CHEMICAL ENGINEERING

Chemical Engineering program was first established by Department of Chemical Engineering in the Faculty of Engineering, King Mongkut's University of Technology Thonburi, was established in 1974 by Professor Dr.Preeda Wibulsawas. Since then, our department has been developed into one of the leading Chemical Engineering Departments in Thailand.

In the academic aspect, our teaching and research programs have been continuously improved to keep pace with such a dynamic learning society in these days. From the original 5-year curriculum with around 200 credits, the program is now run in 4 years with 150 credits. Even though the time and credit have been reduced, our high standard in teaching and the essential structure of curriculum are still maintained. Apart from the regular 4-year undergraduate program, the 2-year Master Degree program (M.Eng.) in Chemical Engineering was commenced in 1982. This program has strengthened our research activities to a large extent even at the present time. The department's research interests cover in several areas. We now have 7 research groups which are involved in the major interests of the present chemical engineering technologies. Our research program, however, has been further improved since the launching of the Ph.D. program in Chemical Engineering in 1991. This program is closely cooperated with some well-established overseas universities such as the University of New South Weles in Australia, and the University of Waterloo in Canada.
In 1997, the department has set out a new school to offer a Master Degree in Chemical Engineering Pratice. This school was called the "Chemical Engineering Practice School" (**ChEPS**). The funding of the school activities is mainly from the National Energy Policy Office (NEPO). Because of its unique curriculum which is focused on solving real industrial problems and working in the real industrial site, the program is now very popular and can draw lots of attentions not only from the chemical engineering students, but also the industries who need to improve their plant performance.

The department is also fully equipped with all kinds of teaching and research facilities, such as multimedia lecture rooms, modern research laboratories with various kinds of analytical equipments (e.g. GC, SEM etc.), a workshop for pilot plant testing, and a computer room with several types of engineering softwares (e.g. process simulation (ASPEN PLUS and HYSYS), and Mathematical Analysis softwares (MATLAB), etc.).

CHEMICAL ENGINEERING

PROGRAM TITLE Bachelor of Engineering Program in Chemical Engineering

DEGREE TITLE Bachelor of Engineering (Chemical Engineering)
B. Eng. (Chemical Engineering)

PROGRAM STRUCTURE

1. General Education Courses	**40**	**Credits**
- Social Sciences and Humanities	13	Credits
- Linguistics	9	Credits
- Sciences and Mathematics	18	Credits
2. Field of Specialization Courses	**104**	**Credits**
- Basic Engineering	44	Credits
- Basic Professional	57	Credits
- Elective Courses	3	Credits
3. Free Elective Courses	**6**	**Credits**
Total Program Credits	**150**	**Credits**

Curriculum

1. General Education Courses **40 Credits**

1.1 Social Sciences and Humanities **13 Credits**

SSC	101	Physical Education	1 (0 - 2 - 2)
SSC	210	Man and Ethics for Quality of Life	3 (2 - 2 - 6)
SSC	260	Introduction to Social Sciences	3 (3 - 0 - 6)
SSC	290	Environment and Development	3 (3 - 0 - 6)
SSC	xxx	Social Science and Humanities Elective	3 (3 - 0 - 6)

The student select 1 Course from the following Courses

SSC	162	Society and Culture	3 (3 - 0 - 6)
SSC	211	General Philosophy	3 (3 - 0 - 6)
SSC	212	Introduction to Ethics	3 (3 - 0 - 6)
SSC	213	Introduction to Logic	3 (3 - 0 - 6)
SSC	214	Ethics and Reasoning	3 (3 - 0 - 6)
SSC	221	History of Civilization	3 (3 - 0 - 6)
SSC	231	General Psychology	3 (3 - 0 - 6)
SSC	241	Principle of Political Science	3 (3 - 0 - 6)
SSC	251	Principles of Jurisprudence	3 (3 - 0 - 6)
SSC	261	Human and Society	3 (3 - 0 - 6)
SSC	271	Managerial Accounting	3 (3 - 0 - 6)
SSC	272	Production Cost	3 (3 - 0 - 6)
SSC	281	Economics	3 (3 - 0 - 6)
SSC	291	Man and Environment	3 (3 - 0 - 6)
SSC	311	Buddhist Philosophy	3 (3 - 0 - 6)
SSC	331	Human Relations	3 (3 - 0 - 6)
SSC	333	Industrial and Organizational Psychology	3 (3 - 0 - 6)
SSC	334	Psychology of Adjustment	3 (3 - 0 - 6)
SSC	335	Managerial Psychology	3 (3 - 0 - 6)
SSC	336	Art and Living	3 (3 - 0 - 6)
SSC	351	Labour Law	3 (3 - 0 - 6)
SSC	371	Marketing	3 (3 - 0 - 6)
SSC	372	Personnel Management	3 (3 - 0 - 6)
SSC	373	Management for Small and Medium Enterprises	3 (3 - 0 - 6)

1.2 Linguistics **9 Credits**

LNG	101	Fundamental English I	3 (2 - 2 - 6)
LNG	102	Fundamental English II	3 (2 - 2 - 6)
LNG	103	Fundamental English III	3 (2 - 2 - 6)
LNG	104	Content – based Language Learning I	3 (2 - 2 - 6)

Note : 1. Student must earn core courses 9 credits.
2. Student must to pass a Placement Test to divide two group.
Group A: LNG 101, LNG 102 and LNG 103
Group B: LNG 102, LNG 103 and LNG 104

1.3 Sciences and Mathematics			**18 Credits**
MTH	101	Calculus and Analytic Geometry I	3 (3 - 0 - 6)
MTH	102	Calculus and Analytic Geometry II	3 (3 - 0 - 6)
CHM	103	Fundamental Chemistry	3 (3 - 0 - 6)
CHM	160	Chemistry Laboratory	1 (0 - 3 - 2)
PHY	103	General Physics I	3 (3 - 0 - 6)
PHY	104	General Physics II	3 (3 - 0 - 6)
PHY	191	General Physics Laboratory I	1 (0 - 3 - 2)
PHY	192	General Physics Laboratory II	1 (0 - 3 - 2)

2. Field of Specialization Courses **104 Credits**

2.1 Basic Engineering			**44 Credits**
MTH	201	Linear Algebra and Vector Calculus	3 (3 - 0 - 6)
MTH	202	Differential Equations	3 (3 - 0 - 6)
MTH	302	Statistics for Engineers	3 (3 - 0 - 6)
MTH	303	Numerical Methods	3 (2 - 2 - 4)
CHE	211	Fluid Mechanics	3 (3 - 0 - 6)
CHE	141	Thermodynamics I	3 (3 - 0 - 6)
CHE	471	Engineering Materials and Selection	3 (3 - 0 - 6)
MEE	111	Engineering Drawing	3 (2 - 3 - 4)
MEE	224	Engineering Mechanics	3 (3 - 0 - 6)
MEE	222	Mechanics of Solids I	3 (3 - 0 - 6)
PRE	103	Production Workshop I	2 (1 - 3 - 2)
PRE	290	Industrial Organization and Management	3 (3 - 0 - 6)
PRE	380	Engineering Economics	3 (3 - 0 - 6)
EEE	102	Electrotechnology I (Power)	3 (2 - 3 - 4)
CPE	100	Computer Programming for Engineers	3 (2 - 2 - 6)

2.2 Basic Professional			**57 Credits**
CHM	213	Organic Chemistry I	3 (3 - 0 - 6)
CHM	214	Organic Chemistry II	3 (3 - 0 - 6)
CHM	261	Organic Chemistry Laboratory I	1 (0 - 3 - 2)
CHM	241	Physical Chemistry I	3 (3 - 0 - 6)
CHM	242	Physical Chemistry II	3 (3 - 0 - 6)
CHM	265	Physical Chemistry Laboratory	1 (0 - 3 - 2)
CHE	103	Material and Energy Balances	3 (3 - 0 - 6)
CHE	142	Thermodynamics II	3 (3 - 0 - 6)
CHE	221	Fundamentals of Heat Transfer	3 (3 - 0 - 6)
CHE	231	Fundamentals of Mass Transfer	3 (3 - 0 - 6)
CHE	301	Chemical Process Industries	3 (2 - 2 - 4)
CHE	312	Chemical Engineering Equipment Operation and Design I	3 (3 - 0 - 6)
CHE	322	Chemical Engineering Equipment Operation and Design II	3 (3 - 0 - 6)
CHE	332	Chemical Engineering Equipment Operation and Design III	3 (3 - 0 - 6)
CHE	343	Chemical Kinetics and Reactor Design	4 (4 - 0 - 8)

CHE	452	Chemical Engineering Plant Design	3 (3 - 0 - 6)
CHE	461	Process Dynamics and Control	3 (3 - 0 - 6)
CHE	481	Chemical Engineering Laboratory I	1 (0 - 3 - 2)
CHE	482	Chemical Engineering Laboratory II	1 (0 - 3 - 2)
CHE	483	Undergraduate Seminar	1 (0 - 2 - 3)
CHE	484	Chemical Engineering Project I	1 (0 - 2 - 3)
CHE	485	Chemical Engineering Project II	3 (0 - 6 - 9)
CHE	300	Industrial Training	2 (S/U)

2.3 Elective Courses **3 Credits**

CHE	451	Mechanical Design of Process Equipment	3 (3 - 0 - 6)
CHE	473	Chemical Plant Safety	3 (3 - 0 - 6)
CHE	510	Polymer Science and Technology	3 (3 - 0 - 6)
CHE	512	Synthetic Membrane Technology	3 (3 - 0 - 6)
CHE	520	Petroleum and Petrochemical Technology	3 (3 - 0 - 6)
CHE	522	Design Know-How I : Natural Gas Industry	3 (3 - 0 - 6)
CHE	523	Design Know-How II : Petrochemical Industry	3 (3 - 0 - 6)
CHE	530	Industrial Waste Treatment	3 (3 - 0 - 6)
CHE	540	Biochemical Engineering	3 (3 - 0 - 6)
CHE	541	Food Science for Chemical Engineering	3 (3 - 0 - 6)
CHE	542	Food Manufacturing	3 (3 - 0 - 6)
CHE	571	Computational Technique in Chemical Engineering I	3 (2 - 2 - 4)
CHE	572	Computational Technique in Chemical Engineering II	3 (2 - 2 - 4)
CHE	573	Problem Solving in Chemical Engineering	3 (3 - 0 - 6)
CHE	591	Independent Study	3 (3 - 0 - 6)
CHE	592	Selected Topics	3 (3 - 0 - 6)

3. Free Elective Courses **6 Credits**

XXX	xxx	Free Elective	3 (3 - 0 - 6)
XXX	xxx	Free Elective	3 (3 - 0 - 6)

At least six credits of free electives can be chosen from any course offered by King Mongkut's University of Technology Thonburi.

STUDY PLAN

- **First Year**

First Semester **Cr (Le - Pr - SS)**

LNG	101	Fundamental English I	3 (2 - 2 - 6)
Or			
LNG	102	Fundamental English II	
CHM	103	Fundamental Chemistry	3 (3 - 0 - 6)
CHM	160	Chemistry Laboratory	1 (0 - 3 - 2)
MTH	101	Calculus and Analytic Geometry I	3 (3 - 0 - 6)
PHY	103	General Physics I	3 (3 - 0 - 6)
PHY	191	General Physics Laboratory I	1 (0 - 3 - 2)
PRE	103	Production Workshop I	2 (1 - 3 - 2)
SSC	210	Man and Ethics for Quality of Life	3 (2 - 2 - 6)
Or			
SSC	260	Introduction to Social Science	
		Total	**19 (15 - 11 - 36)**
			Hours / Week = 62

Second Semester **Cr (Le - Pr - SS)**

LNG	102	Fundamental English II	3 (2 - 2 - 6)
Or			
LNG	103	Fundamental English III	
MEE	111	Engineering Drawing	3 (2 - 3 - 4)
CHM	241	Physical Chemistry I	3 (3 - 0 - 6)
CPE	100	Computer Programming for Engineers	3 (2 - 2 - 6)
PHY	104	General Physics II	3 (3 - 0 - 6)
PHY	192	General Physics Laboratory II	1 (0 - 3 - 2)
MTH	102	Calculus and Analytic Geometry II	3 (3 - 0 - 6)
		Total	**19 (15 - 10 - 36)**
			Hours / Week = 61

- **Second Year**

First Semester **Cr (Le - Pr - SS)**

CHE	103	Material and Energy Balances	3 (3 - 0 - 6)
CHE	141	Thermodynamics I	3 (3 - 0 - 6)
CHM	213	Organic Chemistry I	3 (3 - 0 - 6)
CHM	242	Physical Chemistry II	3 (3 - 0 - 6)
CHM	265	Physical Chemistry Laboratory	1 (0 - 3 - 2)
MTH	201	Linear Algebra and Vector Calculus	3 (3 - 0 - 6)
MEE	224	Engineering Mechanics	3 (3 - 0 - 6)
		Total	**19 (18 - 3 - 38)**
			Hours / Week = 60

Second Semester

			Cr (Le - Pr - SS)
LNG	103	Fundamental English III	3 (2 - 2 - 6) Or
LNG	104	Content – based language learning I	
CHE	142	Thermodynamics II	3 (3 - 0 - 6)
CHE	211	Fluid Mechanics	3 (3 - 0 - 6)
CHM	214	Organic Chemistry II	3 (3 - 0 - 6)
CHM	261	Organic Chemistry Laboratory I	1 (0 - 3 - 2)
MTH	202	Differential Equations	3 (3 - 0 - 6)
SSC	260	Introduction to Social Science	3 (3 - 0 - 6)
Or			
SSC	210	Man and Ethics for Quality of Life	3 (2 - 2 - 6)
		Total	**19 (17 - 5 - 38)**
			Hours / Week = 59

- **Third Year**

First Semester **Cr (Le - Pr - SS)**

CHE	221	Fundamental of Heat Transfer	3 (3 - 0 - 6)
CHE	312	Chemical Engineering Equipment Operation and Design I	3 (3 - 0 - 6)
EEE	102	Electrotecnology I (Power)	3 (2 - 3 - 4)
MEE	222	Mechanics of Solids	3 (3 - 0 - 6)
MTH	302	Statistics for Engineers	3 (3 - 0 - 6)
MTH	303	Numerical Methods	3 (2 - 2 - 4)
		Total	**18 (16 - 5 - 32)**
			Hours / Week = 53

Second Semester **Cr (Le - Pr - SS)**

CHE	231	Fundamentals of Mass Transfer	3 (3 - 0 - 6)
CHE	301	Chemical Process Industries	3 (2 - 2 - 4)
CHE	322	Chemical Engineering Equipment Operation and Design II	3 (3 - 0 - 6)
CHE	343	Chemical Kinetics and Reactor Design	4 (4 - 0 - 8)
CHE	481	Chemical Engineering Laboratory I	1 (0 - 3 - 2)
PRE	380	Engineering Economics	3 (3 - 0 - 6)
SCC	101	Physical Education	1 (0 - 2 - 2)
		Total	**18 (15 - 7 - 34)**
			Hours / Week = 56

Summer Session **Cr (Le - Pr - SS)**

CHE	300	Industrial Training	2 (S/U)

- **Fourth Year**

First Semester **Cr (Le - Pr - SS)**

CHE	332	Chemical Engineering Equipment Operation and Design III	3 (3 - 0 - 6)
CHE	461	Process Dynamics and Control	3 (3 - 0 - 6)
CHE	471	Engineering Materials and Selection	3 (3 - 0 - 6)
CHE	482	Chemical Engineering Laboratory II	1 (0 - 3 - 2)
CHE	483	Undergraduate Seminar	1 (0 - 2 - 3)
CHE	484	Chemical Engineering Project I	1 (0 - 2 - 3)
SSC	xxx	Social Science or Humanities Elective	3 (3 - 0 - 6)
XXX	xxx	Free Elective	3 (3 - 0 - 6)
		Total	**18 (15 - 7 - 38)**
			Hours / Week = 60

Second Semester **Cr (Le - Pr - SS)**

CHE	452	Chemical Engineering Plant Design	3 (3 - 0 - 6)
CHE	xxx	Chemical Engineering Elective	3 (3 - 0 - 6)
CHE	485	Chemical Engineering Project II	3 (0 - 6 - 9)
PRE	290	Industrial Organization & Management	3 (3 - 0 - 6)
SSC	290	Environment and Development	3 (3 - 0 - 6)
XXX	xxx	Free Elective	3 (3 - 0 - 6)
		Total	**18 (15 - 6 - 39)**
			Hours / Week = 60

COURSE DESCRIPTIONS

CHE 103 Material and Energy Balances 3 (3 - 0 - 6)
Prerequisite: none
Basic engineering calculations. Humidity and saturation. Hygrometry and the humidity chart. Solubility and crystallization of two-component systems and three-component systems. Analysis of various material balance problems. General energy balance. Heat of reaction, Heats of solution and mixing. Simultaneous use of material and energy balances for steady state processes. Enthalpy-concentration charts. Humidity charts and their use, Material and energy balances of physical processes and chemical processes.

CHE 141 Thermodynamics I 3 (3 - 0 - 6)
Prerequisite: none
A general balance equation and conserved quantities. Mass balance and energy balance (the first law of thermodynamics). Applications of mass and energy balances. Entropy balance and the second law of thermodynamics. Reversibility. Helmholtz free energy, Gibbs free energy. Entropy changes of matter and application of entropy balance, heat engine, Heat pump, lost work, power generation cycles. Refrigeration. Liquefaction processes, Evaluation of thermodynamic partial derivatives. Evaluation of changes in the thermodynamic properties of real substances, Corresponding state and generalized equation of state, The third law of thermodynamics

CHE 142 Thermodynamics II 3 (3 - 0 - 6)
Prerequisite: CHE 141
Criteria for equilibrium in one-component systems. Stability of thermodynamic systems. Molar Gibbs free energy and fugacity of a pure component. Phase rule for one-component systems. Partial molar properties, Generalized Gibbs-Duhem equation. Criteria for equilibrium in multicomponent systems. Phase rule for multicomponent-system. Ideal gas mixture. Partial molar Gibbs free energy and fugacity of a component in a mixture. Excess mixture properties. Activity coefficient equations. Vapor-liquid equilibria, Liquid-liquid equilibria, Computational calculations of thermodynamic properties and phase equilibria.

CHE 211 Fluid Mechanics 3 (3 - 0 - 6)
Prerequisite: MTH 202 or concurrent
Concepts and definitions. Fluid statics. Control volume for mass balance. Control volume for energy balance. Control volume for Newton's second law of motion. Shear stress in laminar flow. Analysis of a differential fluid element in laminar flow. Differential equations of fluid flow. Inviscid fluid flow. Dimensional analysis.

Boundary-layer theory. The effect of turbulence on momentum transfer. Flow in closed conduits.

CHE 221 Fundamentals of Heat Transfer 3 (3 - 0 - 6)
Prerequisite: CHE 211, CHE 142
Basic mechanisms of heat transfer, Heat conduction: general conduction equation Fourier's law and thermal conductivity. One-dimension, steady-state conduction through plane wall and composite wall without and with heat generation. Conduction in fins. Two-dimension, steady-state conduction. Transient conduction. Convective heat transfer: Mechanism and thermal boundary layer, heat transfer coefficient. Forced convection for external and internal flows. Free convection systems. Boiling and condensation. Heat exchangers Radiation heat transfer: Radiation intensity and blackbody radiation. Surface emission, absorption, reflection and transmission, Kirchoff's law. Gray surfaces. Radiation exchange between surfaces.

CHE 231 Fundamentals of Mass Transfer 3 (3 - 0 - 6)
Prerequisite: CHE 221
Mass transfer processes and basic mechanisms. Important definitions associated with mass transfer by diffusion: Fick's first law of diffusion. General equations for mass transfer. Steady state and one dimensional diffusion with and without chemical reactions. Unsteady-state diffusion. Simultaneous mass and heat transfer, mass and momentum transfer. Convective mass transfer: Mechanism, and determination of convective mass transfer coefficients by analytical methods and by empirical equations. Interphase mass transfer: Two-resistance theory, individual and overall mass transfer coefficients. Analysis of continuous contact interphase mass transfer processes.

CHE 300 Industrial Training 2 (S/U)
A student is required to be trained in the industrial plant for not less than 6 weeks under supervision of staff assigned by the industry and staff of Chemical Engineering Department.

CHE 301 Chemical Process Industries 3 (2 - 2 - 4)
Prerequisite: CHE 103
Introduction to chemical process industries which include raw materials anal chemical reactions leading to products. Principles of separation techniques. Process flow sheets of standard symbols. Process utilities such as water supply, energy and wastes. Illustration of process plants such as paper, cement, sugar, petrochemical and food industries. Visits to industrial plants.

CHE 312 Chemical Engineering Equipment Operation and Design I 3 (3 - 0 - 6)
Prerequisite: CHE 211
Operation and design of fluid and particle mechanical equipment used in the unit operations of chemical engineering. For example, metering of fluids, pumps and compressors, agitation and mixing. Solid-fluid separations, such as filtration, flow through granular beds of solids, fluidization. Centrifugal separation and precipitation. Characterization of particulate solids, size reduction, pneumatic and hydraulic transport, etc.

CHE 322 Chemical Engineering Equipment Operation and Design II 3 (3 - 0 - 6)
Prerequisite: CHE 221
Principles of operation and design of heat transfer equipment for chemical engineering processes, for examples, heat exchangers, condensers, evaporators, cooling towers and dryers.

CHE 332 Chemical Engineering Equipment Operation and Design III 3 (3 - 0 - 6)
Prerequisite: CHE 231
Separation processes for mixtures based on interphase mass transfer, for examples, gas absorption, distillation and extraction. Chemical engineering calculations of interphase mass transfer processes by an equilibrium stage method and diffusional rate method. Design of industrial separation equipment such as plate tower and packed tower etc.

CHE 343 Chemical Kinetics and Reactor Design
Prerequisite: CHE 142 4 (4 - 0 - 8)
Rate analysis for homogenous and heterogeneous in term of chemical reaction kinetics and diffusion and their relations with temperature, Homogenous reaction systems involving multiple reaction. Ideal flows with different characteristics and their material and energy balance equations. Non ideal flow; Residence time distribution of fluid in vessel. Models for non-ideal flow. Heterogeneous reaction systems involving fluid-particle reactions. Design of isothermal reactor; single and multiple reactors, recycle reactor. Non-isothermal reactor, catalysis and catalytic reactor.

CHE 451 Mechanical Design of Process Equipment
Prerequisite : MEE 222 3 (3 - 0 - 6)
Standard mechanical design procedures of process equipment using ASME Codes, API Codes, AWWA Codes and TEME Codes. Design of pressure vessels under the internal pressure and external pressure, openings, connections, flanges, vertical supports and horizontal supports. For example, the design of heat exchangers, storage tanks and distillation columns.

Consideration of vessel thickness, design for safety, welding specification, joint efficiency, pressure testing, inspection and quality control.

CHE 452 Chemical Engineering Plant Design 3 (3 - 0 - 6)
Prerequisite : CHE 312, CHE 322, CHE 332 and CHE 343
The hierarchical approach to conceptual synthesis and design of chemical processes. Selection of batch/continuous processes. Input-output, and recycle structure of the process flowsheet. Separation system. Heat exchanger networks. Cost diagram. Preliminary process optimization. Process retrofit. Safety and waste minimization in process design. Computer application.

CHE 461 Process Dynamics and Control 3 (3 - 0 - 6)
Prerequisite: CHE 231 and CHE 343
Modeling of processes and control systems. Application of Laplace Transform and block diagram in process modeling. Dynamics of first and higher order processes. Measurement device and control elements. Control system analysis and design. Stability of control loops. Advanced control systems, cascade, override etc. Forward and multivariable process control.

CHE 471 Engineering Materials and Selection 3 (3 - 0 - 6)
Prerequisite: none
Introduction to material selection. Engineering Materials and their properties. Mechanical and physical properties of metals and nonmetals. Phase diagram, grain structure and deformation of solids. Factors affecting properties. Processing and treatment of metals and nonmetals. Fundamental of corrosion theory, types of corrosion and corrosion prevention method. Materials selection and uses in engineering design.

CHE 473 Chemical Plant Safety 3 (3 - 0 - 6)
Prerequisite: none
Concept and definitions of chemical plant safety. Management strategies in chemical processes safety. Toxicology and chemical industrial hygiene. Toxic release and dispersion models. Fires and explosions. Design for fire prevention and explosions. Reliefs and relief sizing. Hazard identification and risk assessment. Accident investigations and case study. Personal protective equipment.

CHE 481 Chemical Engineering Laboratory I 1 (0 - 3 -2)
Prerequisite CHE 312
Chemical Engineering Laboratories I and II are designed to expose the students to the mechanisms and operation of the equipment related to fluid mechanics, size reduction/separation, heat and mass transfer, chemical kinetics and process control.

CHE 482 Chemical Engineering Laboratory II 1 (0 - 3 - 2)
Prerequisite: CHE 322 and CHE 332 or concurrent
See CHE 481

CHE 483 Undergraduate Seminar 1 (0 - 2 - 3)
Prerequisite: Fourth year students
The undergraduate seminar requires each student to search a research paper in the areas of chemical engineering and gives a presentation in the class under supervision of an advisor. The fundamental knowledge and references are necessary for analysis and understanding of the content of that research. The students will be trained to give presentation and to participate in academic discussion. Submission of report is required after the presentation.

CHE 484 Chemical Engineering Project I 1 (0 - 2 - 3)
Prerequisite: Fourth year students
The students are required to choose interested research problems (projects) related to chemical engineering. They are encouraged to work in groups under supervision of members of the department. Each group has to prepare a project proposal, which consists of well-defined objectives and methodology of the selected project. The students have to complete the experimental results, prepare the report and pass the oral examination.

CHE 485 Chemical Engineering Project II 3 (0 - 6 - 9)
See CHE 484

CHE 510 Polymer Science and Technology 3 (3 - 0 - 6)
Prerequisite: none
Introduction. Types of polymers. Bonding in polymers. Stereoisomerism. Polymer morphology. Polymer synthesis. Molecular weight characterization and determination (Osmometry, Light scattering, Viscosity measurement, Gel permeation chromatography). Polymer solubility and solutions, Transitions in polymers: Glass transition temperature and melting. Polymer processing. Industrial polymer: Plastics, resins, natural and synthetic rubbers.

CHE 512 Synthetic Membrane Technology 3 (3 - 0 - 6)
Prerequisite: CHM 103, CHE 231
Principles of synthetic membrane separation and concentration processes. Preparation and characterization of synthetic membranes. Theory and mass transfer in membrane separation processes, for examples, reverse osmosis, ultrafiltration, microfiltration and gas separation. Membrane separation equipments and process design. Application of membrane separation processes.

CHE 513 Non-metallic Materials 2 (2 - 0 - 4)
(For non-chemical engineering)
Introduction to polymer. Basic principle of chemistry and structure of polymer. Polymerization processes. Principle of polymer processing. Industrial polymer, plastics, resins, and rubber. Introduction to ceramic materials : insulator and refractory.

CHE 520 Petroleum & Petrochemical Technology
Prerequisite: none 3 (3 - 0 - 6)
Distillation and refining processes used in petroleum industry. Chemistry, and properties of petroleum and refined products. Synthesis processes from natural gas and refined liquids and gases from petroleum refining. Petrochemical industry.

CHE 522 Design Know - How I: Natural Gas Industry
Prerequisite: none 3 (3 - 0 - 6)
Application of underlying principles and theories as well as relevant experiences, knowledge and know-how in designing and calculation data and standard of different technology for practical industrial application. Design of reliable and successful operation of process/system. Safety and hazardous prevention and consideration in design. Analysis and trouble shooting improved design and operation. Emphasis is given to equipment, devices, processes and plants relevant to gas separation industry.

CHE 523 Design Know - How II: Petrochemical Industry
Prerequisite: none 3 (3 - 0 - 6)
Similar to CHE 522. Example and emphasis are, however, given to those relevant to petrochemical Industry.

CHE 530 Industrial Waste Treatment 3 (3 - 0 - 6)
Prerequisite: none
Characteristics and composition of various industrial wastes such as wastewater, air pollution, solid waste and hazardous waste. In-plant waste management. Stream sanitation surveys. Wastewater and other wastes technology as well as concept designs. Waste management, treatment and disposal of industrial solids waste and sludge from wastewater. Criteria setting. Remedial measures for treatment and disposal of industrial wastes.

CHE 540 Biochemical Engineering 3 (3 - 0 - 6)
Prerequisite: none
Biochemical engineering principles of the industrial microbial and enzyme processes that cover the following topics: kinetics of enzyme catalysed reaction, isolation and utilization of enzymes, metabolic pathways and energetics, kinetics of microbe-catalyzed reactions, transport phenomena in microbial systems, design and analysis of bio-reactors, pure culture fermentation and downstream processing.

CHE 541 Food Science for Chemical Engineering
Prerequisite: none 3 (3 - 0 - 6)
Chemical composition of food, their nutritive values and the processing effects. Microorganisms and their effect on food. Principles of food preservation in brief. Food additives and their utilization. Important commodities and processing.

CHE 542 Food Manufacturing 3 (3 - 0 - 6)
Prerequisite: none
Raw materials and post-harvest technology. Thermal processing of foods, (blanching, pasteurization and sterilization), canning, aseptic processing and packaging, drying and dehydration. Intermediate moisture food, extrusion, and microwave cooking. Non-thermal processing: chilling, freezing, ionising radiation, chemical preservation and fermentation Fundamentals of food packaging.

CHE 571 Computational Techniques in Chemical Engineering I 3 (2 - 2 - 4)
Prerequisite: none
Introduction and demonstration of chemical engineering and mathematical softwares, which are used in solving chemical engineering problems in design, simulation and optimization of chemical engineering processes.

CHE 572 Computational Techniques in Chemical Engineering II 3 (2 - 2 - 4)
Prerequisite: CHE 571
This is an advanced course of CHE 571. The aim of this course is to improve the students, skill in applying computer software to analyze, design, optimize, and control chemical processes.

CHE 573 Problem Solving in Chemical Engineering
Prerequisite: none 3 (3 -0 - 6)
This is an introduction course in engineering problem solving and design which consists of problem definition and identification, techniques in data analysis, strategies in problem solving with engineering approaches, decision making and evaluation as well as optimization.

CHE 591 Independent Study 3 (3 - 0 - 6)
Prerequisite: none
Self study on selected topics with guidance from supervisor (s). Chosen topics must be approved by the department.

CHE 592 Selected Topics 3 (3 - 0 - 6)
Prerequisite: none
Teaching of special topics related to chemical engineering which are of current interest.