



THAMMASAT ENGLISH PROGRAMME OF ENGINEERING (TEPE)

Chemical Engineering

(Revision 2004)

Chemical engineering is an applied engineering field covering broad ranges of technical knowledge beginning from basic engineering subjects, chemistry and applied chemistry including specialized major subjects such as material & energy balance, momentum, heat and mass transfer, etc. It studies how to improve the product quality and production process for the benefits of the manufacturers and users.

The recent industrial development in Thailand urges a large demand for chemical engineers. They can pursue their professional careers in a wide range of industrial area such as petroleum and petrochemical industries, pharmaceutical and food industries, consumer products manufacturing, plastic and chemical industries, fiber & textile manufacturing, building materials production, etc. as well as in the research and academic fields.

Curriculum Outline

Overall credits : 146 credits

Curriculum Outline	Total credits
Total credit requirements	146
1. General Courses	48
Part I: General Courses required by Thammasat University	21
- Humanities	3
- Social Sciences	3
- General Sciences and Mathematics	6
- Languages	9
Part II : Engineering Sciences and Mathematics	27
2. Engineering Courses	92
2.1 Core Courses	14
2.2 Major Courses	78
2.2.1 Compulsory Courses	57
2.2.2 Technical Elective Courses	21
2.3 Practical Training (no credit)	0
3. Free Electives	6

*This curriculum may be revised of necessary.



Details of Curriculum

1. General Courses	48	credits
Part I : General Courses required by Thammasat University	21	credits

- Humanities 3 credits
TU 110
 - Social Sciences 3 credits
TU 120
 - General Sciences and Mathematics 6 credits
TU 130, CN 208
 - Languages totally 3 courses 9 credits
 - Thai 1 course 3 credits
 - choose from the following courses TH 161 or TH 160 (for foreign students or with permission of the Thai department)
 - English 6 courses 6 credits
EL 171 EL 172 *EL 214 *EL 215 *EL 314 *EL 315
- Note : * Credits are not counted.

Part II : Engineering Sciences and Mathematics	27	credits
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Students have to complete all of the following compulsory courses

SC 124 SC 133 SC 134 SC 174 SC 183 SC 184

MA 111 MA 112 MA 131 MA 214 MA 251

2. Engineering Courses	92	credits
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2.1 Core Courses	14	credits
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Student must complete totally 14 credits of core courses below.

IE 121 IE 261 CE 100 CE 101 CE 202 ME 111

2.2 Major Courses

Students must complete totally 78 credits below.

2.2.1 Compulsory Courses	57	credits
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Intra-Departmental Courses	54	credits
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AE 202 AE 204 AE 205 AE 213 AE 233

AE 284 AE 285 AE 314 AE 315 AE 323

*This curriculum may be revised if necessary.



AE 334 AE 335 AE 351 AE 371 AE 372

AE 381 AE 422 AE 461 AE 473 AE 482

AE 491

Inter-Departmental Courses 3 credits

LE 209

2.2.2 Elective Courses 21 credits

1. Select from the courses below 12 credits

AE 316 AE336 AE 366 AE 367 AE 406

AE 407 AE 408 AE 409 AE 417 AE 418

AE 419 AE 426 AE 428 AE 429 AE 446

AE 448 AE 449 AE 456 AE 457 AE 458

AE 468 AE 469 AE 476 AE 506 AE 507

2. Minor Degree or Research or Working Practice no less than 9 credits

2.1 *Minor Degree Option* no less than 9 credits

Students must enroll in AE 396 and choose one department within Thammasat University for minor degree. Students must follow the degree requirement of the minor degree elected but the credits taken must be no less than 9 credits

2.2 *Research Option* total 9 credits

Students must enroll in AE 396 ,AE 496 and AE 497

2.3 *Working Practice Option* total 9 credits

AE 498 and AE 499

3. Free Elective 6 credits

Students may choose any courses available within Thammasat University as free electives for 6 credits. Free Electives may include Foreign Language courses.



Remark: Students with grade of 2.00 (C) or with the level (S) in an Engineering course are not allowed to re-enroll in that course unless stated otherwise in the curriculum.



Course Planning

Year 1

Semester 1

Course Number	Title	Credit (lecture-lab-self study)	Prerequisite
CE 100	Ethics for Engineers	0(0-0-0)	-
CE 101	Introduction to Engineering Profession	2(2-0-4)	-
MA 111	Fundamentals of Calculus	3(3-0-6)	-
ME 111	Engineering Graphics	3(2-3-2)	-
IE 121	Engineering Materials I	3(3-0-6)	-
SC 133	Physics for Engineers I	3(3-0-6)	-
SC 183	Physics for Engineers Laboratory I	1(0-3-0)	Used to study and study together with SC 133
EL 171	English Course II	3(3-0-6)	-
TU 130	Integrated Sciences and Technology	3(3-0-6)	-
	Total	21(19-6-36)	

Semester 2

Course Number	Title	Credit (lecture-lab-self study)	Prerequisite
TH 161 Or TH 160*	Thai Usage I Or Thai Usage	3(3-0-6) 3(3-0-6)	-
EL 172	English Course III	3(3-0-6)	EL 171
SC 124	Chemistry for Engineers	3(3-0-6)	-
SC 174	Chemistry for Engineers Laboratory	1(0-3-6)	-
MA 112	Analytic Geometry and Applied Calculus	3(3-0-6)	MA 111
MA 131	Applied Linear Algebra	3(3-0-6)	-
SC 134	Physics for Engineering II	3(3-0-6)	Used to study SC 133
SC 184	Physics for Engineers Laboratory II	1(0-3-0)	Used to study and study together with SC 134
	Total	20(18-6-42)	



Year 2

Semester 1

Course Number	Title	Credits (lecture – lab – self study)	Prerequisite
AE 204	Physical and Analytical Chemistry	4(4-0-8)	-
AE 284	Chemistry Laboratory for Chemical Engineers I	1(0-3-0)	-
CN 208	Introductory Computer Programming	3(2-3-4)	-
CE 202	Engineering Mechanics - Statics	3(3-0-6)	SC 133
MA 214	Differential Equation	3(3-0-6)	MA 112
TU 110	Integrated Humanities	3(3-0-6)	-
IE 261	Engineering Statistics	3(3-0-6)	-
EL 214	Communicative English I	0(0-4-2)	EL 172
	Total	20(18-10-38)	

Semester 2

Course Number	Title	Credits (lecture – lab – self study)	Prerequisite
AE 213	Chemical Engineering Thermodynamics I	3(3-0-6)	-
AE 202	Organic Chemistry	3(3-0-6)	-
AE 205	Material and Energy Balances	3(3-0-6)	-
AE 233	Fluid Mechanics for Chemical Engineering	3(3-0-6)	MA 214
AE 285	Chemical Laboratory for Chemical Engineer II	1(0-3-0)	AE 284
LE 209	Introduction to Electrical Engineering	3(3-0-6)	-
MA 251	Numerical Method and Applications	3(3-0-6)	MA 214
TU 120	Integrated Social Sciences	3(3-0-6)	-
EL 215	Communicative English Course II	0(0-4-2)	EL 214 (or can be taken in the same semester as EL 214 or with the instructor's permission)
	Total	22(21-7-44)	



Year 3

Semester 1

Course	Title	Credits (lecture – lab – self study)	Prerequisite
AE 334	Mass Transfer	3(3-0-6)	AE 205, MA 214
AE 351	Heat Transfer	3(3-0-6)	AE 233
AE 371	Chemical Process Engineering and Industrial Trips	3(3-0-6)	-
AE 372	Chemical Engineering Management	3(3-0-6)	-
AE 314	Chemical Engineering Thermodynamics II	3(3-0-6)	AE 213
AE 315	Reaction Engineering	3(3-0-6)	MA 111
xx xxx	Free Elective	3(3-0-6)	-
EL 314	Communicative English III	0(0-3-3)	EL 215 (or can be taken in the same semester as EL 215 or with the instructor's permission)
	Total	21(21-3-45)	

Semester 2

Course number	Title	Credits (lecture-lab-self study)	Prerequisite
AE 323	Chemical Engineering Safety	3(3-0-6)	-
AE 335	Separations	3(3-0-6)	AE 205
AE 381	Chemical Engineering Laboratory I	1(0-3-0)	AE 233, AE 351
AE xxx	Chemical Engineering Elective	3(3-0-6)	-
AE xxx	Chemical Engineering Elective	3(3-0-6)	-
xx xxx	Free Elective	3(3-0-6)	
xx xxx	Free Elective	3(3-0-6)	
*MA 251	Numerical Methods and Applications	3(3-0-6)	MA 214
EL 315	Communicative English IV	0(0-3-3)	EL 314 (or can be taken in the same semester as EL 314 or with the instructor's permission)
	Total	22(21-6-45)	

** For students ID. 47

Summer

Course number	Title	Credits (lecture-lab-self study)
AE 396	Industrial Training	0 (0-180-0)
		(0-180-0)



Year 4

Semester 1

Course	Title	Credits (lecture – lab – self study)	Prerequisite
AE 422	Industrial Waste Treatment	3(3-0-6)	-
AE 461	Process Dynamics and Control	3(3-0-6)	MA 214, AE 202
AE 473	Chemical Process Design and Economic Evaluation	3(3-0-6)	AE 334, AE 335, AE 351
AE 482	Chemical Engineering Laboratory II	1(0-3-0)	AE 335
AE 491	Chemical Engineering Seminar	1(0-3-0)	Senior Standing or Permission from Instructor
AE 496	Research for Undergraduates I	3(3-0-6)	-
AE xxx	Chemical Engineering Elective	3(3-0-6)	-
AE xxx	Chemical Engineering Elective	0(0-3-3)	-
	Total	17(15-6-33)	

Semester 2

Course number	Title	Credits (lecture-lab-self study)	Prerequisite
AE 497	Research for Undergraduates II	6(0-6-12)	-
AE 498	Co-operative Education in Chemical Engineering	3(0-160-0)	Pass the courses required by the curriculum at least 90 credits and permission from Instructor
AE 499	Co-operative Education in Chemical Engineering II	6(0-320-0)	AE 498
	Total	15(0-486-12)	



Course Descriptions

University's general courses

EL 171 English Course II 3(3-0-6)

Prerequisite : -

This intermediate course aims to develop the four English skills-listening, speaking, reading and writing. Students are required to have more practice in listening comprehension, reading various printed materials and writing short paragraphs.

EL 172 English Course III 3(3-0-6)

Prerequisite : EL 171

This advanced course aims to develop student's English skills. Students are required to have more practice in listening to news and dialogues, reading more complex passages, and writing various types of paragraphs.

EL 214 Communicative English I 0(0-4-2)

Prerequisite : EL 172

In this intermediate course, students will practice the four skills through academic activities such as discussions and group work. This will enable students to communicate effectively with native English speakers.

- Speaking : to improve pronunciation of problematic sounds
- Writing : to study essay writing such as how to write an introduction and a conclusion
- Listening : to practice listening to problematic sounds for Thai students
- Reading : to study vocabulary and practice different reading strategies such as reading for the main idea and critical reading
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Grading criteria : S (Satisfactory) or U (Unsatisfactory)

EL 215 Communicative English II 0(0-4-2)

Prerequisite : EL 214 (or can be taken in the same semester as EL 214 or with the instructor's permission)

In this advanced course, students will be able to have classroom discussions and effectively communicate with English native speakers. Students will do communicative activities in class using English.

- Speaking: to practice academic speaking skills such as oral presentations and speeches.
- Writing: sentence and paragraph writing and summary writing.
- Listening : to study problematic sounds and become familiar with common listening problems.
- Reading: to study reading strategies; for example, speed reading, critical reading, reading extended texts and doing exercises.

Grading criteria: S (Satisfactory) or U (Unsatisfactory)

EL 314 Communicative English III 0(0-3-3)

Prerequisite : EL 215 (or can be taken in the same semester as EL 215 or with the instructor's permission.)



This course aims to prepare students for taking classes in English. Students will be assigned many activities such as oral reports and note-taking. They will practice their four skills through classroom activities. For example

- Speaking : oral presentations, seminars and group discussions
- Writing : academic reports and essays
- Listening : listening to lectures and practice in taking notes.
- Reading : reading extended academic texts and practicing summarizing.

Grading criteria : S (Satisfactory) or U (Unsatisfactory)

EL 315 Communicative English IV 0(0-3-3)

Prerequisite : EL 314 (or can be taken in the same semester as EL 314 or with the instructor's permission)

This course aims to provide students with training and practice in various forms of oral, written and visual presentations. Students will work in groups to produce an academic-style paper, prepare materials for poster presentations, and deliver oral presentation.

Grading criteria : S (Satisfactory) or U (Unsatisfactory)

TH 160 Thai Usage 3(3-0-6)

Prerequisite : -

Study Thai language about alphabet, the sound system, the words and meaning, the structure of sentences. Also, the skills of listening, reading, and writing Thai. Emphasis is placed on encouraging effective communication skills.

TH 161 Thai Usage I 3(3-0-6)

Prerequisite : -

The aim of the theoretical part of the course is to lead into the more important sections, namely the practical ones, and these in turn are designed to promote skills in reading, listening, writing and speaking. All these skills will be achieved through emphasizing the depth of knowledge, ideas, reasoning and development of sound critical faculty. Students will be encouraged to read and criticize various types of writing from a broad perspective. The teaching method with regard to reading, listening, writing and speaking will be based on the principle of integration, with special emphasis on reading and writing.

TU 110 Integrated Humanities 3(3-0-6)

Prerequisite: -

To study different aspects of man from the beginning till now, such as beliefs, intellectual developments and creativities. And how to survive in this changeable world with the problems that we are facing in this globalization technomania society through concentration on one's inner self.

TU 120 Integrated Social Sciences 3(3-0-6)

Prerequisite : -

A study of the origin of social sciences in the modern world, the separation of social science from science, the acceptance of scientific paradigm for the explanation of social phenomenon. Analysis of significant disciplines, concepts and theories in social science by pointing out their strengths and weaknesses when applied to social problems. Analysis of current issues with the application of social theories so that each issue is understood from the individual perspective, group perspective and macro - social, national and world perspectives.

*This curriculum may be revised if necessary.



TU 130 Integrated Science and Technology 3(3-0-6)

Prerequisite: -

A study of scientific concept, theory and rule concerning inorganic particle from the planetary level to particle level, and to molecule and atom levels, the interaction between atom and molecule, chemical and inorganic chemical reaction relating to biological condition of living things and the evolution of life on the planet. The exploring of basic concepts in science and technology that are pertinent to modern day living, important debates concerning the relationship between science and technology and the environment and society and their distinctive features as separate fields of knowledge.

CN 208 Introductory Computer Programming 3(3-0-6)

Prerequisite: -

An introductory level to computer programming. Number systems. Introduction to computer organizations. Algorithms and flowcharts. Approaches for solving problems using a computer. Fundamental concepts of a programming language: data types, operators, variables, constants and expressions. Control structures: sequence, decision, repetition. Subprograms. Composite data structures.

MA 111 Fundamentals of Calculus 3(3-0-6)

Prerequisite: -

Review of the elementary Number system and functions. Calculus of one variable functions: limit continuity the derivative and its applications. Antiderivatives Techniques of Integrations and its applications. Series, Taylor's Theorem and its applications.

MA 112 Analytic Geometry and Applied Calculus 3(3-0-6)

Prerequisite: MA 111

Analytic geometry for Conic sections. Second degree equations. Vectors transformation of coordinates. Polar coordinates and functions of several variables. Partial derivatives. Multiple integrals. Scalar fields and vector fields. Derivative of vector valued functions. Integration in the Vector fields. Gauss's Theorem Green's Theorem and Stoke's Theorem. Fourier and Laplace analysis and their applications.

MA 131 Applied Linear Algebra 3(3-0-6)

Prerequisite: -

Theorems of Matrices. Hermitian matrices and Unitary matrices. LU-factorizations Vector spaces. Linear independence. Dimensions. Rank of matrices. Applications of matrices for solving systems of linear equations. Inverse of matrices. Determinant. Cramer's Rule. Linear transformations. Inner product spaces. Orthogonal complement and least square. Eigenvalues. Eigenvectors and its application. Diagonalization of matrices. Fundamental concepts of tensor.

MA 214 Differential Equation 3(3-0-6)

Prerequisite: MA 112

First-order differential equations. Second-order differential equations. Homogeneous linear equations. Nonhomogeneous linear differential equations. Differential equations of higher order. Series solution of linear differential equations. Partial differential equations. The Laplace transform and Fourier transform. Introduction to nonlinear differential equations. Applications Engineering problem solving.

*This curriculum may be revised if necessary.



MA 251 Numerical Methods and Application 3(3-0-6)

Prerequisite : MA 214

Numerical solutions of one variable equations. Polynomial interpolation. Numerical methods of differential and integration. Numerical solutions of ordinary differential equations. Draw examples in Engineering problem solving. Error Analysis Numerical solutions of systems of linear equations (direct methods and iteration methods) Numerical methods in determining Eigenvalues and Eigenvectors. Finite elements. Use package program for solving Engineering problems.

SC 124 Chemistry for Engineers 3(3-0-6)

Prerequisite : -

Atomic Structure, Chemical Bonds, Gases, Solids, Liquid and Solutions, Chemical Equilibrium, Acids and Bases, Organic Chemistry, The Periodic Table, Transition Elements, Electrochemistry, Chemical Kinetics and Environmental Chemistry.

SC 133 Physics for Engineers I 3(3-0-6)

Prerequisite : -

Motion in one, two and three dimensions, motion and gravitation, work and energy, collides, rotational motion, equilibrium of rigid bodies, elasticity, fluids mechanics, harmonic oscillation, wave motions, sound and wave and applications, heat and kinetics theory, the 1st law and the 2nd of thermodynamics.

SC 134 Physics for Engineers II 3(3-0-6)

Prerequisite : passed SC 133

Electric charge and electric field, Gauss' law electric potential, capacitors and dielectrics, magnetic induction and Faraday's law of induction, inductor, AC circuits, electromagnetic theorem and application, optics (lens and optical equipment, reflection, refraction, interference, diffraction and polarization), modern physics.

SC 174 Chemistry for Engineers Laboratory 1(0-3-0)

Prerequisite : -

Practical work in support of SC 124

SC 183 Physics for Engineers Laboratory I 1(0-3-0)

Prerequisite : Used to study and study together with SC 133

Practical work in support of SC 133

SC 184 Physics for Engineers Laboratory II 1(0-3-0)

Prerequisite : Used to study and study together with SC 134

Practical work in support of SC 134

Core Courses

CE 100 Ethics for Engineers

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(Participate activities organized by the faculty)

Prerequisite: -

*This curriculum may be revised of necessary.



Ethical issues relevant to the engineering profession. Potential impact of technology transfers and implementation with respect to society and its members. Potential problems that may arise are studied along with possible ways to prevent them from occurring and ways to deal with them once they occur.

CE 101 Introduction to Engineering Profession 2(2-0-4)

Prerequisite :

Engineering profession, Role and responsibility, Engineering fields, Curriculum and courses in engineering, Problem solving in engineering, Mathematical and scientific tools, Tests and experiments, Engineers and society and environment, Computers in engineering.

CE 202 Engineering Mechanics - Statics 3(3-0-6)

Prerequisite : SC 133

Equilibrium force analysis. Application of equilibrium equations for structures and machines. Center of gravity. Theorems of Pappus. Beams. Fluid mechanics. Friction. Analysis by inertia for mass. Introduction for bending moment, shear and deflection.

ME 111 Engineering Graphics 3(2-3-4)

Prerequisite: -

The significance of drawing. Instruments and their uses. Lining and lettering. Work preparation. Applied Geometry. Dimensioning and description. Orthographic projection. Pictorial drawing. Freehand sketching. Sectioning. Allowance and tolerance. Computer aided drawing for 2-D and 3-D objects.

IE 121 Engineering Materials 1 3(3-0-6)

Prerequisite: -

Properties and structure of engineering materials such as metal, alloy, ceramics, plastics, rubber, wood and concrete. Phase diagram. Materials characteristics. Materials properties testing. Relation of microstructure and macrostructure with material properties. Manufacturing processes of materials. Effects of heat treatment on microstructure and properties of material.

IE 261 Engineering Statistics 3(3-0-6)

Prerequisite: -

Presenting and analyzing data. Probability theory. Statistics distribution. Sampling theory. Estimation theory; statistical inference. Hypothesis testing. Analysis of variance. Regression and correlation. Using statistical methods as the tool in engineering problem solving.

Major Courses

LE 209 Introduction to Electrical Engineering 3(3-0-6)

Prerequisite: -

Basic circuit theory. Analysis of DC and AC circuits. Electric power systems. Introduction to DC and AC machines: generators and motors. Introduction to analog and digital electronics. Basic theorems and applications in control system engineering. A laboratory work is required to illustrate understanding of the topics covered in this course.

*This curriculum may be revised if necessary.



- AE 202 Organic Chemistry 3(3-0-6)
Prerequisite: -
Bonding in organic molecules. Classes and nomenclature of organic compounds. Characteristic reactions of organic compounds. Reaction mechanism. Stereochemistry. Resonance. Nucleophilic additions and substitutions. Elimination reactions. Electrophilic additions and substitutions.
- AE 204 Physical and Analytical Chemistry 3(3-0-6)
Prerequisite: -
Quantum chemistry. Principles and uses in selected analytical instrument such as thermal analysis instrument, chromatograph, X-ray related instrument, and instrument with spectroscopic method.
- AE 205 Material and Energy Balances 3(3-0-6)
Prerequisite: -
Chemical and physical process calculations. Material and energy balances applied to chemical process systems. Determination of thermodynamic properties needed for such calculations. Sources of data. Calculation procedures. Introductory thermochemistry.
- AE 213 Chemical Engineering Thermodynamics I 3(3-0-6)
Prerequisite: -
The first law of thermodynamics in closed systems. Ideal gas behavior. Properties of pure substances. Equation of state for ideal and real gas. Application of the first law to open systems. The second law of thermodynamics. Entropy. Carnot cycle. Heating and cooling systems. Application of thermodynamic equations.
- AE 233 Fluid Mechanics for Chemical Engineering 3(3-0-6)
Prerequisite: MA214
Mass, momentum, and energy balances on finite and differential systems. Flow characteristics in pipes, and porous media. Navier-Stoke equation. Bernoulli equation. Boundary layers. Non-Newtonian flow. Sedimentation and filtration.
- AE 284 Chemistry Laboratory for Chemical Engineers I 1(0-3-0)
Prerequisite: -
Selected topics in gravimetric analysis, volumetric analysis (including acid-base, precipitation, and oxidation-reduction titrations), and qualitative analysis. Experiment with analytical equipment.
- AE 285 Chemistry Laboratory for Chemical Engineers II 1(0-3-0)
Prerequisite: AE 284
Selected topic in organic synthesis and separation of organic compounds using processes such as crystallization, extraction, and distillation. Selected topics in physical chemistry such as thermodynamics (including enthalpy, equilibrium, and electrochemistry) and kinetics.
- AE 314 Chemical Engineering Thermodynamics II 3(3-0-6)

*This curriculum may be revised if necessary.



Prerequisite: AE 213

Thermodynamic behavior of pure substances and mixtures. Properties of solutions, phase equilibria, electrolyte solution. Chemical equilibria for homogeneous and heterogeneous systems.

AE 315 Reaction Engineering

3(3-0-6)

Prerequisite: MA111

Analysis and prediction of rates of chemical conversion in flow and nonflow processes involving homogeneous and heterogeneous systems. In-depth studies covering heat and mass transfer effects as well as the chemical kinetics of the chemical reaction while exploring the methods of designing chemical reactor.

AE 323 Chemical Engineering Safety

3(3-0-6)

Prerequisite: -

Principles of safety and loss prevention in plant. Types of accidents in chemical operations. Chemical Exposure and Environment. Information on chemicals regulators, prevention and control of chemical hazards instrumentation for safe operations. Personal protective equipment. Safety law and regulations regarding to control and handling of chemicals. HAZOP Analysis for Safety. Dispersion calculations. Risk in the workplace. Application of transport phenomena in predicting long-term effects of chemical pollutants in perspective of assessment of environmental quality.

AE 334 Mass Transfer

3(3-0-6)

Prerequisite: AE 205, MA214

Fick's law. Steady diffusion. Mass transfer coefficients. Mass transfer equipment. Simultaneous heat and mass transfer. Mass transfer with reaction. Absorption, adsorption, humidification, cooling tower, drying, evaporation, fluidization, and membrane separation.

AE 335 Separations Process

3(3-0-6)

Prerequisite: AE 205

Introduction and survey of separations based on phase equilibria, and rate processes. Emphasis on analysis and modeling of separation processes. Staged and countercurrent operations such as distillation and extraction.

AE 336 Transport Phenomena

3(3-0-6)

Prerequisite: AE 205

Viscosity and mechanism of momentum transfer. Thermal conductivity and mechanism of energy transfer. Diffusivity and mechanism of mass transfer. Shell momentum, energy and mass balances. Equations of change and applications to various systems. Transport phenomena in laminar and turbulent flows both in isothermal and non-isothermal systems. Macroscopic momentum, energy and mass balances.

AE 351 Heat Transfer

3(3-0-6)

Prerequisite: AE233



Theories and applications of heat and mass transport phenomena, emphasizing their analogies and contrasts. Fourier's law. Steady thermal conduction. Heat transfer from extended surfaces. Heat transfer coefficients. Condensation and boiling. Radiation and Convection. Heat exchangers.

AE 371 Chemical Process Engineering and Industrial Trips **3(3-3-9)**

Prerequisite: -

Topics including various kinds of chemical process, raw material, energy, types of unit operations. Plant safety and environmental implications in process. Site visit industries to gain perspective knowledge of chemical process.

AE 372 Chemical Engineering Management **3(3-0-6)**

Prerequisite: -

Studies of practical aspects of management with production facility, especially for chemical and related industries, by utilizing the quantitative, economical and system approaches. The topics including basic accounting and balance sheet, business strategy and international competitiveness, quality management, quality control, facility layout, forecasting, future aspects, project management and other current interests.

AE 381 Chemical Engineering Laboratory I **1(0-3-0)**

Prerequisite: AE233, AE351

Physicochemical properties of materials. Fluid mechanics, heat, kinetics and mass transfer experiments illustrating principles and applications of transport phenomena in chemical engineering practices. Lectures on experimental design, instrumentation, laboratory safety, and report writing. Laboratory experiments on fluid mechanics and heat transfers.

AE 422 Industrial Waste Treatment **3(3-0-6)**

Prerequisite:

Industrial processes and wastewater characteristics. Physical principles and design criteria used in separating liquids and solids from liquid, particularly for those having applications in water and waste treatment systems. Fundamental of biological kinetics and process analysis. Aerobic and anaerobic biological treatments and applications in wastewater treatment systems. Use of models as a tool for air quality management. Pollutant dispersion. Fundamentals of mathematical modeling for air pollution modeling and control principles for particulate and gaseous pollutants. Comprehensive overviews on the planning of solid waste management systems.

AE 461 Process Dynamics & Control **3(3-0-6)**

Prerequisite: MA 214, AE 205

Analysis of the dynamic linear and linearized behaviors of chemical processes. Stability analysis. Design of PID controllers. Selections of control and manipulated variables. Root locus, Bode and Nyquist plots. Implementations of computer control systems on laboratory processes and process simulations.

AE 473 Chemical Process Design & Economic Evaluation **3(3-0-6)**

Prerequisite: AE 334, AE335, AE351

A systematic procedure for designing flowsheets for chemical processes. A comprehensive design of a specific process, including economic feasibility studies, estimating costs of equipment, operating costs, and other financial evaluations necessary for determining the profitability of a process.

*This curriculum may be revised if necessary.



AE482 Chemical Engineering Laboratory II

1(0-3-0)

Prerequisite: AE 335

Laboratory investigation of chemical engineering principles applied to equipment design with emphasis on mass transfer operations and separation. Emphasis on investigation of basic important relationships in engineering. Also stress on experimental design, analysis of results, and preparation of engineering reports.

AE491 Chemical Engineering Seminar

1(0-3-0)

Prerequisite: Senior standing or permission from instructor

A seminar is individually given by a student on recent development of research concerning with various fields in chemical engineering. This subject emphasizes on a presentation and writing a report with the correct Thai grammar as well as analysis and discussion supported by engineering knowledge.

AE 316 Chemical Engineering Reactor Design

3(3-0-6)

Prerequisite: AE315

Basic concepts in reactor design and ideal reactor models. Selectivity and optimized considerations in the design of isothermal reactors. Temperature and energy effects in chemical reactors. Study of nonideal flows. Reactor design for catalytic and non-catalytic heterogeneous reactions.

AE 366 Mathematical Techniques for Chemical Engineering

3(3-0-6)

Prerequisite: -

Matrices and determinants properties and special matrices, systems of linear equations and methods of solution by matrices, eigenvalues, eigenvectors and applications to least squares and stage processes. Fourier series, Laplace and Z transforms and applications. Series and numerical solutions. Power, Bessel, Euler, Runge-Kutta, Milne. Finite differences approximations and Crank-Nicholson. Applications applied to chemical engineering problems in fluid flows, heat transfers, mass transfers and chemical reactor analysis.

AE 367 Optimization

3(3-0-6)

Prerequisite: -

Mathematical optimization problem formulation in chemical engineering. Basic optimization theory. General optimization methods. Use of software in process optimization. Analysis and solution of selected practical problems. Tutorials and project assignments.

AE 396 Industrial Training

0(0-180-0)

Prerequisite : Junior standing or permission from instructor

Practical training in industries or research laboratory during summer session for not less than 180 hours must be arranged and supervised by the department. A written report must be submitted to the department. Measuring level is "S" or "U"

AE 406 Special Topics in Chemical Engineering I

2(2-0-4)

Prerequisite: Permission from instructor.

Current interesting topics and modern developments in various fields of chemical engineering.



- AE 407 Special Topics in Chemical Engineering II 2(2-0-4)
Prerequisite: Permission from instructor.
Current interesting topics and modern developments in various fields of chemical engineering.
- AE 408 Special Lectures in Chemical Engineering I 3(3-0-6)
Prerequisite: Permission from instructor.
Current interesting topics and modern developments in various fields of chemical engineering.
- AE 409 Special Lectures in Chemical Engineering II 3(3-0-6)
Prerequisite: Permission from instructor.
Current interesting topics and modern developments in various fields of chemical engineering.
- AE 417 Catalysis 3(3-0-6)
Prerequisite: -
Definition of catalysts. How catalysts effect reaction rates. Structure and characterization of catalysts. Control of catalytic performance. Types of catalysts. Application of catalysis.
- AE 418 Introduction to Statistical Thermodynamics 3(3-0-6)
Prerequisite: AE 314
Review of classical thermodynamics. Phase and chemical equilibrium for multi-component systems. Prediction of thermodynamic functions from molecular properties. Concepts in applied statistical mechanics. Equilibrium Theories of liquids.
- AE 419 Applications of Statistical Thermodynamics and Computer Simulation Techniques 3(3-0-6)
Prerequisite: AE 314
Applications of statistical mechanics in chemical engineering. Ensembles. Monatomic and polatomic ideal gases. Ideal lattices; adsorption and polymer elasticity. Imperfect gases. Dense liquids. Computer simulation techniques.
- AE 426 Pollution Prevention 3(3-0-6)
Prerequisite: -
The continuous application of an integration of preventative environmental and business strategies for procuring resources, producing and processing products, and/or providing services at higher efficiency, increased profitability, and at reduced risks to the environment. Realizations of P2 for production processes including conserving raw materials, water and energy; eliminating toxic and dangerous raw materials, and reducing the quantity of toxicity of all emissions and waters at source during the production process. Reduction of the environmental, health and safety impact of products over their entire life cycles, from raw material extraction, through manufacturing and use, to the ultimate disposal of the product by using Life Cycle Assessment technique.
- AE 428 Biochemical Engineering 3(3-0-6)
Prerequisite: AE 315
Biochemical and engineering principles of industrial microbial and enzyme processes. Microbiology and biochemistry. Review of kinetics of enzyme catalyzed reactions. Biomass production. Transportation phenomena in microbial systems. Design and analysis of biological reactors.

*This curriculum may be revised if necessary.



- AE 429 Life Cycle Assessment** 3(3-0-6)
Prerequisite: -
Principles of Life Cycle Assessment. Product systems. Goal and scope definition. Inventory. Unit processes. Environmental effect potential. Impact assessment. Computer simulation of product systems. Use of LCA in product development. Environmental comparison of products and applications.
- AE 446 Plastic and Waste Recycling Technology** 3(3-0-6)
Prerequisite: -
Basic methods for recycling and reuse agro-industrial wastes. Recycling technology focusing on composite plastics and rubbers. Plastic collections and separations. Cost and markets for recycled plastics. Examples of recycling and reuses, including recycling of automobile tires.
- AE 448 Corrosion Technology** 3(3-0-6)
Prerequisite: AE 315
Corrosion phenomena and definitions. Electrochemical aspects including reaction mechanisms. Thermodynamics. Pourbaix diagrams. Kinetics of corrosion processes. Cathodic and anodic protection. Coatings and inhibitors. Materials selection and uses.
- AE 449 Introduction to Polymer Technology** 3(3-0-6)
Prerequisite: -
Introduction to the chemistry and physical status of polymer materials. Discussion of the formation of polymers from corresponding monomers, emphasizing mechanisms and kinetics of various polymerization techniques. Measurements of average molecular weights and molecular weight distribution of polymers. Viscosity and rheology of polymer solutions and melts.
- AE 456 Combustion and the Environment** 3(3-0-6)
Prerequisite: -
Introduction to combustion. Combustion chemistry. Environmental concerns of major pollutants, such as carbon monoxide, nitrogen oxides, sulphur oxides, and related environmental legislation. Analytical techniques for monitoring emissions of pollutants. Pollution control techniques. Combustion modelling. Combustion technologies.
- AE 457 Petroleum & Petrochemical Technology** 3(3-0-6)
Prerequisite: AE 202
Nature and chemistry of petroleum. Separation process of petroleum. Various petroleum derivatives. Chemical and physical properties of petroleum derivatives. Main petrochemical production processes such as ethylene, propylene, polystyrene, benzene, toluene, and xylene.
- AE 458 Natural Gas Processing** 3(3-0-6)
Prerequisite: Senior standing or permission from instructor.
Condition of gases. Processing of a gas for its liquids. Design of absorption and rectification columns.
- AE 468 Design and Analysis of Experiments for Chemical Engineering Processes** 3(3-0-6)



- Prerequisite:* -
Statistical design of experiments and the analysis of experimental data from chemical engineering processes. Empirical modelling of process behaviour. Applications of factorial and fractional factorial experimental designs in screening studies.
- AE 469 Chemical Engineering Process Simulation** **3(3-0-6)**
Prerequisite: -
Process simulations by using a well-known commercial software to study the effects of various factors on chemical engineering processes.
- AE 476 Chemical Product Design** **3(3-0-6)**
Prerequisite: -
Basic sequence of ideas involving technical knowledge required in designing specific products. Products include specialty chemicals, such as pharmaceuticals etc.
- AE 496 Research for Undergraduates I** **3(0-3-0)**
Prerequisite : -
Original research under direction of one of the members of the staff. The topics including chemical engineering design instruction and experience in special projects, such as industrially motivated, timely, or interdisciplinary projects. Project subject and content varies.
- AE 497 Research for Undergraduates II** **6(0-6-0)**
Prerequisite : -
Original research under direction of one of the members of the staff. The topics including chemical engineering design instruction and experience in special projects, such as industrially motivated, timely, or interdisciplinary projects. Project subject and content varies.
- AE 498 Co-operative Education in Chemical Engineering I** **3(0-160-0)**
Prerequisite : *Permission from instructor*
Working in chemical industrial at least 4 months under supervision of industrial supervisor and the faculty staff. A written report and oral presentation are required.
- AE 499 Co-operative Education in Chemical Engineering II** **6(0-320-0)**
Prerequisite : *Permission from instructor*
Working in chemical industrial at least 4 months under supervision of industrial supervisor and the faculty staff. A written report and oral presentation are required.
- AE 506 Special Lectures in Chemical Engineering III** **3(3-0-6)**
Prerequisite: *Permission from instructor.*
Current interesting topics and modern developments in various fields of chemical engineering.
- AE 507 Special Topics in Chemical Engineering III** **2(2-0-4)**
Prerequisite: *Permission from instructor.*

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CHEMICAL ENGINEERING

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