COURSE STRUCTURE UNDERGRADUATE CHEMICAL ENGINEERING

KODE	SUBJECT	CREDIT
CODE	**1st Semester**	
Compulsory		
	Academic Writing	3
	Physics Mechanics and Heat	4
	Calculus	4
	Basic Chemistry	2
	Statistics and Probability	2
ENCE611001	Introduction to Chemical Engineering	3
	Total	**18**
Elective		
	Total	**0**
	Total Credit Term 1	**18**
	2nd Semester	
Compulsory		
ENGE 6 0 0007	Physics Electricity, Magnets, Wave, and Optics	4
ENCE612002	Organic Chemistry	3
ENCE612003	Mass and Energy Balances	3
ENCE612004	Basic Chem. and Org. Chem. Lab.	1
	Linear Algebra	4
ENCE612005	Physical Chemistry	3
	Total	**18**
Elective		
	Total	**0**
	Total Credit Term 2	**18**
	3rd Semester	
Compulsory		
ENCE613006	Material Science and Corrosion	3
ENCE613007	Numerical Computation	3
ENCE613008	Instrumental Analytical Chemistry	3
ENCE613009	Fluid and Particle Mechanics	3
ENCE613010	Phys. Chem. and Anal. Chem. Lab.	1
ENCE613011	Chemical Engineering Thermodynamics	4
ENCE613012	Transport Phenomena	3
	Total	**20**
Elective		
	Total	**0**
	Total Credit Term 3	**20**
	4th Semester	
Compulsory		
ENCE614013	Chemical Engineering Modeling	3
ENCE614014	Mass Transfer	4
ENCE614015	Heat Transfer	3
ENCE614016	Process Engineering Drawing	2
ENCE614017	Chemical Process Simulation	3
ENCE614018	Molecular Biology	3
	Health, Safety, and Environment	2
	Total	**20**
Elective		
	Total	**0**
	Total Credit Term 4	**20**
	5th Semester	
Compulsory		
ENCE615019	Chemical Reaction Engineering 1	3

ENCE615020	Process Control	3
	Integrated Character Building Subject	6
	Engineering Economics	3
ENCE615021	Unit Operation Laboratory 1	1
ENCE615022	Industrial Project Management	2
	Total	**18**
Elective		
	Total	**0**
	Total Credit Term 5	**18**
	6th Semester	
Compulsory		
	Integrated Character Building Subject	6
	Sports / Arts	1
	Religion	2
ENCE616023	Unit Operation Laboratory 2	1
ENCE616024	Chemical Reaction Engineering 2	3
ENCE616025	Process Equipment Design	3
ENCE616026	Chemical Product Design	4
	Total	**20**
Elective		
	Total	**0**
	Total Credit Term 6	**20**
	7th Semester	
Compulsory		
ENCE617027	Plant Design	4
ENCE610028	On the Job Training	2
ENCE610029	Research Methodology and Seminar	2
ENCE610030	Capita Selecta	2
	Total	**10**
Elective		
	Elective 1	3
	Elective 2	3
	Elective 3	3
	Total	**9**
	Total Credit Term 7	**19**
	8th Semester	
Compulsory		
ENCE618031	Natural Gas Processing	3
ENCE610032	Skripsi	4
	Total	**7**
Elective		
	Elective 4	3
	Elective 5	3
	Total	**6**
	Total Credit Term 8	**13**

ELECTIVE COURSES

Code	Elective Course for Odd Semester	Credit	Code	Elective Course for Even Semester	Credit
ENCE617101	Applied Termodynamics	3	ENCE618104	Polymer Engineering	3
ENCE617102	Thermodynamic Prop. Hydrocarbons	3	ENCE618105	Controlled Release of Drugs	3
ENCE610103	Special Topics 1	3	ENCE618106	Special Topics 2	3

Resume	General Course of University	15
	General Course of Engineering Faculty	28

	Skill Course	88
	Total	131
	Optional Course	15
	Total Courses Load	146

CHEMICAL ENGINEERING INTERNATIONAL PROGRAM SYLLABUS

TERM 1

Code
Academic Writing
3 SKS
Learning Objectives
Syllabus
Prerequisites
Textbook

ENGE 6 0 0006
Physics Mechanics and Heat
BASIC PHYSICS 1
4 credits

Learning Objectives: Students are able to understand the concepts and basic laws of mechanics physics and applied in a systematic and scientific problem solving which influenced by the force for both moving and not moving objects.
Syllabus: Scale, kinematics of point objects, mechanics of point objects, law of conservation of linear momentum and energy, harmonic motion, gravity, dynamics and kinematics of rigid objects, Introduction and basic concept (pressure, thermodynamic system, state of the system, temperature), expansion, equilibrium energy (thermal state equation), heat transfer, ideal gas, first law of thermodynamics, enthalpy and entropy, The first law of thermodynamics application for open and closed system, Second law of thermodynamics, kinetic theory of ideal gas. Practical of Mechanics: Measurement, Moment of inertia, Gravity acceleration, Fluid density, Scratch coefficient, Collision, Swing torque, Viscosity of water, Young's modulus, Viscosity of Newtonian fluid, Fluids surface tension, Oscillation, Practical of Heat: Coefficient of linear expansion, Heat conductivity, Thermocouple calibration, Calorimeter, Joule Constant, Laplace Constant, Heat Collector, Determining of air Cp/Cv, Expansion of fluids and water anomaly. Notes: For Architecture and Interior Architecture Program, practical is not mandatory.
Prerequisite: -
Textbook:
1. Halliday.D, R Resnick, Fisika I, edisi terjemahan P Silaban, Penerbit Erlangga 1986.
2. Ganijanti AS, Mekanika, Penerbit Salemba Teknik, 2000.
3. Tipler PA, Fisika I, ed III, terjemahan Lea Prasetio, Penerbit Erlangga, 1998.
4. Giancoli D.C, General Physics, Prentice Hall Inc, 1984.
5. Sears-Salinger, Thermodynamics, Kinetic theory and statistical thermodynamics, Wesley, 1975.
6. Giancoli, D.C, Physics: principles with applications, Prentice Hall Inc, 2000

ENGE 6 0 0003
CALCULUS
4 credits

Learning Objectives: After attending this subject, students are expected to capable of:
1. Understanding calculus basic concepts and competent to solve applied calculus problems.
2. Understanding the basic concepts of two or more variables function with its application.
3. Understanding the basic concepts of sequences and series as well as basic concepts of vectors and analytic geometry.

Syllabus: Real number system, non-equivalency, Cartesians Coordination System, mathematic induction, Function and Limit, Continuous Function. Differential including chain's rule, implicit differential, and advanced differential function. Transcendent and differential Function. Applied Differential. Integral, basic integral function, Integration technique. Integral application on Cartesians and polar coordinate, indefinite. Sequences and infinite series. Spare rows and rows of positive change sign, Taylor and McLaurin series. Function of many variables and its derivatives. Maximum and Minimum. Lagrange Methods. Integral folding and its application.
Prerequisite: -
Textbook:
1. D.E.Vanberg and E.J, Purcell, Calculus with Analytic Geometry, 7th ed., Aplleton-Cen-tury-Crofts, 1996.
2. D.E.Vanberg, E.J Purcell, A.J Tromba, Calcu-lus, 9th. Prentice-Hall, 2007.
3. G.B Thomas & R.L Finney, Calculus & Analytic Geometry 9th ed., 1996, Addison-Wesley

ENGE 6 0 0009
BASIC CHEMISTRY
2 Credits

Learning Objectives
Syllabus
Prerequisites
Textbook

ENGE 6 0 0010
STATISTICS AND PROBABILITY
2 Credits

Learning Objectives
Syllabus
Prerequisites
Textbook

ENCE611001
INTRODUCTION TO CHEMICAL ENGINEERING
3 CREDITS

Learning Objectives: Students are able to:
1. Distinguish chemical engineering from the other techniques
2. Explain the development of chemical engineering
4. Understand the fundamentals of chemical engineering of existing processes and systems as well
5. Do simple calculation from mass and energy balance, and know the criteria for process equipment.

Syllabus: Overview of the chemical engineering profession, employment, and the contribution of chemical engineering, chemical engineering code of ethics, processes and equipment of chemical industry, chemical engineering graduate of the criteria according to ABET, Bologna Declaration, and the industry.
Prerequisites:
Textbook:
1. R.N. Shreve and G.T. Austin, Shreve's Chemical Process Industries, McGraw Hill, 1984
2. R.M. Felder and R.W. Rousseau, Elementary Principles of Chemical Processes, 3rd Edition, Wiley 2005
3. R. Schizininger and M. W. Martin. Introduction to Engineering Ethics. Mc. Graw-Hill, 2000.

TERM 2

ENGE 6 0 0007
PHYSICS ELECTRICITY, MAGNETS, WAVE, AND OPTICS
4 CREDITS

Learning Objectives: Students are able to understand:
1. The concept and basic law of physics – electricity and magnetism and apply it systematically and scientifically in solving everyday magnetism and electricity physics problem.
2. The concept and basic law of wave and optical physics and apply systematic and scientific problem solving in a natural wave phenomenon or wave that arises from technical, physical properties of light and geometric optics.

Syllabus: Electric charge and Coulomb law, Electric field, Static and Gauss law, Electric potential, Capacitor, Direct electric current and basic circuit analysis, Magnetic field, Induction and electromagnetic, Faraday law and inductance, Material magnetism properties, A series of transient, Alternating current, Waves, Sounds, Polarization, Interference, Diffraction, Optical geometry, Lighting and photometry. Practical of Electricity: Electrolysis, Wheatstone bridge, Kirchhoff law, Earth's magnetic field, Temperature coefficient, Characteristic of series RLC circuit, Ohm law, Transformer. Practical of Optics: Polarimeter, Lens, Photometry, Prisms bias index, Spectrometer, Diffraction grid, Newton's ring.
Prerequisite: -
Textbook:
1. Halliday, D, R. Resnick, Fisika II,edisi terjema-han P. Silaban, Penerbit Erlangga, 1986.
2. Ganijanti AS, Gelombang dan Optik, ed III, Jurusan Fisika FMIPA UI, 1981.

3. Tipler P.A, Fisika II, ed III terjemahan Bam-bang Sugiyono, Penerbit Erlangga, 2001.
4. D.C.Giancoli, General Physics, Prentice Hall Inc, 1984.

ENCE612002
ORGANIC CHEMISTRY
3 CREDITS

Learning Objectives: Students are able to:
Explain the link structure and stereochemistry, IUPAC name, physical properties, chemical reactivity, and reaction mechanisms
Determine the mechanisms of some organic chemical reactions and be able to estimate how to synthesize a simple organic chemical compounds.
Syllabus: Naming of organic compounds, the role of structure and stereochemistry of the physical / chemical an organic compound, the cracking reactions or free radicals alkane, polymerization of alkenes, aromatic electrophilic substitution on benzene, substitution and elimination reactions of alkyl halidas, acylation and esterification reactions, dehydration-polymerization on carboxylic compound
Prerequisites: -
Textbook:
1. Fessenden, alih bahasa : A. Hadiyana Pujatmaka, Kimia Organik, edisi Kedua Erlangga 1986
2. Morrison, RT and Boyd, RN, Organic Chemistry, 6th ed., Prentice Hall 1998.
3. Organic Chemistry lecture notes

ENCE612003
MASS AND ENERGY BALANCE
3 CREDITS

Learning Objectives: Students are able to solve the problem of mass balances, energy balances, and the combination of it.
Syllabus: Basic concept **of** mass and energy balance in the chemical process, chemical equations and stoichiometry, the principles of mass balance, mass balance with and without chemical reactions, recycle, bypass and purge, the mass balance in the system with lots of tools, general equation of energy balance, enthalpy changes, energy balance application for the system without and with chemical reactions, the solution of system combined heat balance and energy balance.
Prerequisites: -
Textbook:
1. Himmelblau D.M. Basic Principles and Calculation in Chemical Engineering, 6th ed, Prentice Hall 1996
2. G. Reklaitis V. Introduction to Material and Energy Balances, John Wiley 1983
3. Felder, R.M. & R.W. Rousseau. Elemnetary Principle of Chemical Process. John Wiey & Sons inc. 2005.
4. Dictates of Mass and Energy Balance 2001

ENCE612004
BASIC CHEMISTRY AND ORGANIC CHEMISTRY LAB.
2 CREDIT

Learning Objectives: Students are able to prepare a preliminary report on the theory behind the lab module, conducting experiments in the laboratory, process and analyze data from experiments, and create a final report containing the explanation of phenomena that occur during experiments.
Syllabus: General techniques and chemical lab safety aspect, physical and chemical properties, separation and purification of substances, the reaction of metals with acids, water crystals, suspension formed reaction, identification of hydrocarbons, alcohols and phenols identification, identification of carbonyl compounds, carbohydrates, lipid analysis, extraction and identification of fatty acids from corn oil.
Prerequisites: -
Textbook:
1. Fessenden, translation: A. Hadiyana Pujatmaka, Organic Chemistry, Second edition 1986 grants
2. Morrison, RT and Boyd, RN, Organic Chemistry, 6th ed., Prentice Hall 1998.
3. Vogel, Practical Organic Chemistry
4. TGP majors, Organic Chemistry Lab Instructions diktat (Basic Chemistry and Organic Chemistry Guide, Department of Chemical Engineering , FTUI)
5. Fieser, Organic Chemistry

6. Moran, L. dan Masciangioli, T.Safety and Security of Chemical Lab, the National Academies Press, 2010
7. Brown, T.L., H. E. LeMay and B.E. Bursten, Chemistry, ed. 8, Prentice Hall, 2000.
8. Vogel, Anorganic Qualitative Analyze, PT. Kalman Media Pustaka, 1985.

ENGE 6 0 0004
LINEAR ALGEBRA
4 credits

Learning Objectives: Students are able to explain/understand/apply linear algebra and associate this subject with other subjects.
Syllabus: Introduction of elementary linear algebra, Matrix, Determinant, Vectors in R2 and R3. Euclideas vector space, General vector space, Review of vector space, Product space, Value and diagonalization eigen vector, Linier Transformation, Application on the system of differential equation, Application on the quadratic surface, Decomposition of LU, Least Squares.
Prerequisite: -
Textbook:
1. H. Anton, Elementary Linear Algebra, 9th ed, John Wiley& Sons, 2005.
2. G.Strang, Introduction to Linear Algebra, Wellesley-Cambridge Press, 2007.

ENCE612005
PHYSICAL CHEMISTRY
3 CREDITS

Learning Objectives: Students are able to understand the basic concepts of physical chemistry including the topics of thermodynamics, equilibrium reactions, and molecular spectroscopy, and apply these concepts to solve simple problems of chemical physics
Syllabus: pvT properties: gas properties: ideal gas laws, kinetic theory of gases, the viscosity of gas; the properties of liquids and solutions: fluid viscosity, colligative properties of solution, electrolyte solution, Arrhenius and Debye-huckel theory; chemical bond and spectroscopy: atomic orbital, molecular orbital, hybrid orbital, visible light / infrared / ultraviolet spectroscopy; phase and chemical equilibrium: liquid-vapor phase equilibrium and Raoult's law, the application of Le Chatelier's principle to equilibrium reactions.
Prerequisites: -
Textbook:
1. Levine, IN, Physical Chemistry, 6th ed., McGraw-Hill, 2008.
2. Atkins & de Paula, Atkin's Physical Chemistry, 9th ed., Oxford University Press, 2009

TERM 3

ENCE613006
MATERIAL SCIENCE AND CORROSION
3 CREDITS

Learning Objectives
1. Students able to understand the role of materials selection in designing equipment
2. Students able to understand the characteristics of materials
3. Students able to understand corrosion : Process, prevention, testing and protection, as well as calculating and designing simple corrosion protection

Syllabus
1. History of Material Science in human civilization, material science applications in Chemical Engineering
2. Atomic, Molecular, Chemical Bonding and its correlation with the properties of materials
3. Crystal structure
4. Phase Diagram and its relation to the manufacture of metal
5. Mechanical properties of materials and ters equipments
6. Metal and the alloy
7. Corrosion and Chemical Industry
8. The basic concept of corrosion, electrochemical, polarization, passivity
9. The types of corrosion mechanism and its prevention
10. Cathodic protection and inhibitors
11. Corrosion monitoring

Prerequisites : -
Textbook
1. Ilmu Bahan dan Teknologi Bahan (Lawrence H.Van Vlack diterjemahkan oleh Ir. Sriati Djaprie, M.E.,M.Met). Bagian Pendahuluan

ENCE613007
NUMERICAL COMPUTATION
3 CREDITS

Learning Objectives
Syllabus
1. Chemical process system modelling
2. Ordinary differential equations : initial value problem
3. Ordinary differential equations : limits value problem
4. Partial Differential Equations

Prerequisites : -
Textbook
ENCE613008
INSTRUMENTAL ANALYTICAL CHEMISTRY
3 CREDITS

Learning Objectives: Students are able to explain and compare the various basic principles methods of analytical chemistry and its application as well as solve problems by applying the stages of problem solving.
Syllabus: Skill workshop, Electrochemistry process, Potentiometry, Atomic Spectroscopy (AAS), Molecular spectroscopy (IR), Chromatography gas.
Prerequisite: -
Textbook:
1. Day R.A. dan A. L. Underwood, Analisis Kimia kuantitatif (terjemahan), Erlangga, 1986, atau buku aslinya dalam bahasa Inggris.
2. D. A. Skoog, et.al., Fundamentals of Analytical Chemistry, 5th. Ed., Saunders College Publishing, 1988. Atau edisi terbaru
3. G. D. Christian and J. E O'Reilly, Instrumental Analysis, 2nd. Ed., Allyn Bacon Inc., 1986.
4. Donald R. Woods, Problem based learning: How to gain the most from PBL, 2994, Mc-Master University, Hamilton, ON L8S 4L8.

ENCE613009
FLUID AND PARTICLE MECHANICS
3 CREDITS

Learning Objectives: Students are able to apply the phenomenon of fluid flow and particle (continuity equation, Bernoulli, etc) to solve problem in process unit through calculation of energy and force, etc, especially in the fluid flow system of piping, rate measurer and fluid transportation tool, and in the system of fluid-solid flow (fluidization, filtration, sedimentation, particle motion in gas.
Syllabus: Fluid properties; static fluid and its application; basic equation of fluid flow (mass balance and continuity equation, energy balance and Bernoulli Equation); the application of Bernoulli equation to measuring flow rate; friction loss in fluid flow through piping, The equipment of fluid transport: pump, compressor, turbine; high velocity gas flow; particle motion in fluid; fluidization; filtration; sedimentation.
Prerequisite: Transport Phenomena
Textbook:
1. Noel de Nevers, Fluid Mechanics for Chemical Engineers, 2nd Ed., McGraw-Hill, 1991.
2. Bruce R. Munson, Donald F. Young, Theodore H. Okiishi, Fundamentals of Fluid Mechanics, John Wiley & Sons, 2006.

ENCE613010
PHYSICAL CHEMISTRY AND ANALYTICAL CHEMISTRY LAB.
1 CREDIT

Learning Objectives: Students are able to apply the principles of physical chemistry and analytical chemistry which is obtained from the study and the experiments in laboratory, able to explain physical chemistry phenomena, and able to use quantitative and qualitative analysis tools.

Syllabus: Isothermal adsorption, effect of concentration and temperature on reaction rate, three-component liquid systems, colligative properties of solution, chemical equilibrium and Le Chatelier's principle, determination of molecular properties based on gas density, gravimetric analysis, potentiometric methods, spectrophotometry visible light, conductometric methods, gas chromatography.
Prerequisite: Physical Chemistry and Analytical Chemistry Instrumental
Textbook:
1. Kwe Tjien Fe (translation), Practical Guide Physical Chemistry, London, Scholastic 1987
2. Physical Chemistry Lab Instructions FTUI TGP-1989.
3. TGP majors, Organic Chemistry Lab Instructions diktat
4. R. Day A. And A. L. Underwood, Quantitative Chemical Analysis (translation), grants, 1986, or the original book in English.
5. D. A. Skoog, et al, Fundamentals of Analytical Chemistry 5th., Saunders College Publishing, 1998 or latest edition
6. Daniel et al., Experimental Physical Chemistry, 7th ed., McGraw-Hill 1970.

ENCE613011
CHEMICAL ENGINEERING THERMODYNAMICS
4 CREDITS

Learning Objectives: Students are able to explain the basic principles relating to the PVT and thermodynamic properties of pure and mixtures compounds, mass and energy balance, thermodynamic cycles, phase equilibrium and reaction, and be able to apply problem-solving strategies to resolve the thermodynamic problems in a group.
Syllabus: Skills assessment: The first law of thermodynamics: energy, enthalpy, steam tables, mass and energy balance of steady state and non-steady system; second law of thermodynamics and cyclic processes: entropy signification, Rankine cycle and refrigeration cycle; thermodynamic properties of pure and mixed compounds: the amount of residual and partial molar quantities; Equilibrium: Raoult's law and liquid-vapor phase equilibrium, activity coefficients and coefficients fugacity no ideal system, the chemical reaction equilibrium and Le Chatelier's principle; Simulation process: module of thermodynamics properties, phase equilibrium module, and reaction equilibrium module
Prerequisites: -
Textbook:
1. J. M. Smith, H. C. Van Ness, and M. M. Abbott, Introduction for Chemical Engineering Thermodynamic, 5th ed., McGraw-Hill, 1996.
2. Thermodynamics Notes, Kamarza Wulan dan Praswasti PDK Wulan.
3. Donald R. Woods, Problem Based Learning: How to gain the most PBL, 1994, Mc-Master University, Hamilton, ON L8S 4L8.
4. Mulia, K and Wulan, PPDK, Textbook of Chemical Thermodynamics

ENCE613012
TRANSPORT PHENOMENA
3 CREDITS

Learning Objectives: Students can identify and describe as well as analyze momentum, mass, and heat transfer phenomenon, through the application of macroscopic and microscopic balance.
Syllabus: Viscosity and momentum transfer phenomenon, Velocity distribution of laminar flow, Thermal conductivity and energy transfer mechanism, Temperature and concentration distribution in solids and laminar flow, Diffusivity and mass transfer mechanism, Converter equation for isothermal system, Momentum transfer in turbulent flow, Mass and energy transfer in turbulent flow, Transfer between two phases, Macroscopic balance of isothermal and non-isothermal system, Macroscopic balance of multi-component system.
Prerequisites:
Textbook:
1. R. B. Bird, W. E. Stewart and E. N. Lightfoot, Transport Phenomena, 2nd Ed., John Wiley, 2002.
2. J.R. Welty et al., Fundamentals of Momentum, Heat and Mass Transfer, 3rd Ed., Wiley, 1984.
3. Brodkey, R. S and RC Herskey, Transport Phenomena, McGraw-Hill, 1998

TERM 4

ENCE614013
CHEMICAL ENGINEERING MODELING
3 CREDITS

Learning Objectives: Students are able to create a mathematical model of a process system and solve it using numerical methods with the assistance of a programming language
Syllabus: Modeling chemical process systems, equation systems of linear algebra and non-linear algebra; ordinary differential equations: initial value problem and boundary value problem; partial differential equations.
Prerequisites: -
Textbook:
1. Rice, RG. And Duong D. D, Applied Mathematics and Modeling for Chemical Engineers, John Willey & Sons, New York, 1995.
2. Davis, M. E., Numerical Methods and Modeling for Chemical Engineers, John Willey & Sons, New York, 1984
3. Constantinides, A. and Mostouvi, N, Numerical Methods for Chemical Engineers with MATLAB Applications, Prentice Hall, 1999.
4. Tosun, I., Modeling in Transport Phenomena: A Conceptual Approach, Elsevier, 2002.

ENCE614014
MASS TRANSFER
4 CREDITS

Learning Objectives: Students are able to analyze the phenomenon of mass transfer and apply it to solve the problem of unit mass transfer process.
Syllabus: Batch and continuous distillation; a mixture of binary or multiple components, humidification and drying, gas absorption, solvent extraction.
Prerequisites: Chemical engineering thermodynamics, transport phenomena
Textbook:
1. Ketta, John J., Unit Operations Handbook, Vol 2: Mass Transfer, Marcel Dekker 1993
2. Treyball, R. E, Mass Transfer Operations, McGraw-Hill, 1984
3. Coulson, J. M. And J. Richardson R. Chemical Engineering Vol. 2, Pergamon Press. In 1989.

ENCE614015
HEAT TRANSFER
3 CREDITS

Learning Objectives: Students are able to analyze the heat transfer phenomena and apply them to solve problems in heat transfer process unit.
Syllabus: Introduction, skills workshop process, steady-state conduction, unsteady-state conduction, natural and forced convection, radiation.
Prerequisite: Transport Phenomena
Textbook:
1. Holman, J. P., “Heat Transfer (translation: E. Jasjfi), the sixth edition, the publisher, Jakarta 1993.
2. Mc. Adam, W. H., “Heat Transmission”, 3rd Ed., Mgraw-Hill International Book Company, 1981.
3. Kern, D. Q., “Process Heat Transfer”, Mc.Graw-Hill International Book Company, 1984.

ENCE614016
PROCESS ENGINEERING DRAWING
2 CREDITS

Learning Objectives: Students are able to draw it manually process flow diagrams, P & IDs and plant layout, familiar with the use of software for drawing, understand and able to read the meaning of the picture
Syllabus: The importance of engineering drawings, standard rules of the drawing, block diagrams, and symbols of industrial equipment, process flow diagrams, piping and instrumentation symbols, piping and Instrumentation diagram, plot plan, plant layout, isometric piping and equipment.
Prerequisites: -
Textbook:
1. W. Boundy, Engineering Drawing, McGraw-Hill Book Company
2. Colin Simmons and Dennis Maguire, Manual of Engineering Drawing, Edward Arnold
3. ISO 1101, Mechanical Engineering Drawings, International Organization for Standardization
4. Japanese Industrial Standard, Technical Drawing for Mechanical Engineering, Japanese Standard Association.

5. Warren J. Luzadder, Fundamentals of Engineering Drawing, Prentice-Hall, Inc.

ENCE614017
CHEMICAL PROCESS SIMULATION
3 credits

Learning Objectives: Students are able to use the latest chemical engineering software to make the steady state and dynamic simulations, and able to manipulate the process variable and the topology of the unit processes in the chemical industry.
Syllabus: steady state and dynamic models, stream, heat exchanger equipment, piping and rotating equipment, separation equipment, columns and towers, reactors, refrigeration system, the selection of PID controllers for temperature, pressure, level and flow, cascade control, model testing and tuning PID controllers.
Prerequisites: -
Textbook:
1. Fogler, HS, Elements of Chemical Reaction Engineering, Prentice-Hall
2. Douglas, J. M., 1998, Conceptual Design of Chemical Processes, McGraw-Hill, 1988
3. Peter, M.S, and K.D. Timmerhaus, 1991, Plant Design and Economic for Chemical Engineering 4th Edition, McGraw-Hill.
4. HYSYS Steady State Model and Tutorial
5. SuperPro Designer User Guide and Tutorial, intelligent, Inc.

ENCE614018
MOLECULAR BIOLOGY
3 CREDITS

Learning Objectives: Students are able to explain structure and chemical compounds in living things including the function, the synthesis and metabolism of chemical compounds that occur in cells. Chemical compounds include nucleic acids, proteins, carbohydrates, and lipids.
Syllabus: Molecular biology, nucleic acids, structure and replication of DNA and RNA, transcription and translation, amino acids, synthesis and structure of proteins, enzymes, and metabolism.
Prerequisite: -
Textbook:
1. Lehninger Principles of Biochemistry & eBook by Albert Lehninger, David L. Nelson and Michael M. Cox (Jun 15, 2008)
2. Biochemistry (3rd Edition) by Christopher K. Mathews, Kensal E. van Holde and Kevin G. Ahern (Dec 10, 1999)

ENGE 6 0 0012
HEALTH, SAFETY, AND ENVIROMENT
2 credits

Learning Objectives: Students are able to:
1. Identify various types of hazards, characterization, proposes a method which is suitable for risk reduction and mitigation and safety management system design.
2. Increase awareness of health and safety industry, and understand the regulatory framework and standard of safety and environmental programs.

Syllabus: Introduction to Regulation and Standards; Risk Perception, Assessment and Management; Machinery Hazards; Noise Hazards; Process Safety Hazard; Fire and Explosion Hazard; Electrical Hazard; Toxicology in The Workplace; Environmental Protection; Environmental Protection Control Processes; Hazard Communication to Employees; Personal Protective Equipment (PPE): Types of PPE and Selection of PPE; Safety Audits, Incident and Emergency Planning.
Prerequisite: -
Textbook:
1. Charles A. Wentz, Safety, Health and Environ-mental Protection, MGH, 1998.
2. Asfahl, C.R., Rieske, D.W., Industrial Safety and Health Management, 6th Ed., Pearson Education, Inc. 2010.
3. United Kingdom – Health and Safety Executive, http://www.hse.gov.uk/
4. Undang-undang dan Peraturan Nasional terkait dengan Sistem Manajemen K3 dan Lingkungan.
5. Related Journal, standards and Publications.

TERM 5

ENCE615019
CHEMICAL REACTION ENGINEERING 1
3 CREDITS

Learning Objectives: Students are able to comprehend the concept of chemical kinetics and catalysis, design the experiment of kinetics data interpretation, formulate the kinetics models as well as analyze the performance of reaction
Syllabus: Basic concepts of chemical reaction kinetics, chemical reaction thermodynamics, experiments and kinetics data, formulation of kinetic models, the estimation method of constant values of the kinetic model, the sensitivity analysis of the kinetics model, catalyst and the influence of external and internal diffusion of the chemical reaction rate, the effectiveness factor, the effect of heat displacement at the catalytic reaction.

Prerequisites: Physical Chemistry
Textbook:
1. Davis, Mark E. and Davis, Robert J. (2003) Fundamentals of chemical reaction engineering. McGraw-Hill Higher Education, New York, NY.
2. Fogler, H. S., Elements of Chemical Reaction Engineering, Prentice-Hall, 3rd Ed., 1999
3. Fogler, H. S., and LeBlanc, Strategies for Creative Problem Solving, Prentice-Hall, 1995.
4. Levenspiel, O., Chemical Reaction Engineering, 2nd Ed., John Wiley & Sons. Of 1972.
5. K. J. Leidler, Chemical Kinetics, 3rd ed., Harper Publish, 1987
6. Widodo, W. P., Slamet, Lecture diktat of Chemical Kinetics and Reactor Design, TGP-UI, 2002.

ENCE615020
PROCESS CONTROL
3 CREDITS

Learning Objectives: Students are able to design a single loop control system and connected the dynamic process with the performance
Syllabus: Introduction to process control, objectives and benefits of control, the principle of mathematical modeling, process modeling and control analysis, the system dynamic behavior of a typical process, the identification of empirical models, loop-back baited, PID controllers, PID controller tuning, stability analysis,
Prerequisites: Mathematic (calculus and linear algebra), Energy and Mass Balance, Numerical Method
Textbook:
1. T. Marlin, ***Process Control: Designing Processes and Control Systems for Dynamic Performance*****,** 2nd Edition, McGraw-Hill, New York, 2000.
2. D. E Seborg, T. F. Edgar, D. A. Mellichamp, ***Process Dynamics and Control***, John Wiley & Sons, 1989, ISBN 0-471-86389-0
3. Ogata, Katsuhiko, ***Teknik Kontrol Automatik (Sistem Pengaturan), Jilid 1***, Penerbit Erlangga, 1985, Bandung
4. Bequette, R. W., ***Process Dynamics: Modeling, Analysis, and Simulation***, Prentice Hall,1998
5. Luyben, William L., ***Process Modeling, Simulation and Control for Chemical Engineers,*** Second Edition, McGraw-Hill International Edition, 1990
6. Stephanopoulos, George, ***Chemical Process Control: An Introduction to Theory and Practice***, Prentice-Hall International, 1984

UIGE600004
INTEGRATED CHARACTER BUILDING SUBJECT
6 CREDITS

General Instructional Objective: Develop students' participation to improve awareness of social issues, national state, and the environment that is based on faith and piety, manners, and ethics in the context of academics science and technology development.
Learning Objectives: Students are expected to capable of:
1. Understanding, explaining, and analyzing the philosophy and logical science, attitude, social and culture in Indonesia.
2. Understanding academic and nation values from social and cultural diversity in Indonesia.
3. Understanding the problems by applying step learning actively and using information technology.
4. Using Bahasa Indonesia in discussion and academic writing as well.

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

ENCE605018
ENGINEERING ECONOMICS
3 CREDITS
Learning Objectives
Syllabus
Prerequisites
Textbook

ENCE615021
UNIT OPERATION LABORATORY
11 CREDITS

Learning Objectives: Students be able to:
1. Verify the technique of chemical engineering concept in fluid mechanic (CHS 220804), heat transfer (CHS 220807) that applied on tools or process unit.
2. Operate the equipment and measuring the flow rate (orifice meter, venturimeter, rotameter), temperature (thermocouple), process and analyze the data, discussed and took the conclusion, convey the result in the writing report in standard format.

Syllabus: The modules operating unit including: fluid circuit, centrifugal pump, incompressible flow, filtration, fluidization, conduction, convection, double pipe heat exchange, mixing and compounding.
Prerequisites: Fluid Mechanics and Heat Transfer
Textbook: Practical Manual Processes and Operations Teknik1, UI Department of Chemical Engineering

ENCE615022
INDUSTRIAL PROJECT MANAGEMENT
2 CREDITS

Learning Objectives: Students can explain the Project Management correctly and implementing project management in an activity.
Syllabus: Concept Project - Production, Project Life Cycle, Project Selection, Project Planning, Project Implementation, Project Completion & Evaluation.
Prerequisites:
Textbook: Suharto, Imam, Project Management, 1990.

TERM 6

UIGE600020 – 48
SPORTS/ARTS
1 CREDIT
Learning Objectives
Syllabus
Prerequisites
Textbook

UIGE600010-15
RELIGION
2 CREDITS

General instructional objectives: Students have a concern for social issues, national and state based on religious moral values applied in the development of knowledge through intellectual skills.

Learning Objectives: After attending this subject, when students given a problem, students can:
1. Analyzed based on values their religion.
2. Analyzed by applying the steps to active learn.
3. Discuss and express their opinions by using Bahasa Indonesia in right and good manner, both in discussion and paper.

Syllabus: Adapted to the respective religion.
Prerequisite: -
Textbook: Adapted to the problem subject.

ENCE616023
UNIT OPERATION LAB. 2
1 CREDIT

Learning Objectives: Students be able to:
1. Verify the technique of chemical engineering concept in transport phenomena theory (CHS 210802), Heat Transfer (CHS 220807), Process Control (CHS 310806) that applied on tools or process unit.
2. Operate the equipment and measuring the flow rate (orifice meter, venturimeter, rotameter), air humidity (humidity meter), temperature (thermocouple), process and analyze the data, discussed and took the conclusion, convey the result in the writing report in standard format.

Syllabus: The modules operating unit of mass transfer and the process controlling including: measuring the diffusivity coefficient of liquid gas, drainage, wetted wall column, gas absorption, climb film evaporation, flow rate control, pipe reactor.
Prerequisites: Mass Transfer and Process Controlling
Textbook:
1. Practical Manual Processes and Technique Operations 2, UI Department of TGP
2. Literature for the course prerequisites

ENCE616024
CHEMICAL REACTION ENGINEERING 2
3 CREDITS

Learning Objectives: Students are able to design and analyze various types of chemical reactors
Syllabus: The basic concept of chemical reactor design, isothermal ideal reactor designs: batch, CSTR, and PFR / PBR, ideal-isothermal reactor designs: spherical reactor, membrane reactor, micro-reactor, reactor design for multiple reactions, non-isothermal reactor designs: CSTR, multiple steady state, non-isothermal reactor design: PFR / PBR, multi-bed reactor (interstage cooler / heater), multi-phase reactor design (multiple phase), non-ideal reactor design
Prerequisites: Chemical Reaction Engineering 1
Textbook:
1. Fogler, H. S., Elements of Chemical Reaction Engineering, Prentice-Hall, 3rd Ed., 1999
2. Fogler, H. S., and LeBlanc, Strategies for Creative Problem Solving, Prentice-Hall, 1995.
3. Levenspiel, O., Chemcial Reaction Engineering, 2nd Ed., John Wiley & Sons. Of 1972.
4. K. J. Leidler, Chemical Kinetics, 3rd ed., Harper Publish., 1987
5. Widodo, W. P., Slamet, Lecture diktat of Chemical Kinetics and Reactor Design, TGP-UI, 2002

ENCE616025
PROCESS EQUIPMENT DESIGN
3 CREDITS

Learning Objectives: Students are able to design chemical process equipment in accordance with the applicable standards.
Syllabus: Pumps, compressors, piping, pressure vessels and tanks, distillation columns, heat exchangers.
Prerequisites: Fluid Mechanics, Heat Transfer, Mass Transfer, Corrosion Materials Science.
Textbook:
1. Kern, D. Q., “Process Heat Transfer”, Mc.Graw-Hill International Book Company, 1984.
2. Ludwid, Applied Process Design for Chemical and Petrochemical Plant, Vol. 2, Gulf Publishing Co.

ENCE616026
CHEMICAL PRODUCT DESIGN
4 CREDITS

Learning Objectives: Students are able to design chemical products systematically and structured, and analyze the technical and economic feasibility.
Syllabus: An understanding of consumer needs, product specifications, creating and selecting the product concept, product formulation, manufacturing, supply chain, economic.
Prerequisites: Chemical Reaction Engineering 1 (already pass or on taking), Economic Engineering
Textbook:

1. Cussler, L., G. D. Moggridge, 2001, Chemical Product Design, Cambridge University Press
1. Ulrich K. T., Eppinger S. D., 2003, Product Design and Development, 3rd ed., McGraw-Hill
2. Seider W. D., J. Seader D., Lewin D. R., 2004, Product and Product Design Principles. Synthesis, Analysis and Evaluation, Wiley and Sons Inc.
3. Wesselingh, J.A, et al. 2007, Design and Development of Biological, Chemical, Food, and Pharmaceutical Product, John Wiley & Sons

TERM 7

ENCE617027
PLANT DESIGN
4 credits

Learning Objectives: Students are able to design processes and chemical plant and able to analyze the technical and economic feasibility.
Syllabus: Conceptual design of the process / plant, development of PFD,synthesis and analysis the process heuristically, process simulation, rule of thumb the process design and contruction material, heat integrity/process, plant layout, and economic analysis.
Prerequisite: Process Controlling, Equipment Process Design, Simulation of Chemical Engineering, Engineering Economics

Textbook:

1. Douglas, J. M., 1998, Conceptual Design of Chemical Processes, McGraw-Hill.
2. Seider W. D., Seader J. D., Lewin D. R., Sumatri Widagdo, 2008, Product and Product Design Principles. Synthesis, Analysis and Evaluation, Wiley and Sons Inc, 3 edition.
3. Turton, R., R. C. Bailie, W. B. Ehiting and J. A. Shaeiwitz, 1998, Analysis, Synthesis, and Design of Chemical Process, Prentice-Hall
4. Gavin Towler, R K Sinnott, 2012, Chemical Engineering Design: Principles, Practice and Economics of Plant and Process Design, Butterworth-Heinemann, Second Edition.
4. Peter, M. S, and K. D. Timmerhaus, Ronald West, and Max Peters, 2002, Plant Design and Economic for Chemical Engineering, 5 Edition, McGraw-Hill.
5. Biegler L. T, I. E, Grossmann and A. W. Westerberg, 1997, Systematic Methods for Chemical Process Design, Prentice-Hall.
6. Branan, C., 1998, Rule of Thumb for Chemical Engineers : A manual of quick, accurate solutions to everyday process engineering problems, 2nd edition, Gulf Publishing, Co.
7. Wallas, Stanley M. 1990, Chemical Process Equipment : Selection and Design, Buther Worths.
8. Ed Bausbacher, Roger Hunt, 1993, Process Plant Layout and Piping Design, Prentice Hall; 1 edition
9. CHEMCAD Manual, HEATEXET Manual, HYSYS/UNISIM Manual

ENCE610028
ON THE JOB TRAINING
2 CREDITS

Learning Objectives: Students get field experience, capable of analyzing the processes / systems / operations and products in the chemical process industry, and able to apply the process skills: problem solving, interpersonal commu-

nication, working in groups, conduct assessment
Syllabus: -
Prerequisites: Students have to take a minimum of 110 credits (minimum value of D) with a GPA of 2.0
Textbook: -

ENCE610029
RESEARCH METHODOLOGY AND SEMINAR
2 CREDITS

Learning Objectives: Students are able to determine the appropriate method for research activities and produce the ideas, processes, and scientific research in writing and oral.
Syllabus: Introduction, techniques to identify problems and arrange hypotheses, think logically, the techniques of scientific writing, technical writing research proposals, designing research techniques, presentation techniques, techniques to collect data, analyze it and present it.
Prerequisites: Students have to take a minimum of 90 credits (minimum value of D) with a GPA of 2.0
Textbook:
1. Handout
2. Research Proposal Format The preparation of various agencies

ENCE610030
CAPITA SELECTA
2 CREDITS

Learning Objectives: Students are able to explain the development of industry and engineering, business opportunities and the problems it faces in general.
Syllabus: Held with invited guest lecturers who are competent in fields that fit the requirement of each program study (can be different in each semester).
Prerequisite:-
Textbook: -

TERM 8

NATURAL GAS PROCESSING
ENCE618031
3 CREDITS

Learning Objectives: Students are able to design the most appropriate process for the removal of natural gas impurities with the process simulator and able to evaluate the energy consumption of refrigeration system and natural gas liquefaction system
Syllabus: Front-end natural gas processing and products, the physical properties of hydrocarbon systems, systems of units of gas, natural gas dehydration (absorption, adsorption), gas sweetening, sulfur recovery, mercury removal, LPG processing, processing CNG, LNG processing.
Prerequisite: Chemical Engineering Thermodynamics
Textbook:
1. R.N. Maddox and D.J. Morgan, Gas Conditioning & Processing, Vol. 2 & Vol. 4, 4th ed., Campbell Petroleum Series, 2006.
2. John M. Campbell, Gas Conditioning and Processing, Vol. 1 and 2, 2nd Edition Campbell Petroleum Series 1988
3. Arthur L Kohl, Fred C. Riesenheld, “Gas Purification”, chapter 4, 5, 6. Gulf Publishing Company 3rd Ed., 1980.
4. Bukacek, Reading for LNG Processing I & II, 1984.

ENCE610032
UNDERGRADUATE THESIS
4 CREDITS

Learning Objectives: Students are able to analyze the chemical process engineering problems, and use knowledge and science comprehensively to obtain alternative solution, able to make a paper systematically according to rules and able to explain systematically, analytical, orderly, and correct according to thesis contents.

Syllabus: Guide and rule related to undergraduate thesis, the topic is suitable with research topic.
Prerequisite: In accordance with the regulations
Textbook:
1. Guide the practical implementation of the Constitutional Court. Thesis, Depok, 1999.

ELECTIVE COURSES

ODD SEMESTER

ENCE617101
APPLIED THERMODYNAMICS
3 CREDITS

Learning Objectives: Students are able to analyze problems of thermodynamics based on a thorough review including fundamental aspects of thermodynamics, experimental, and green chemistry, based on current information from scientific journals.
Syllabus: The case study of industrial thermodynamic, example cycle processes, phase equilibrium, and chemical reaction equilibrium to process and product engineer; friendly solvents such as supercritical CO_2 and ionic liquid
Prerequisites: Chemical Engineering Thermodynamics
Textbook:
1. References relevant to a given problem.
2. Mulia, K and Wulan, PPDK, Textbook of Chemical Thermodynamics

ENCE617102
THERMODYNAMIC PROPERTIES OF HYDROCARBONS
3 CREDITS

Learning Objectives: Students are able to predict the magnitude of thermodynamic properties of hydrocarbons and the phase condition, either manually or using software calculations.
Syllabus: introduction to hydrocarbon thermodynamics properties, basic thermodynamic concepts, P-V-T data correlations, physical properties of hydrocarbon fluids, computing aided thermodynamics properties, the vapor-liquid behavior of two-phase systems, water-hydrocarbon system behavior, product specifications in the disposal lease of hydrocarbon
Prerequisites: Chemical Engineering Thermodynamics
Textbook:
1. Wayne C. Edmister, Byung Ik Lee, Applied hydrocarbon thermodynamics, Volume 1, Gulf Publishing Company (1988), Houston, Texas.
2. John M. Campbell, Gas Conditioning and Processing, Vol. 1, 8th Edition Campbell Petroleum Series 2001.

ENCE610103
SPECIAL TOPICS 1
3 CREDITS

EVEN SEMESTER

ENCE618104
POLYMER ENGINEERING
3 CREDITS

Learning Objectives: Students are able to explain the basic principles and characteristics of polymer manufacturing until being able to keep abreast of the latest technology.
Syllabus: The concept of polymer and polymer characteristics, synthesis / polymerization, kinetics of polymerization, the polymer solution, characterization, process of making plastics.
Prerequisites: Organic Chemistry
Textbook:
1. R. J. Lovell, Introduction to Polymers, P. A. Lovell, Chapman & Hall.
2. R. B., Seymour, Polymers for Engineering Applications, ASM International.
3. F. W. Billmeyer, Textbook of Polymer Science, Wiley.
4. R. J. Crawford, Plastic Engineering, Pergamon Press.
5. Donald R. Woods, Problem Based Learning: How to gain the most PBL, 1994, Mc-Master University, Hamilton, ON L8S 4L8.

ENCE618105
CONTROLLED RELEASE OF DRUGS
3 CREDITS

Learning Objectives: Students are able to explain the principles of controlled drug release system or bioactive compounds for medical purposes and use these principles to the application of controlled release of drugs.
Syllabus: easily degradable polymeric biomaterials, various encapsulation techniques of drug and bioactive compounds in nano / microspheres, diffusion and permeation, controlled release strategy, the discussion of the case.
Prerequisites: Organic Chemistry
Textbook:
1. Saltzman, WM, Drug Delivery: Engineering Principles for Drug Therapy, Oxford University Press, 2001.
2. Wen, H. and Park, K, ed., Oral Controlled Release Formulation Design and Drug Delivery, Wiley, 2010.

ENCE618106
SPECIAL TOPICS 2
3 CREDITS