

Study Plan: Chemical Engineering

First year student (First semester)

Code	Subject	Credits
		(Theory-Laboratory-Self learning)
010323301	วิศวกรรมกระบวนการเคมี (Chemical Process Engineering)	3(3-0-6)
010323592	ภาษาอังกฤษเพื่อการศึกษา 1 (English for Academic Purposes I)	3(3-0-6)
010403099	การเขียนแบบวิศวกรรม (Engineering Drawing)	3(2-2-5)
040113001	เคมีสำหรับวิศวกร (Chemistry for Engineers)	3(3-0-6)
040113002	ปฏิบัติการเคมีสำหรับวิศวกร (Chemistry Laboratory for Engineers)	1(0-3-1)
040203111	คณิตศาสตร์วิศวกรรม 1 (Engineering Mathematics I)	3(3-0-6)
040313005	ฟิสิกส์ 1 (Physics I)	3(3-0-6)
040313006	ปฏิบัติการฟิสิกส์ 1 (Physics Laboratory I)	1(0-2-1)
0803xxxxx	วิชาเลือกในกลุ่มวิชาพลศึกษา (Physical Education Elective Course)	1(x-x-x)
	Total	21(x-x-x)

First year student (Second semester)

Code	Subject	Credits
		(Theory-Laboratory-Self learning)
010323102	ปฏิบัติการฟิสิกส์เคมีพื้นฐานสำหรับวิศวกรเคมี (Physico-chemical Laboratory for Chemical Engineers)	1(0-3-1)
010323105	ดุลมวลสารและพลังงาน (Material and Energy Balance)	3(3-0-6)
010323593	ภาษาอังกฤษเพื่อการศึกษา 2 (English for Academic Purposes II)	3(3-0-6)
010403096	การโปรแกรมคอมพิวเตอร์ (Computer Programming)	3(2-2-5)
010403098	วัสดุวิศวกรรม (Engineering Materials)	3(3-0-6)
040203112	คณิตศาสตร์วิศวกรรม 2 (Engineering Mathematics II)	3(3-0-6)
040313007	ฟิสิกส์ 2 (Physics II)	3(3-0-6)
040313008	ปฏิบัติการฟิสิกส์ 2 (Physics Laboratory II)	1(0-2-1)
0803xxxxx	วิชาเลือกในกลุ่มวิชาพลศึกษา (Physical Education Elective Course)	1(x-x-x)
	Total	21(x-x-x)

Second year student (First semester)

Code	Subject	Credits
		(Theory-Laboratory-Self learning)
010323107	อุณหพลศาสตร์วิศวกรรมเคมี 1 (Chemical Engineering Thermodynamics I)	3(3-0-6)
010323111	อุปกรณ์การควบคุมกระบวนการ (Process Control Instrumentation)	3(3-0-6)
010323401	การเรียนรู้โดยใช้ปัญหาเป็นหลัก 1* (Problem Based Learning I)	(S/U)1(0-3-1)
010403097	สถิตยศาสตร์วิศวกรรม (Engineering Statics)	3(3-0-6)
040203211	คณิตศาสตร์วิศวกรรม 3 (Engineering Mathematics III)	3(3-0-6)
040503011	สถิติสำหรับวิศวกรและนักวิทยาศาสตร์ (Statistics for Engineers and Scientists)	3(3-0-6)
xxxxxxxx	วิชาเลือกในกลุ่มวิชาภาษา (Language Elective Course)	3(x-x-x)
xxxxxxxx	วิชาเลือกในหมวดวิชาศึกษาทั่วไป 1 (General Education Elective Course I)	1(x-x-x)
	Total	19(x-x-x)

Second year student (Second semester)

Code	Subject	Credits
		(Theory-Laboratory-Self learning)
010323103	คณิตศาสตร์สำหรับวิศวกรเคมี (Mathematics for Chemical Engineers)	3(3-0-6)
010323104	กลศาสตร์วัสดุและการออกแบบอุปกรณ์ในกระบวนการ (Mechanics of Material and Process Equipment Design)	3(3-0-6)
010323106	ปรากฏการณ์การถ่ายโอน 1 (Transport Phenomena I)	3(3-0-6)
010323108	อุณหพลศาสตร์วิศวกรรมเคมี 2 (Chemical Engineering Thermodynamics II)	3(3-0-6)
010323302	ปฏิบัติการเฉพาะหน่วยทางกล (Mechanical Unit Operation)	3(3-0-6)
010323303	ปฏิบัติการในวิชาปฏิบัติการเฉพาะหน่วยทางกล (Mechanical Unit Operation Laboratory)	1(0-3-1)
010323402	การเรียนรู้โดยใช้ปัญหาเป็นหลัก 2* (Problem Based Learning II)	(S/U) 1(0-3-1)
xxxxxxxx	วิชาเลือกในกลุ่มวิชาภาษา (Language Elective Course)	3(x-x-x)
	Total	19(x-x-x)

Third year student (First semester)

Code	Subject	Credits
	(Theory-Laboratory-Self learning)	
010323110	ปรากฏการณ์การถ่ายโอน 2 (Transport Phenomena II)	3(3-0-6)
010323304	ปฏิบัติการเฉพาะหน่วยทางวิศวกรรมเคมี (Chemical Engineering Unit Operation)	3(3-0-6)
010323305	ปฏิบัติการในวิชาปฏิบัติการเฉพาะหน่วยทางวิศวกรรมเคมี (Chemical Engineering Unit Operation Laboratory)	1(0-3-1)
010323306	วิศวกรรมปฏิกิริยาเคมีและการออกแบบเครื่องปฏิกรณ์เคมี (Chemical Reaction Engineering and Reactor Design)	3(3-0-6)
010323310	พลศาสตร์และการควบคุมกระบวนการ (Process Dynamics and Control)	3(3-0-6)
010323403	การเรียนรู้โดยใช้ปัญหาเป็นหลัก 3* (Problem Based Learning III)	(S/U) 1(0-3-1)
xxxxxxxx	วิชาเลือกในหมวดวิชาศึกษาทั่วไป 2 (General Education Elective Course 2)	3(x-x-x)
xxxxxxxx	วิชาเลือกในหมวดวิชาศึกษาทั่วไป 3 (General Education Elective Course 3)	3(x-x-x)
	Total	19(x-x-x)

Third year student (Second semester)

Code	Subject	Credits
		(Theory-Laboratory-Self learning)
010323201	ความปลอดภัยในการปฏิบัติการทางเคมี (Safety in Chemical Operations)	3(3-0-6)
010323202	เทคโนโลยีสิ่งแวดล้อม (Environmental Technology)	3(3-0-6)
010323309	การออกแบบโรงงานทางวิศวกรรมเคมี (Chemical Engineering Plant Design)	3(3-0-6)
010323311	โครงการปฏิบัติการวิศวกรรมเคมี (Chemical Engineering Laboratory Project)	2(0-6-3)
010323405	โครงการออกแบบทางวิศวกรรมเคมี (Chemical Engineering Design Project)	3(0-9-3)
xxxxxxxx	วิชาเลือกในกลุ่มวิชาวิทยาศาสตร์และคณิตศาสตร์ (Science and Mathematics Elective Course)	3(x-x-x)
xxxxxxxx	วิชาเลือกในหมวดวิชาศึกษาทั่วไป 4 (General Education Elective Course 4)	3(x-x-x)
	Total	20(x-x-x)

Fourth year student (First semester)

Code	Subject	Credits
		(Theory-Laboratory-Self learning)
010323308	เศรษฐศาสตร์และการประเมินราคาทางวิศวกรรมเคมี (Chemical Engineering Economics and Cost Estimation)	3(3-0-6)
010323406	โครงการวิศวกรรมเคมี 1 (Chemical Engineering Project I)	1(0-3-1)
0103xxxxx	วิชาเลือกทางวิศวกรรมเคมี (Chemical Engineering Elective Course)	3(x-x-x)
xxxxxxxxx	วิชาเลือกในกลุ่มวิชามนุษยศาสตร์และสังคมศาสตร์ (Humanities and Social Science Elective course)	3(x-x-x)
	Total	10(x-x-x)

Fourth year student (Second semester)

Code	Subject	Credits
		(Theory-Laboratory-Self learning)
010323407	โครงการวิศวกรรมเคมี 2 (Chemical Engineering Project II)	3(0-9-3)
0103xxxxx	วิชาเลือกทางวิศวกรรมเคมี (Chemical Engineering Elective Course)	3(x-x-x)
xxxxxxxxx	วิชาเลือกเสรี (Free Elective Course)	3(x-x-x)
xxxxxxxxx	วิชาเลือกเสรี (Free Elective Course)	3(x-x-x)
	Total	12(x-x-x)

010323102 (Physico-chemical Laboratory for Chemical Engineers) 1(0-3-1)

Prerequisite : None

Experiments to study physico-chemical properties; density; melting point; viscosity and conductivity; flash point and specific gravity determination, study of vapor-liquid equilibrium, chemical equilibrium, heating value, turbidity and water hardness, coagulation.

010323103 (Mathematics for Chemical Engineers) 3(3-0-6)

Prerequisite : 130203103 Engineering Mathematics III

Numerical method for solving for root of equations, system of linear equations, curve fitting and interpolation, numerical differentiation and integration, solution of ordinary and partial differential equations.

010323104 Mechanics of Material and Process Equipment Design 3(3-0-6)

Prerequisite : 010403097 Engineering Statics

Mechanical properties of engineering materials, stress and strain, stresses due to static and fatigue loads, stresses caused by torsion, shearing force and bending moment diagrams, bending stresses and shear stresses caused by bending, stresses in thin cylinder and spherical shell, deflection of beams, combined stresses and Mohr's circle of stresses, elastic stability of columns, theories of failure; design of pressure vessels under internal and external pressure; supports for vessels, lug supports, leg supports, skirt supports and saddle supports, design of openings.

010323105 Material and Energy Balance 3(3-0-6)

Prerequisite : 010322301 Chemical Process Engineering

Basic calculations for chemical engineers, material and energy balances of a single unit and overall processes, problem solving and analysis of steady chemical processes using a simultaneous material and energy balances.

010323106 Transport Phenomena 1 3(3-0-6)

Prerequisite : None

Properties of fluids, fluid statics, mass, momentum and energy balance equations, equation of continuity and equation of change, dimensional analysis and similitude, incompressible flow, measurement techniques for fluid flow, modes of heat transfer and application, analysis of steady state and transient heat conduction, fundamentals of mass transfer, diffusion and diffusion coefficient.

010323107 Chemical Engineering Thermodynamics I 3(3-0-6)

Prerequisite : None

The first law of thermodynamics, mass and energy balance of the system, behavior of pure compound, state equation of fluid, calculation of heat due to chemical reactions, the second law of thermodynamics and entropy, residential properties of compound, application of thermodynamics in fluid system.

010323108 Chemical Engineering Thermodynamics II 3(3-0-6)

Prerequisite : 010323107 Chemical Engineering Thermodynamics I

Properties of mixtures, vapor – liquid equilibria, partial molar properties, ideal solutions, fugacity, excess properties, enthalpy and entropy changes of mixtures, chemical equilibria analyses of mixture processes, phase equilibria, chemical equilibrium constant, thermodynamics of fluid mixtures.

010323110 Transport Phenomena 2 3(3-0-6)

Prerequisite : 010323106 Transport Phenomena 1

Boundary layer theory, fluid flow around objects, pump and characteristic curve, overall heat transfer coefficient, analysis of heat convection for laminar and turbulent flows over various bodies and in tubes, two phases heat transfer involving conduction and convection, analysis of heat radiation between surfaces, differential equations of mass transfer, one- and multi-dimensional diffusion, steady- and unsteady-state molecular diffusion, mass transfer with and without chemical reaction, convective mass transfer, convective mass transfer between phases.

010323111 Process Control Instrumentation 3(3-0-6)

Prerequisite : 040303005 Physics I

Characteristics, types and limits of measuring instruments used in chemical process industry; temperature, pressure, flow, level, pH, turbidity, and composition transducers; actuators used in process industries; interfacing components techniques.

010323201 Safety in Chemical Operations 3(3-0-6)

Prerequisite : None

Safety principle, appearance and prevention of dangers in processes of chemical industry and others, environment of industries, principles of safety management, basic industrial psychology, design of pressure system, risk assessment, hazardous conditions.

010323202 Environmental Technology 3(3-0-6)

Prerequisite : 010323302 Mechanical Unit Operation

Fundamental of water, air and soil pollutions; causes and origins of pollutions; prevention and treatment of wastes by mechanical and biochemical operations; treatment of air pollution by mechanical units, cyclone, filter, water sprayer, electroprecipitator; recycling of wastes; knowledge of ISO 14000 standard; tools for environmental management.

010323301 Chemical Process Engineering 3(3-0-6)

Prerequisite : None

Basic concepts of chemical process industry, preliminary analysis of chemical engineering processes, manufacturing process, process diagram, technology of manufacturing process.

010323302 Mechanical Unit Operation 3(3-0-6)

Prerequisite : 010323105 Material and Energy Balance

Calculation and basic design of mechanical processes, fluid flow, fixed bed, fluidized bed, filtration, size reduction and screening, mixing of liquids and solids; centrifugal separation of particles from fluid, centrifuge, centrifugal filtration, sedimentation; dust collecting, cyclone, hydrocyclone.

010323303 Mechanical Unit Operation Laboratory 1(0-3-1)

Prerequisite : 010323302 Mechanical Unit Operation or co-study

Experiment on fluid and solid process, sedimentation, fluid flow measurement, mixing, size reduction, size classification, fixed bed, fluidized bed, filtration, agitation, pump, rotary drum.

010323304 Chemical Engineering Unit Operation 3(3-0-6)

Prerequisite : 010323106 Transport Phenomena I

Calculation and basic design of heat and mass transfer, evaporation, distillation, extraction, absorption, adsorption, crystallization, cooling tower, drying, basic units relating heat and mass transfer.

010323305 Chemical Engineering Unit Operation Laboratory 1(0-3-1)

Prerequisite : 010323304 Chemical Engineering Unit Operation or co-study

Experiment on heat and mass transfer process, evaporation, distillation, extraction, absorption, adsorption, crystallization, cooling tower, drying, basic units relating heat and mass transfer.

010323306 Chemical Reaction Engineering and Reactor Design 3(3-0-6)

Prerequisite : 010323107 Chemical Engineering Thermodynamics I

Rate laws and stoichiometry, batch and continuous reactor design, homogeneous reactions, reaction rate analysis, isothermal and non-isothermal reactor design, heterogeneous reaction and reactor design, mass transfer, diffusion and catalytic reaction, design of plug flow and recycling reactors.

010323308 Chemical Engineering Economics and Cost Estimation 3(3-0-6)

Prerequisite : None

Introduction to general economics, accounting data and financial statements in the chemical industry, cost estimation of chemical process equipment, estimation of capital requirements and operating expenses, economic evaluation in chemical engineering plant design, economic evaluation for alternative selection and investment of chemical processes.

010323309 Chemical Engineering Plant Design 3(3-0-6)

Prerequisite : 010323304 Chemical Engineering Unit Operation

Hierarchical approach to conceptual design of chemical processes based on heuristic and economic analysis, selection of reaction system, recycle structure, separation processes, heat exchanger network, and utility system, optimization of design parameters for new and modified processes.

010323310 Process Dynamics and Control 3(3-0-6)

Prerequisite : 010323111 Process Control Instrumentation

Process models and control systems, dynamic modeling of processes, design and analysis of process control system, stability of control systems, frequency responses, measurement, feedback control.

010323311 Chemical Engineering Laboratory Project 2(0-6-3)

Prerequisite : 010323110 Transport Phenomena II

Students will work as a member of team on advanced practical problems of separation processes to gain practical and transferable skills from implementing a solution for the problem. The practical problems includes distillation, absorption, extraction and evaporation.

010323401 Problem Based Learning I

(S/U) 1(0-3-1)

Prerequisite : None

Students work in a small group on chemical engineering problems. Groups will be facilitated by academic advisors who will encourage group member to discuss and exchange ideas on assign problem. Students will have opportunity to practice teamworking, leadership and communication skills.

010323402 Problem Based Learning II

(S/U) 1(0-3-1)

Prerequisite : None

Students work in a small group on chemical engineering problems. Groups will be facilitated by academic advisors who will encourage group member to discuss and exchange ideas on assign problem. Students will have opportunity to practice teamworking, leadership and communication skills.

010323403 Problem Based Learning III

(S/U) 1(0-3-1)

Prerequisite : None

Students work in a small group on chemical engineering problems. Groups will be facilitated by academic advisors who will encourage group member to discuss and exchange ideas on assign problem. Students will have opportunity to practice teamworking, leadership and communication skills.

010323405 Chemical Engineering Design Project

3(0-9-3)

Prerequisite : None

Students work in design teams and undertake an open-ended project to design a specified product or specific engineering problem. Teams are supervised by project advisor who assist in definition of the task(s) to be carried out. Three major parts of the project are: i) teams produce mass and energy balances and a preliminary economic evaluation, ii) every team member establishes the detailed design of plant items, iii) team puts together the complete design and considers plant-wide process aspects.

010323406 Chemical Engineering Project I

1(0-3-1)

Prerequisite : None

It is required preparatory course for 4th – year student to conduct a chemical engineering project, which must be approved by the department staff. A project proposal and completed report must be done within specified date.

010323407 Chemical Engineering Project II 3(0-9-3)

Prerequisite : 010323406 Chemical Engineering Project I

This is a continued course from Project I. The project must be continued to complete the original objectives. Students must give a final oral presentation and submit the thesis within the specified time.

010323501 Unit Operations in Fuel Technology 3(3-0-6)

Prerequisite : None

Fuels; fuel characteristics and resources, process technologies for fuel production; solid fuels, liquid fuels and gaseous fuels, unit operations in solid fuel production, unit operations in liquid fuel production, unit operations in gaseous fuel production.

010323502 Model Based Technique for Chemical Process Design 3(2-2-5)

Prerequisite : None

Mathematical models in engineering design for chemical process and related industries, computer program for chemical process simulation and process design, development technique for process simulation and problem solving, chemical engineering case study.

010323503 Process Integration and Optimization 3(2-2-5)

Prerequisite : None

Chemical engineering concepts for process design with mass and energy integration, mathematical model development for thermal process using process simulation and optimization, optimization techniques.

010323504 Eco-Design and Environmental Tools 3(3-0-6)

Prerequisite : None

Cleaner technology, life cycle assessment, carbon footprint, environmental management systems, eco-labelling, design for environment, sustainable consumption and production, future trends of environment issues for chemical engineering.

010323505 Multiphase Flows 3(3-0-6)

Prerequisite : None

Properties of dispersed phase flow, dilute versus dense, flow phase coupling, size distribution, particle-fluid interaction, momentum transfer, energy coupling, particle-particle interaction, particle-wall interaction, multiphase flows and engineering designs, gas-solid separation, dense-phase fluidized beds, circulating fluidized beds, heat and mass transfer in fluidization systems, pneumatic conveying of solids.

010323506 Computational Fluid Dynamics 3(3-0-6)

Prerequisite : None

Governing equations of fluid dynamics, classification of quasi-linear partial differential equations, grid generation, boundary-fitted coordinate, unstructured meshes, Lax-Wendroff technique, MacCormack's technique, relaxation technique and application to low-speed inviscid flow, pressure correction technique, SIMPLE algorithm, numerical solutions by means of an implicit method and the pressure correction method, finite volume methods (FVM) via finite difference methods, finite element method (FEM), Lagrange and Hermite families and convergence criteria, vortex methods, compressible flows via finite element methods, Taylor-Galerkin methods, formulations of finite volume equations, Burgers' equations.

010323507 Industrial Compressor and Process Applications 3(3-0-6)

Prerequisite : None

Compression method, thermodynamics of compressions, basic relationships, turbocompressor, centrifugal compressor, axial compressor, positive displacement compressor, reciprocating compressor, rotary compressor, testing and application considerations.

010323508 Thermal Power Engineering 3(3-0-6)

Prerequisite : None

Steam power cycles, firetube boilers watertube, design and construction of boilers, boiler settings and accessories, combustion system and draft system, steam distribution, steam traps, efficiency of steam system, feedwater system, boiler water treatment, thermal-oil and hot water systems, in-service operations, inspections, maintenances, repairs, regulations.

010323509 Thermal Process Engineering 3(3-0-6)

Prerequisite : None

Heat transfer fundamentals, thermal design of shell-and-tube heat exchanger, double-tube heat exchanger, plate heat exchangers, liquid boiling and evaporators, reboilers, mechanism of condensation, system as process heating medium.

010323510 Design Manufacturing and Product Development 3(3-0-6)

Prerequisite : None

Product development ideas and methods currently used in product realization process, the Integrated product and process design, product cost analysis, product functional requirements, product concepts and embodiments, material selection, manufacturing processes and design, product and process improvement.

010323512 Process Intensification 3(3-0-6)

Prerequisite : None

The development of novel equipment or apparatuses and techniques for chemical engineering process leads to compact, safe, energy-efficient, environment-friendly and sustainable processes. Process intensifying equipment, multifunctional reactors such as membrane reactor, hybrid separations, alternative energy sources.

010323513 Introduction to Rheology and Rheometry 3(3-0-6)

Prerequisite : None

Fundamental of vectors and tensors analysis, standard flow for rheology, material functions, rheological models and fluid mechanics description of rheology, analytical solutions of flow of non-Newtonians fluids, basic rheometry.

010323514 Bioreactors and Biosensors 3(3-0-6)

Prerequisite : None

Biological processes, transport phenomena in biological systems, modeling of biological processes reactor types, immobilized systems and membrane systems, biosensor, types and its application.

010323515 Funding Strategies for Startups 3(3-0-6)

Prerequisite : None

Substance and process of funding technology startups, comparative analysis of various sources of capital, venture capital as a business, market practice and standards for term sheet

negotiation; strategy, tactics necessary to negotiate and build effective, long-term relationships with investors.

010323516 Chemical Reactor Design and Control 3(3-0-6)

Prerequisite : 010313306 Chemical Reaction Engineering and Reactor Design

Reactor basics, steady-state design of CSTR systems, control of CSTR systems, control of batch reactors, steady-state design of tubular reactor systems, control of tubular reactor systems, control of special types of industrial reactors.

010323517 Distillation Design and Control 3(3-0-6)

Prerequisite : 010323304 Chemical Engineering Unit Operation

Vapor-liquid-equilibrium, analysis of distillation columns, setting up a steady-state simulation, distillation economic optimization, complex distillation systems, steady-state calculations for control structure selection, converting from steady-state to dynamic simulation, control of more complex columns, reactive distillation, control of sidestream columns, control of petroleum fractionators.

010323518 Control System Design 3(3-0-6)

Prerequisite: 010323310 Process Dynamics and Control or Corequisite

Open-loop and closed-loop stability analysis using root locus and frequency domain techniques, design of feedback controllers with time and frequency domain specifications, control of multivariable processes sampled-data control theory.

010323548 Chemical Process Simulation 3(1-4-6)

Prerequisite : 010323105 Material and Energy Balance

Chemical process simulation, modelling physical properties, unit operation modelling, flowsheet modelling and simulation.

010323549 Selected Topics in Chemical Engineering Design and Development 3(3-0-6)

Prerequisite : None

Study in selected areas or topics of chemical engineering process design and process control technology.

010323550 Pulp and Paper Technology 3(3-0-6)

Prerequisite : None

Consumption and production of pulp and paper, sources of fiber for papermaking, physical and chemical properties of fiber, evaluation of paper processing, pulping process and paper manufacture

010323551 Paper Recycling Technology 3(3-0-6)

Prerequisite : None

Collection systems and sorting of recovered paper, unit operations and equipment in recycled fiber processing, deinking chemistry, papermaking potential recycled fiber.

010323552 Pulping and Bleaching Technology 3(3-0-6)

Prerequisite : None

Preparation of raw materials for pulping and bleaching processes, chemical reaction and mechanism in pulping and bleaching processes, by product and chemical recovery in pulping and bleaching processes

010323553 Principle of Quantum Mechanics for Engineer 3(3-0-6)

Prerequisite : 040113061 Chemistry for Engineers

Origin of quantum mechanics, postulates and general principles of quantum mechanics, hydrogenic atoms, the structures of many-electron atoms, the spectra of complex atoms, concepts of chemical bonds, valence bond theory, molecular orbitals, computational chemistry, molecular interactions van der waals interactions and hydrogen bonding, molecules in motion

010323554 Polymer Technology 3(3-0-6)

Prerequisite : None

Introduction of polymer, molecular structure of polymer, polymer properties, polymer compounding, polymer processing consisting of extrusion, injection molding, blow molding, compression molding, thermoforming, rubber process, and fiber process, polymer recycle and polymer waste management.

010323555 Polymerization Process 3(3-0-6)

Prerequisite : None

Introduction of polymerization, polymerization processes, reactors for polymerization, batch polymerization process, solution polymerization process, suspension polymerization process, emulsion polymerization process, polymerization plants.

010323556 Colloid Technology 3(3-0-6)

Prerequisite : None

Introduction of colloid, Interface phenomena, colloid stability and instability, surfactant, surfactant system, colloid system processes foam, emulsion, suspension, micellization, soil removing or deinking, and detergency processes.

010323557 Nanocomposite Materials 3(3-0-6)

Prerequisite : None

Introduction of composites and nanocomposites, polymeric composites, nanocomposite synthesis, nanocomposites in application as advanced or special materials, product design and innovation of nanocomposites.

010323558 Alternative Fuels 3(3-0-6)

Prerequisite : None

Alternative fuels, alternative fuels production from fossil fuels, alternative fuels production from selected renewable energy resources, and upcoming alternative fuels with their production technologies.

010323559 Minerals Engineering 3(3-0-6)

Prerequisite : None

Significance, history and sources of inorganic materials, mineral and ores, minerals for chemical industry, mineral processing technologies, unit operations in mineral processing.

010323560 Micro and Nano Engineering 3(3-0-6)

Prerequisite : None

Systems engineering for micro- and nanoscale technologies, micro-electro-mechanical systems, introduction to nanotechnology, modeling and simulation in micro- and nano scale, systems reliability, test and evaluation techniques from very-large-scale integration (VLSI) to new developments in micro- and nanoscale technology (MNT), developing and implementing robust

micro- and nanoscale technology programs, applications of future generations of nanotechnology, biomedical microsystems.

010323561 Chemical Engineering in Pharmaceutical Industry 3(3-0-6)

Prerequisite : None

Chemical engineering in the pharmaceutical industry, role of chemical engineering in pharmaceutical process research and development, reaction kinetics and characterization, quality by design for analytical methods, drug products; process design and development of production pharmaceutical manufacturing.

010323562 Zeolite and Molecular Sieve 3(3-0-6)

Prerequisite : None

Introduction of zeolite and molecular sieve, types and structures, synthesis and preparation, properties (acid, base, and shape-selectivity), post-synthetic treatment/modification of the materials, characterization methods, their applications as catalysts in refinery, synthetic fuel production, chemical synthesis, and as adsorbent in adsorption/separation process, and in other novel applications.

010323563 Heterogeneous Catalysis 3(3-0-6)

Prerequisite : None

Principles of heterogeneous catalysis, preparation of solid catalysts, bulk catalysts and supported catalysts, characterization of the catalysts, energy-related catalysts, environmental catalysts, deactivation, regeneration, developing of industrial solid catalyst, scale-up process.

010323564 Petroleum Processing 3(3-0-6)

Prerequisite : None

Crude oil and its processing, petroleum products and refinery configuration, major units the atmospheric and vacuum crude distillation units, the distillation of the light ends from crude oil, catalytic reforming, fluid catalytic cracking (FCC), distillate hydrocracking, the technologies of motor fuel alkylation, catalytic olefin condensation, and isomerization for upgrading light naphtha and refinery light ends, refinery gas treating processes, quality control of products in petroleum refining, environmental control in petroleum refining, green petroleum concept.

010323565 Biochemical Engineering 3(3-0-6)

Prerequisite : None

Biochemical engineering, enzymes; enzyme kinetics, enzyme immobilization and immobilized enzyme kinetic, cell; cell types, cell cultivation and cell kinetics, fermentation; reactor types and cell recycling, agitation and aeration, sterilization.

010323566 Bioseparation 3(3-0-6)

Prerequisite : None

Bioseparation, disruption of microbial cell, separation of insoluble bioproduct; filtration and centrifugation, separation of soluble bioproduct; liquid extraction, precipitation and ion-exchange, supercritical extraction, chromatography technology, membrane technology.

010323567 Computer Software for Chemical Engineering Calculations 3(3-0-6)

Prerequisite : None

Use of commercial software to analyze, compute, visualize and solve chemical engineering problems.

010323568 Energy Technology 3(3-0-6)

Prerequisite : None

Energy usage and supply, fossil fuel technologies, renewable energy alternatives and environmental impacts.

010323569 Creative and Critical Thinking 3(3-0-6)

Prerequisite : None

Clarifying ideas; analyzing ideas, comparing and contrasting, classification, determining parts-whole relationships, sequencing; analyzing arguments, detailing reasons and conclusions, uncovering assumptions; creative thinking, generating possibilities, creating metaphors; critical thinking, determining the reliability of sources, causal explanation, prediction, generalization, reasoning by analogy, deduction: conditional reasoning.

010323580 Selected Topics in Chemical Engineering Petroleum and Petrochemical Technology 3(3-0-6)

Prerequisite : None

Study in selected areas or topics of chemical engineering petroleum and petrochemical technology.

010323581 Selected Topics in Chemical Engineering Material Technology 3(3-0-6)

Prerequisite : None

Study in selected areas or topics of chemical engineering material technology.

010323582 Selected Topics in Chemical Engineering Energy and Environment Technology 3(3-0-6)

Prerequisite : None

Study in selected areas or topics of chemical engineering energy and environment technology.

010323583 Selected Topics in Chemical Engineering Process Design and Process Control Technology 3(3-0-6)

Prerequisite : None

Study in selected areas or topics of chemical engineering process design and process control technology.

010323590 Sustainable Development and Industry 3(3-0-6)

Prerequisite : None

Introduction to sustainable development, sustainability issues in different industrial supply chains, sustainable technologies, sustainable process design, sustainability assessment tools, life cycle assessment and carbon footprint, strategies for corporate sustainability, application of corporate sustainability strategies.

010323591 Operations Management 3(3-0-6)

Prerequisite : None

Introduction to operations management, competitiveness, strategy and productivity, management of quality and quality control, introduction to logistics and supply chain management, inventory management, planning and scheduling, other management tools lean manufacturing, kaisen, TPM, etc.

010323592 English for Academic Purposes I 3(3-0-6)

Prerequisite : None

Skills required to succeed on academic courses. the development of skills required for academic study in English listening to lectures, note-taking, seminar skills, presentation skills and academic reading, writing and referencing.

010323593 English for Academic Purposes II 3(3-0-6)

Prerequisite : 010323592 English for Academic Purposes I

Students will improve skills required to succeed on academic courses. This module focuses on academic English. Students will focus on the development of skills required for academic study in English listening to lectures, note-taking, seminar skills, presentation skills and academic reading, writing and referencing.

010323594 Academic English Writing 3(3-0-6)

Prerequisite : None

Writing skill clear, grammatically accurate and well-organised academic English. language used to express the main communicative functions used at all levels of academic discourse: defining, comparing, describing cause and effect. Examples of different types of texts and the language series of writing tasks, both individually and co-operatively in groups.

010323595 English for Engineering Business and Management 3(3-0-6)

Prerequisite : None

A wide range of managerial topics within the sphere of engineering business and management using English language. Effective presentation, marketing techniques, brand management, team building and conducting meetings.

010403096 Computer Programming 3(2-2-5)

Prerequisite : None

Computer concepts, computer components, hardware and software interaction, EDP concepts, program design and development methodology, high-level language programming, computer based problem-solving.

010403097 Engineering Statics 3(3-0-6)

Prerequisite : 040203111 Engineering Mathematics I

040303005 Physics I

Classification of engineering mechanic, state and behavior of body in engineering statics, system and resultant of forces acting to body, resultant and resolution of forces: equilibrium, analysis of simple structures, centroid and center of gravity of body, friction force, truss stcture, moment of inertial of an area, virtual work and stability.

010403098 Engineering Materials 3(3-0-6)

Prerequisite : None

Study of retationship between structures, properties, production processes and applications of main groups of engineering materials i.e. metals, polymers, ceramics and composites, phase equilibrium diagrams and their interpretation, mechanical properties and materials degradation.

010403099 Engineering Drawing 3(2-2-5)

Prerequisite : None

Specifications and standards of drawings; orthographic projection; orthographic drawing and pictorial drawings, dimensioning and tolerancing; sections, auxiliary views and development; freehand sketches, detail and assembly drawings; basic computer-aided drawing.

040113001 Chemistry for Engineers 3(3-0-6)

Prerequisite : None

Matters and scientific measurement, atoms molecules and ions, stoichiometry, electronic structure of the atoms, periodic properties, chemical bond, shape of molecules, gas liquid and solid, solutions thermochemistry, chemical kinetics, chemical equilibrium, acid-base equilibrium, electrochemistry.

040113002 Chemistry Laboratory for Engineers 1(0-3-1)

Prerequisite : 040313001 Chemistry for Engineers or co-requisite

All experiments are corresponded to the course of 040113001 Chemistry for Engineers.

040203111 Engineering Mathematics I 3(3-0-6)

Prerequisite : None

Analytic geometry, polar coordinates, parametric equations; vector algebra, lines and planes in three dimensional space; limit, continuity, differentiation and integration of real-valued functions of a real variable and their applications, indeterminate forms, techniques of integration, numerical integration; improper integrals.

040203112 Engineering Mathematics II 3(3-0-6)

Prerequisite : 040203111 Engineering Mathematics I

Mathematical induction; sequence and series of real numbers, Taylor series expansions of elementary functions; Fourier series; matrices and determinants, systems of linear equations, eigenvalues and eigenvectors; surfaces in three-dimensional space; limit, continuity, differentiation and integration of real-valued functions of several variables and their applications.

040203211 Engineering Mathematics III (3-0-6)

Prerequisite : 040203112 Engineering Mathematics II

Vector-valued functions, space curves, derivatives and integrals of vector-valued functions, gradient, curl and divergence, line integrals, surface integrals; introduction to differential equations and their applications, linear differential equations, Laplace transforms, system of linear differential equations, solution in series.

040313005 Physics I 3(3-0-6)

Prerequisite : None

Vector, Mechanics of motion, rectilinear and curvilinear motion, Newton's law of motion, circular motion, work, power, energy, momentum, moment of inertia, rotation equations, torque, angular momentum, rolling, simple harmonics motion, superposition of two simple harmonics, damped oscillation, forced Oscillation, types of waves, standing waves, beats, intensity and sound level, Doppler effect, properties of matters, heat transfer, ideal gas equation, laws of thermodynamics, heat engines and reverse engine, physical properties of fluid, buoyancy, Pascal's law, pressure measurement equation of continuity, Bernoulli's equation, flow measurement.

040313006 Physics Laboratory I 1(0-2-1)

Prerequisite : 040313005 Physics I or co-requisite

All experiments are corresponded to the course of 040313005 Physics I.

040313007 Physics II 3(3-0-6)

Prerequisite : 040313005 Physics I

Coulomb's law, electric fields, Gauss's law, electric potential, dielectric materials, Biot-Savart law, Ampere's law, magnetic substance, Lorentz force, electromotive force, inductance, alternating

current and basic electronic circuits, properties of waves, reflection, refraction, interference, diffraction, geometrical optics, optical instruments, Black-body radiation, photoelectric effect, Compton's scattering, X-rays, hydrogen atom, wave-particle duality, structure of nucleus, radioactivity, nuclear reactions.

040313008 Physics Laboratory II 1(0-2-1)

Prerequisite : 040313007 Physics II or co-requisite

All experiments are corresponded to the course of 040313007 Physics II.

040423002 Introduction to Environment and Management 3(3-0-6)

Prerequisite : None

Our environment, basic concepts in environmental management, economic instruments for environmental management, standards and regulations in environmental management, air quality and noise management, radioactive waste management, environmental impact assessment, environmental ethics, sustainable environmental management.

040503011 Statistics for Engineers and Scientists 3(3-0-6)

Prerequisite : None

Fundamentals of statistic, sample space and probability; sampling variables and probability function; expectation values, deviations and variants; discontinuous and continuous sampling variables, statistic induction: estimation and statistic experimentation of hypothesis; variant analysis; fundamental regression and correlation analysis. Engineering and scientific problem-solving using appropriate statistical software packages.

040603002 Computer System and Applications 3(3-0-6)

Prerequisite : None

Computer system, problem solving with computer, computer applications as a problem-solving tool, computer technology in document processing and data processing, accessing to network systems and efficient electronic communications.

080203908 Quality of Life Development in Work and Socialization 3(3-0-6)

Prerequisite : None

Content and Concept of moral and ethics, quality of life development self and social attitude development, self and social responsibilities, work-life balance management, public mind,

techniques in understanding people, work analysis, training, communication in organization, personal financial management and effective work.

080303104 Psychology for Work 3(3-0-6)

Prerequisite : None

Psychology applied to work: motivation, decision-making, problem-solving, conflicts at work, creative thinking, coordination, leadership, team building and communication at workplace.

080303501 Basketball 1(0-2-1)

Prerequisite : None

History of basketball, techniques, rules, regulations, usage of proper equipment, practice in basic skills and applying the skills to play games, good sportsmanship and spectator.

080303502 Volleyball 1(0-2-1)

Prerequisite : None

History of volleyball, techniques, rules, regulations, usage of proper equipment, practice in basic skills and applying the skills to play games, good sportsmanship and spectator.

080303503 Badminton 1(0-2-1)

Prerequisite : None

History of badminton, techniques, rules, regulations, usage of proper equipment, practice in basic skills and applying the skills to play games, good sportsmanship and spectator.

080303504 Dancing 1(0-2-1)

Prerequisite : None

History of dancing, basic dancing skills, dancing etiquette for developing knowledge, understanding and positive attitudes, Latin dancing and ballroom dancing.

080303505 Table Tennis 1(0-2-1)

Prerequisite : None

History of table tennis, techniques, rules, regulations, usage of proper equipment, practice in basic skills and applying the skills to play games, good sportsmanship and spectator.