



Curriculum of Bachelor Degree in Chemical Industries Engineering
Courses Description

30206221	Organic Chemistry Structure, Bonding and Molecular Properties of organic Compounds; Alkanes and Cycloalkanes; Stereochemistry of Alkanes and Cycloalkanes; Alkenes and alkynes; Stereochemistry; Alkyl Halides and their Reactions; Aromatic Compounds and their Reactions. Alcohols, ethers, thiols; Aldehydes and ketones; Carboxylic acids and derivatives; Amines [Pre-requisite; 30206101]	3 (3-0)
30206223	Organic Chemistry Laboratory Basic Techniques in Organic Chemistry Laboratory; Determination of melting point; Simple, fractional and steam distillation; Crystallization; Properties, separation, purification, and analysis of simple organic compounds. [Co-requisite; 30206221]	1(0-3)
30206231	Analytical & Instrumental Chemistry Solutions and concentrations; chemical analysis volumetric, quantitative, qualitative, and gravimetric with applications; Acid- base equilibrium and titration; complex formation titration; oxidation-reduction titration; precipitation titration; absorption and emission spectroscopy; ultraviolet and visible Spectrophotometer; flame emission and atomic absorption-emission spectrometry; infrared Spectrophotometer; X-ray methods; nuclear magnetic resonance spectroscopy; refractometry and polarimetry; chromatography; PH and ion selective potentiometer; voltammetry; polarography. [Pre requisite 30206101]	3 (3-0)
30206232	Analytical & Instrumental Chemistry Laboratory Acid- base equilibrium and titration; complex formation titration; oxidation-reduction titration; precipitation titration. Experiments related to flame photometer; refractometer; polarimeter; spectrophotometer; polarography; chromatographic separation using gas chromatograph (GC) and high performance liquid chromatography (HPLC). [Co-requisite; 30206231]	1(0-3)
CHE 0211	Chemical Engineering Principles The scope of Chemical Engineering, chemical processes, problem solving and teamwork, ethical considerations (academic integrity and professional ethics), Units and dimensions; dimensional consistency; data presentation & data analysis in industrial processes; Principles of mass balances for single and multiple phase systems at steady state. [Pre-requisite; 30206101]	3 (3-0)
CHE 0212	Material and Energy Balances The role of chemical processing, material balances (non-reactive and reactive processes), physical properties estimation, multiphase systems, energy balances (non-reactive and reactive processes), balances on transient processes. [Pre-requisite; CHE 0211]	3 (3-0)
CHE 0234	Chemical Engineering Fluid Mechanics Fluid properties. Hydrostatics. Hydrostatic equation for incompressible fluids. Pressure measuring devices. Pressure distribution over submerged objects. Center of pressure and buoyancy. Dimensional analysis. Laminar and turbulent flow. Flow through tubes. Flow meters. Bernoulli's equation. Pressure drops and energy losses calculations. Fluid friction in steady state, momentum balance in boundary layer, differential momentum equilibrium, computation of velocity curves and coefficient of friction. Pumps, compressors, compressible fluid flow, introduction to two-phase flow. [Pre-requisite; 30202203]	3(3-0)

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CHE 0242	Thermophysical Chemistry Kinetic theory of gases, volumetric properties of real fluids, basic equations of state, thermodynamic diagrams, steam tables, first and second laws of thermodynamics, calculation of thermal properties from volumetric data and heat capacities, Clapeyron and Clausius-Clapeyron Equations, gas liquefaction and pressure cycle of gases. Calculation of ΔG , ΔS , ΔH using the symmetric states principle.	3 (3-0)
[Prerequisite; CHE 0211]		
CHE 0331	Chemical Engineering Fluid Mechanics Laboratory Measurement of fluid properties; (density viscosity and surface tension); fluid statics pressure; Reynolds experiment; flow through orifice; nozzles; Venturi; open channels and weir; head loss in pipes and fittings; pumps in series and parallel; velocity profile.	1(0-3)
[Prerequisite; CHE 0234]		
CHE 0333	Heat Transfer Processes The nature of the means and mechanisms of heat transfer. Conductive heat transfer in steady and unsteady state. Temperature distribution through compound layers, forced convection heat transfer in laminar and turbulent flows (internal and external). Analogy between momentum and heat transfer. Thermal radiation; Boiling and condensation. Applications for the design of heat exchangers.	3 (3-0)
[Pre-requisite; CHE 0234]		
CHE 0334	Heat Transfer Processes Laboratory Radial and axial conduction along different shapes: radiation heat transfer; convection performance and characteristics of heat exchangers; boiling and condensation heat transfer.	1(0-3)
[Pre-requisite; CHE 0333]		
CHE 0336	Mass Transfer Fundamentals of matter transfer including: Molecular diffusion. Mechanisms of mass transfer in fluids and solids. Diffusion coefficient and measurement methods. Diffusion in turbulent flow. Mass transfer across interfaces and studying the theories related to that. Mass transfer coefficient. Efficiency of the transfer process. Analogy between momentum, heat and mass transfer, and related theories. Continuous and stage-wise separation processes. Applications to fractional distillation and absorption of gases.	3(3-0)
[Pre-requisite; CHE 0333 + CHE 0341]		
CHE 0341	Chemical Engineering Thermodynamics Properties of mixtures and solutions. The thermodynamics of mixtures and solutions and their applications to air and water vapor systems. Calculation of ΔG , ΔS , ΔH using the symmetric states principle and the residual thermal properties. Fugacity and activity of ideal and real gases and liquids. Fugacity and activity coefficients. The Gibbs–Duhem equation. Chemical equilibrium in homogeneous and heterogeneous systems. Phase equilibrium diagrams. Thermodynamics of chemical reactions and chemical equilibrium. Applications in electrochemical equilibrium.	3 (3-0)
[Pre-requisite; CHE 0242]		
CHE 0342	Chemical Engineering Thermodynamics Laboratory Boyle's law; Charles law; boiling point elevation; solubility of gases in liquids; specific heat determination; vapor pressure measurement; properties of ideal solutions; Marcet Boiler; heat pump; single stage-reciprocating compressor. Vapor-Liquid Equilibrium. Liquid-Liquid Equilibrium.	1(0-3)
[Prerequisite; CHE 0341]		
CHE 0345	Chemical Reaction Engineering (1) Kinetics of homogeneous reactions, rate of reaction, batch reactors, continuous stirred tank reactor (CSTR), plug flow reactor, single and multiple ideal reactors, residence time distribution	3 (3-0)



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and measurement, isothermal reactors with multiple reactions, effect of temperature and pressure, reactor design for homogeneous reactions, optimization, introduction to heterogeneous reactions.

[Pre-requisite; CHE 0212]

CHE 0346	Chemical Reaction Engineering (2) Multiple phase reactions. Fluid - fluid reactions, fluid - solid reactions. Catalytic reactions with solids. Catalyst deactivation. Thermal properties, reactor stability. Non-ideal reactors and residence time distribution (RTD). Optimization.	3(3-0)
	[Pre-requisite; CHE 0345]	
CHE 0352	Unit Operations Characterization of solid particles, study of different methods of volume distribution, mixing of particles and pastes, crushing, grinding, and sieving, and the devices used for this, handling of solids, systems of fluid and particles mechanics and their application to different processes. Settling and sedimentation, fluidization, filtration, floatation, reverse osmosis, and crystallization.	3(3-0)
	[Pre-requisite; CHE 0333]	
CHE 0441	Chemical Reaction Engineering Laboratory Determination of reaction kinetics; continuous stirred tank reactor; tubular reactor; effect of temperature on rate of reaction; measurement of residence time distributions. Detergents and paints manufacturing.	1(0-3)
	[Co-requisite; CHE 0346]	
CHE 0451	Unit Operations Laboratory Crushing; grinding; milling; screening; mixing; settling and sedimentation; filtration; floatation; fluidization. Diffusivity measurements. Mass transfer coefficient determination.	1(0-3)
	[Pre –requisite; CHE 0352]	
CHE 0453	Separation Processes Developing fundamental equations describing different separation processes like; gas absorption, binary and multi-component distillation, extraction and leaching, evaporation, drying, crystallization, humidification, and dehumidification.	3(3-0)
	[Pre-requisite CHE 0336]	
CHE 0454	Separation Processes Laboratory Basic and applied knowledge of separation unit operation models including experiment on distillation, absorption, extraction and leaching, evaporation, and cooling towers.	1(0-3)
	[Pre-requisite; CHE 0453]	
CHE 0461	Modeling and Simulation in Chemical Engineering Methods for deriving mathematical models for steady and transient processes. Degrees of freedom analysis. Approximation of nonlinear models. Mathematical analysis techniques for solving mathematical models containing linear and nonlinear algebraic equations and ordinary differential equations and partial differential equations linear and nonlinear and their systems. Matrix principles and their operations and their use in solving systems of equations. Fourier series for trigonometric equations. Bessel equations. Sturm-Leuvel theorem, Laplace transforms. Methods for solving mathematical models using software.	3(3-0)
	[Pre-requisite; CHE 0346]	
CHE 0462	Process Simulation Laboratory Introduction to process simulation, the Aspen Plus packages, Aspen Plus user interface, physical and thermodynamic properties, pressure changer units, heat exchangers, flow sheet analysis, reactions and reactors, equilibrium separation processes. Data acquisition and processing; computer-assisted design and simulation of chemical engineering problems using available commercial software packages.	1(0-3)
	[Pre-requisite OR Co-requisite; CHE 0461]	

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CHE 0464	Plants Management Chemical project organization and break-even analysis. Ways of taking and making decisions for different variables. Project planning using graphical representation and critical path methods. Future price projections, asset control, cost estimate and reduction, cash flow diagram. Systems for recovering lost energy, energy economics and economical use of electricity. An introduction to investment alternatives and economics of business and enterprise management. [Pre-requisite; CHE 352]	3(3-0)
CHE 0483	Bioprocess Engineering Biochemical Engineering Technology is the extension of chemical engineering principles to systems using a biological catalyst to bring about desired chemical transformations. This course builds on the concepts learned in Chemical Reaction Engineering (1 and 2) and introduces an overview of the basics of biology, enzymes and cell growth kinetics, enzyme inhibition models and bioreactor modeling and design. The course will improve the student's ability to develop mathematical models for bio-reaction cell growth kinetics; reactor models, design and performance; analyze bioprocesses of different biocatalysts and reactor configurations, fermentation systems, sterilization processes. [Co-requisite; CHE 0346]	3(3-0)
CHE 0490	Field Training Practical training for 8 weeks after the completion of 100 credit hours (See Engineering Training Regulations of the College of Engineering). Every three credit hours are equivalent to (140) hours of training in appropriate industries. [Pre-requisite; Completion of 115 credit hours]	3(0-280)
CHE 0561	Process Dynamics and Control Introduction to practical and theoretical aspects of process control, process modeling, transfer functions, dynamics of open-loop systems, feedback control system, instruments of control system, control laws (P, PI, PD and PID), block diagrams, dynamics of closed-loop systems, stability analysis, root-locus analysis, tuning of controllers, frequency analysis, Bode stability, cascade control, feed-forward control, other control schemes. [Pre-requisite; CHE 0461]	3(3-0)
CHE 0562	Process Dynamics and Control Laboratory Thermocouples and temperature measurements; dynamics and empirical modeling of selected chemical processes; stability boundaries of PI-controllers; tuning PID controllers; simulation of nonlinear dynamic systems using computer software. [Pre-requisite; CHE 0561]	1(0-3)
CHE 0563	Chemical Process Equipment Design Selection of materials of construction, design of pipes and pumping systems, compressors, tanks, pressure vessels, storage equipment, heat exchangers, plate and packed towers. Design of mass and heat exchanger networks; Computer applications. [Pre-requisite; CHE 0461]	3(3-0)
CHE 0566	Plant Design Review of chemical engineering diagrams. Structure of the chemical process flow sheet. Synthesis and analysis of chemical processes. Development of a conceptual design. Sequencing of distillation columns. Plant location; plant layout; safety considerations. Case studies. [Pre-requisite; CHE 0563]	3(3-0)
CHE 0578	Chemical Process Safety Engineering The importance of safety in the industry. Accident analysis. Risks of fire, explosions, dust, noise and radiation, electric current and protective methods, risks of toxic, corrosive and carcinogenic chemicals. Limits of safe exposure to substances and sources of hazard. Analyzing the risks of exceeding operating conditions. Minimum values. Safety equipment and tools required. The	3(3-0)



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Safety management. Application of transport phenomena, thermodynamics and chemical reactions to study safety, health, and loss prevention. Use of dispersion models. Fire and Explosion Risk Assessment and Identification, Accident Investigations, Case Studies, Process Design Study with Safety Considerations.

[Pre-requisite; CHE 0561]

CHE0591 Project (1) 1(1-0)
Theoretical and/or experimental investigation of a problem in chemical engineering, or design and development of a chemical process; a student or a group of students undertake an independent project under the supervision of a faculty member.

[Pre-requisite OR Co-requisite; CHE 0561]

CHE 0592 Project (2) 3(3-0)
Completion of the same project started in Project (I) with more detailed theoretical and/or experimental work, design, and calculations.

[Pre-requisite; CHE 0591]

CHE 1411 Materials and Corrosion Engineering 3(3-0)
Types of materials; Material properties; Crystal structure, crystal defects. Solidification. Heat treatment of metals. Diagrams of phase transformations of pure materials and alloys. Polymeric materials. Composite materials. Electrochemical and metallic aspects of corrosion. Forms of corrosion. Modern Theories of Corrosion and their applications. Corrosion of iron and steel. Corrosion prevention methods. Case studies.

[Pre-requisite; CHE 0336]

CHE 1422 Food Engineering 3(3-0)
Rheological properties of food, phase transitions and transformations in food systems, food freezing, food dehydration, transport phenomena in food systems, food packaging.

[Pre-requisite; CHE 0352]

CHE 1424 Petroleum Refining 3(3-0)
Origin and composition of petroleum, crude oil analysis and evaluation, petroleum products and their uses, refinery structure, refinery operations and processes, atmospheric and vacuum distillation, fluid catalytic cracking, platforming, hydro-desulfurization and hydro-treating, chemical treatment, asphalt production, lube oils production. Utilities in refinery and waste treatment. Specifications and standards.

[Pre-requisite; CHE 0453]

CHE 1426 Chemical Industries Technologies (1) 3(3-0)
Chemical materials from natural gas, petroleum and coal, olefins and their derivatives, aromatics of acetylene and their derivatives, polymerization, synthetic fibers, synthetic rubber, plastic and recycling, oils and greases, soaps and detergents, adhesives, biodiesel, antibiotics, ethanol and vinegar. Case studies of consumer products industries (soaps, detergents, paints and oils).

[Pre-requisite; CHE 0336]

CHE 1428 Polymer Technology 3(3-0)
Chemistry and Physics of polymers, fundamentals of polymer synthesis, addition and condensation polymers, mechanisms and kinetics of polymerization reactions, polymerization techniques, suspension and emulsion, properties of polymeric materials and polymers reinforced by fibers, polymers manufacturing techniques, polymer rheology, methods of polymer fabrication, casting, blow molding, injection molding, extrusion, polymeric solutions, degradation.

[Pre-requisite; CHE 0345]

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CHE 1462	Computer Applications in Chemical Engineering Understand the use and importance of software in chemical industry engineering. Solve basic chemical engineering problems using MS-Excel, MATLAB, Maple, and Polymath. [Pre-requisite; CHE 0352]	3(3-0)
CHE 1518	Electrochemical Engineering Basics of electrochemistry, mass transfer in electrochemical systems, electrochemical applications, batteries, fuel cells, electroplating, electrolytic industries, metal recovery from electrochemical process wastes. [Pre-requisite; CHE 0336]	3(3-0)
CHE 1521	Pharmaceutical Industries The student should cope in this course with Good Manufacturing Practices (GMP) and manufacturing process; engineering principles in pharmaceutical industries; pharmaceutical production processes; Raw material testing/ Packaging and finished product testing; Drug certifying, qualifying and validation; Records and Good Documentation Practices; Samples & GMP case study. [Pre-requisite; CHE 0483]	3(3-0)
CHE 1523	Chemical Industries Technologies (2) Basics of chemical industries and raw materials, describing the different manufacturing methods for a number of industries such as: industrial gases, chloric acid, sulfuric acid, and phosphoric acid, ceramics, cement, glass and fertilizers, phosphate industries, potash, bromine and magnesia industries. This course is provided in a modules system. [Pre-requisite; CHE 1426]	3(3-0)
CHE 1524	Petrochemicals Technology Raw materials for petrochemical industries. Production of primary products: ethylene, propylene, butadiene, benzene, toluene, and xylene. Production of intermediate products: cyclohexane, phenol, styrene, etc. Production of PVC, polystyrene, rubber, nylon, paints lacquers, dyes. [Pre-requisite; CHE 1424]	3(3-0)
CHE 1525	Petroleum Laboratory Laboratory tests performed on crude oil according to ASTM rules, distillation test, Reed vapor pressure test, determination of flash point, smoke point, cloud point, pour point, viscosity, specific gravity, water content of crude oil, sediments, and impurities and salts. [Pre-requisite; CHE 1424]	1(0-3)
CHE 1526	Oil Shale Technology Formation of oil shale–geological background, distribution, and reserves of oil shale in the world and in Jordan, oil shale composition and methods of characterization and analysis, oil shale as an energy source, methods of oil shale utilization for energy production (pyrolysis, gasification, combustion and solvent extraction), industrial processes for oil shale utilization, environmental issues of oil shale technology, effluent gases, wastewater and solid residue. [Pre-requisite; CHE 0352]	3(3-0)
CHE 1527	Nanotechnology in Chemical Engineering Fundamentals of the design, preparation, and properties of nanomaterial are from chemical engineering perspectives. Nanostructure preparation and physical properties of materials change on the Nano scale: chemical patterning/lithography techniques and (self-assembly). Nanoparticle design, characterization of Nano scale structures, Nano fluidics and Nano machines. Nano biomaterials (drug and gene delivery, biosensors, and bio separations). [Pre-requisite; CHE 1411]	3(3-0)
CHE 1528	Processes & Industrial Technology Laboratory This laboratory aims to provide the student with practical and applied knowledge of industrial processes and includes experiments of separation with membranes. Standard methods of water analysis. Settling, sedimentation, chemical and biological treatment of water. Water hardness	1(0-3)



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estimation, organic nitrogen measurement, chlorine and acidity determination, water treatment systems and wastewater treatment systems (primary and secondary and others).

[Pre-requisite; CHE 1571]

CHE 1529 Compounded Fertilizers Technology 3(3-0)
 Mono-, di- and triple-ammonium phosphate manufacturing, potassium nitrate manufacturing, NPK triple fertilizer manufacturing, liquid fertilizer manufacturing, compound fertilizer calculations, congruence between compound fertilizer components, various additives of compound fertilizers.

[Pre-requisite; CHE 1426]

CHE 1543 Catalysis Engineering 3(3-0)
 Explore the new advances in surface science and catalysis. This will include studying the types and mechanisms of homogeneous and heterogeneous catalysis, catalytic reactions over metals, oxides, and zeolite catalysts, activation, and deactivation of catalysts. Theories and concepts of selective oxidation technology. Biocatalytic reactions.

[Pre-requisite; CHE 0346]

CHE 1551 Membrane Separation Processes 3(3-0)
 Membranes and module preparation: symmetrical, asymmetrical, ceramic and metal, and liquid membranes, microfiltration, ultrafiltration, reverse osmosis, gas separation, pervaporation, electro dialysis, facilitated transport, membrane distillation.

[Pre-requisite; CHE 0336]

CHE 1571 Water and Waste-Water Treatment 3(3-0)
 Engineered Systems for water Purification. Coagulation and flocculation, Filtration: slow sand filters and rapid filters, filtering materials, headless in filters. Physical-chemical treatment for dissolved constituents, lime-soda softening, ion exchange, adsorption, membrane processes, iron and manganese removal. Disinfection, kinetics of disinfection, chlorination, other disinfectants.

[Pre-requisite; CHE 0453]

CHE 1572 Hydrometallurgy 3(3-0)
 The chemistry and engineering aspects of hydrometallurgical unit processes - leaching, separation, extraction and recovery, extraction techniques will include the oxidative and non-oxidative leaching of minerals, purification, and recovery of metals by precipitation, ion exchange and solvent extraction, recovery of metals by reduction and electro winning, chemistry, design and operation of some common hydrometallurgical processes.

[Pre-requisite; CHE 0453]

CHE 1599 Special Topics in Chemical Engineering 3(3-0)
 Special topics in chemical engineering taught by faculty members covering contemporary issues in chemical engineering. Title and course contents of the topic must be approved by the Department's Council and pre-announced by the Department of Chemical Engineering.

[Pre-requisite; Passing 120 Cr. Hrs.]