open session for a period of maximum three hours divided into two stages: the dissertation presentation given by the Doctor Candidate for 15-30 minutes and a question and answer session for 120-165 minutes.
- The Doctor Candidate will pass the Promotion Examination if they received a minimum grade of B with GPA 3.00.

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 Master and Doctoral Program

Research funds including consumables and tests for research as part of the thesis and dissertation writing is the responsibility of the student. There are a number of competitive research grants, incentive research grant schemes available from which Master and Doctoral program students may propose to finance his/her research. Complete guidance and research proposal examples are available at the Associate Dean for Research and Community Development secretary at the Dean's Building, 2nd floor or through http://research.eng.ui.ac.id.

International Journal Writing Incentive

This incentives are given to lecturer of State of Private Universities that have published an article in an international journal. Each proposer must be the first writer of the article and include an institution affiliation in Indonesia.

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