

B.Sc. in Chemical Engineering Study Plan

■ University Compulsory Courses 16 C.H

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■ University Elective Courses 9 C.H

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■ Faculty Compulsory Courses 32 C.H

Line No.	Code	Course	
224000	CHE400CH	PROFESSIONAL ETHICS FOR ENGINEERS	1
242020	EE202EE	COMMUNICATION SKILLS FOR ENGINEERS	2
901010	MATH101	CALCULUS(1)	3
901020	MATH102	CALCULUS (2)	3
902010	MATH201	INTERMEDIATE ANALYSIS	3
902030	MATH203	ORDINARY DIFFERENTIAL EQUATIONS	3
911010	CHEM101	GENERAL CHEMISTRY(1)	3
911020	CHEM102	GENERAL CHEMISTRY (2)	3
911072	CHEM107B	GENERAL CHEMISTRY LAB	1
921010	PHY101	GENERAL PHYSICS (1)	3
921020	PHY102	GENERAL PHYSICS (2)	3
921072	PHY107B	GENERAL PHYSICS (LAB)	1
1731150	CS115	C++ PROGRAMMING LANGUAGES	3

■ Department Compulsory Courses 87 C.H

Line No.	Code	Course	
222011	CHE201A	INTRODUCTION TO CHEMICAL ENGINEERING	1
222040	CHE204	FUNDAMENTALS OF CHEMICAL ENGINEERING	3
223110	CHE311	MATERIALS SCIENCE	3
223400	CHE340	THERMODYNAMICS	3
223420	CHE342	CHEMICAL ENGINEERING THERMODYNAMICS (2)	3
223431	CHE343A	FLUID MECHANICS FOR CHEMICAL ENGINEERS	3
223440	CHE344	FLUID MECHANICS LAB	1
223461	CHE346A	HEAT TRANSFER	3
223620	CHE362	UNIT OPERATIONS	3
224310	CHE431	CHEMICAL REACTION ENGINEERING (1)	3
224321	CHE432A	CHEMICAL REACTION ENGINEERING (2)	3
224411	CHE441A	CHEMICAL MEASUREMENTS & TESTING LAB	1
224421	CHE442A	HEAT&MASS TRANSFER LAB	1
224520	CHE452	APPLIED MATHEMATICS AND MODELING FOR CHEMICAL ENGINEERS	3
224611	CHE461A	MASS TRANSFER	3
224640	CHE464	SEPARATION PROCESSES	3
224721	CHE472A	EQUIPMENT DESIGN	3
224830	CHE483	INTRODUCTION TO BIOCHEMICAL ENGINEERING	3
224900	CHE490	ENGINEERING PRACTICE	3

225350	CHE535	CHEMICAL PROCESSING	1
225510	CHE551	PROCESS DYNAMICS AND CONTROL	3
225520	CHE552	PROCESS CONTROL LAB	1
225551	CHE555A	COMPUTER APPLICATIONS LAB.FOR CHEMICAL ENGINEERS	1
225570	CHE557	INSTRUMENTAL ANALYSIS	3
225650	CHE565	UNIT OPERATIONS LAB	1
225750	CHE575	PLANT DESIGN TECHNICAL COMMUNICATION	3
225910	CHE591	GRADUATION PROJECT (1)	1
225920	CHE592	GRADUATION PROJECT (2)	3
243031	EE303	PRINCIPLES OF ELECTRICAL ENGINEERING	3
243051	EE305	NUMERICAL METHODS FOR ENGINEERS	3
251010	ME101	ENGINEERING WORKSHOPS	2
251011	ME101A	ENGINEERING WORKSHOP (LAB)	0
252000	ME200	ENGINEERING DRAWING (A)	1
293410	IE341	ENGINEERING ECONOMY	2
912110	CHEM211	ORGANIC CHEMISTRY(1)	3
912120	CHEM212	ORGANIC CHEMISTRY (2)	3
912131	CHEM213A	ORGANIC CHEMISTRY LAB (1)	1
913470	CHEM347	PHYSICAL CHEMISTRY (2)	3

■ Department Elective Courses 15 C.H

Line No.	Code	Course	
224110	CHE411	CORROSION ENGINEERING	3
224120	CHE412	POLYMER SCIENCE AND TECHNOLOGY	3
224150	CHE415	CERAMICS ENGINEERING	3
224240	CHE424	PETROLUUM REFINERY ENGINEERING	3
224430	CHE443	ENERGY AND ANALYSIS OF FOSSIL FUELS	3
224500	CHE450	EXPERIMENTAL DESIGN AND DATA ANALYSIS	3
224571	CHE457A	OPTIMIZATION	3
224820	CHE482	AIR POLLUTION AND CONTROL	3
225180	CHE518	ELECTROCHEMICAL ENGINEERING	3
225210	CHE521	CHEMICAL INDUSTRIES	3
225240	CHE524	FOOD ENGINEERING	3
225430	CHE543	RENEWABLE ENERGY	3
225631	CHE563A	MINERAL PROCESSING	3
225660	CHE566	DESALINATION	3
225680	CHE568	GAS PROCESSING AND TREATMENT	3
225770	CHE577	INDUSTRIAL SAFETY ENGINEERING	3
225810	CHE581	MEMBRANE SEPARATION PROCESSES	3
225831	CHE583A	PHYSICAL AND CHEMICAL WATER TREATMENT	3
225850	CHE585	BIOCHEMICAL ENGINEERING	3
225870	CHE587	BIOLOGICAL WATER TREATMENT	3
225880	CHE588	PHARMACEUTICAL PROCESS TREATMENT	3

225900	CHE590A	SPECIAL TOPICS A	3
225901	CHE590A	SPECIAL TOPICS B	2
225902	CHE590B	SPECIAL TOPICS C	1
225903	CHE590C	SPECIAL TOPICS-WATER TREATMENT&DESALINATION BY MEMBRANES	3
225904	CHE590D	SPECIAL TOPICS - PHARMACEUTICAL ENGINEERING	3
225905	CHE590	SPECIAL TOPICS - QUALITY CONTROL	3
255282	ME528B	THERMAL POWER PLANTS	3
255812	ME581A	HEATING VENTILATION AND AIR CONDITIONING	3
255822	ME582A	REFRIGERATION	3
295480	IE548	FACILITIES PLANNING	3
295560	IE556	TOTAL QUALITY MANAGEMENT	3
295570	IE557	INTRODUCTION TO PROJECT MANAGEMENT	3
295740	IE574	RELIABILITY AND MAINTENANCE MANAGEMENT	3

TOTAL**159 C.H**

*** For prerequisite & equivalent courses see
the Courses' Description.**

B.Sc. in Chemical Engineering

Courses' Description

ChE 201 Introduction to Chemical Engineering 1 C.H

Careers in Chemical Engineering, units and dimensions, numerical calculations and estimation, process data; representation and analysis, processes and process variables. *Pre: Chem 102*

ChE 204 Fundamentals of Chemical Engineering 3C.H

Material Balances: fundamentals of material balances, single and multi phase systems. Energy balances for processes; steady and transient, reactive and nonreactive. *Pre: ChE 201, CS 115, ME 200 or Co*

ChE 311 Materials Science and Engineering 3 C.H

Atomic structure and bonding. Crystal structures. Solidification, crystalline imperfections and diffusion in solids. Mechanical properties of metals. Thermal processing of metals. Phase diagrams and engineering alloys. Polymeric ceramic and composite materials. Corrosion and degradation of materials. *Pre: Chem 212 and ChE 204*

ChE 340 Thermodynamics 3 C.H

Forms of energy. Open and closed systems. Work and heat. PVT properties of pure fluids and steam tables. First law of thermodynamics. Second law of thermodynamics. entropy concept and third law of thermodynamics (open and closed systems). Analysis of power cycles (power plants and refrigeration) *Pre: Math 203*

ChE 342 Chemical Engineering Thermodynamics 3 C.H

Heat Effects. Phase Rule. Thermodynamic Properties of Gas Mixtures & Liquid Solutions. Vapor-Liquid Equilibria. Liquid-Liquid Equilibria. Chemical Reaction Equilibria. *Pre: ChE 340*

ChE 343 Fluid Mechanics for Chemical Engineers 3 C.H

Fluid Static. Continuity Equation. Energy Equation (Bernoulli's Equation). Flow measuring Devices. Fluid Friction of Flowing Systems. Momentum Balance. Dimensional Analysis. Pumps Types and their Performance Curves. *Pre: Math 203 & ChE 340 or Co*

ChE 344 Fluid Mechanics Laboratory 1 C.H 3 H Lab

The following experiments are expected to be performed: Density, viscosity and surface tension measurements, pressure and flow measurements, friction and Reynolds tests, impact of a water jet, center of pressure, pumps' testing. *Pre: ChE 343*

ChE 346 Heat Transfer 3 C.H

Nature and Modes of Heat Transfer. Steady-State Heat Conduction. Unsteady-State Heat Conduction (Lumped Analysis). Principles of Convection. Empirical Relations for Natural and Forced Convection. Introduction to Boiling & Condensation. Heat Exchangers. *Pre: ChE 343 & EE-305 or Co*

ChE 362 Unit Operation 3 C.H

Characterization of solid particles. Storage of solids. Drag and drag coefficients. Flow through beds of solids. Mechanics of particle motion. Settling. Fluidization. Size reduction. Screening. Filtration. Gravity sedimentation processes. Separation by centrifuges. Separation by cyclones. Evaporation. *Pre: ChE 343*

ChE 400 Professional Ethics for Engineers 1 C.H

Awareness on the role of engineers and engineering profession and the ethical issues in the practice of engineering: codes of ethics, safety and liability, professional responsibility to clients and employers, corporate responsibility, legal obligations, conflicts of interest, risk assessment, sustainable development, social and environmental issues, contemporary issues, multidisciplinary teams, and life long learning. *Pre: Completion of 90 Cr. Hr.*

ChE 411 Corrosion Engineering 3 C.H

Electrochemical and metallurgical aspects of corrosion. Forms of corrosion. Modern theory of corrosion and its application. Iron and steel corrosion. Corrosion prevention. Case studies. *Pre: ChE 311*

ChE 412 Polymer Science and Technology 3 C.H

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: Chem 212 and ChE 431*

ChE 415 Ceramics Engineering 3 C.H

Crystalline structure. Phase diagrams. Ceramic materials and properties. Cement, glass, porcelain, bricks and pottery. Ceramic processing: extrusion, pressing, glazing, and finishing processes. *Pre: ChE 311*

ChE 424 Petroleum Refining Engineering 3 C.H

Origin and composition of petroleum. Crude oil analysis and evaluation. Petroleum products and their uses. Refinery structure. Refinery operations and processes: Atmospheric & Vacuum Distillation, Fluid Catalytic Cracking, Platforming, Hydro-desulfurization and Hydrotreating, Chemical treatment, Asphalt production, Lube oils production. Refinery Utilities. Waste Treatment. Standards and Specifications. *Pre: Chem 212 and ChE 464*

ChE 431 Chemical Reaction Engineering I 3 C.H

Mole balances. Kinetics of homogeneous reactions. Analysis of reaction rate data. Design of isothermal reactors (batch, CSTR, and plug flow). Single and multiple ideal reactors. Multiple reactions. *Pre: Chem 347 and ChE 342*

ChE 432 Chemical Reaction Engineering II 3 C.H

Energy balance for ideal reactors. Non-isothermal reactor design. Multiple steady state and stability of CSTR's. Non-ideal reactors and residence time distribution (RTD). Design of heterogeneous reacting systems. Introduction to fluid-fluid reactions. *Pre: ChE 431*

ChE 441 Chemical Measurements and Testing Lab. 1 C.H 3 H Lab

The following experiments and universal tests in chemical engineering are expected to be performed: Temperature measurement, corrosion testing, petroleum fractions testing, vapor pressure measurement, instrumental analysis techniques: gas chromatography (GC), differential thermal Analysis (DTA), atomic absorption spectrophotometry (AAS), high performance liquid chromatography (HPLC) and fluorescence spectrophotometry. *Pre: ChE 342 & ChE 346*

ChE 442 Heat & Mass Transfer Lab. 1 C.H, 3 H Lab

The following experiments are expected to be performed: Heat conduction in solids, free and forced convection, thermal conductivity of liquids and gases, coil, plate, and shell-and-tube heat exchangers, saturation pressure and throttling, vapor-liquid equilibria, mass transfer and diffusion coefficients of liquids and gases, wetted-wall gas absorption.

Pre: ChE 461 or Co

ChE 443 Energy and Analysis of Fossil Fuels 3 C.H

Importance of energy in our life. Impact of energy generation and use on the environment. Fossil fuels and their analysis. Principles of combustion, gasification, and pyrolysis. Steam and gas generation. Power cycles.

Pre: ChE 432 and ChE 461

ChE 450 Experimental Design and Data Analysis 3 C.H

Review of Statistical distributions. Simple comparative experiments. Experiments with a single factor. Analysis of variance; randomized blocks, Latin squares, and related designs. Incomplete block designs, Factorial designs, Confounding in factorial designs, Two-level fraction factorial designs, Multi-factor experiment and nested designs. *Pre: EE 305*

ChE 452 Applied Mathematics and Modeling for Chemical Engineers 3 C.H

Mathematical modeling of chemical engineering processes. Solution of mathematical models involving ordinary, differential and algebraic equations. Solution of partial differential equations (PDE's), Fourier half-range cosine and sine expansions. Bessel's function. Generalized Bessel's equation, Sturm-Liouville theorem. Laplace transforms. *Pre: EE 305 & ChE 432 or Co*

ChE 457 Introduction to Optimization 3 C.H

Survey of continuous optimization problems. Unconstrained optimization problems. Introduction to constrained optimization. Solution of constrained optimization problems. Software packages in optimization. *Pre: EE 305*

ChE 461 Mass Transfer 3 C.H

Molecular diffusion. Mass transfer coefficients. Mass transfer across interface. Analogy between momentum, heat and mass transfer. Continuous and stage-wise processes. Equipment for gas-liquid mass transfer operations. Absorption. *Pre: ChE 342 and ChE 346*

ChE 464 Separation Processes 3 C.H

Binary and multi-component distillation, humidification and dehumidification, drying, extraction, and leaching. *Pre: ChE 461*

ChE 472 Equipment Design 3 C.H

Selection of materials of construction. Design of pipes and pumping systems, compressors, tanks, pressure vessels, storage equipment, heat exchangers, and plate and packed towers. *Pre: ChE 311, ChE 464 or Co*

ChE 483 Introduction to Biochemical Engineering

This course provides integration of the principles of chemical engineering, biochemistry, and microbiology with applications to the biochemical processes. Quantitative, problem-solving methods are emphasized. Topics include: cellular biology, polymeric cell compounds, enzyme and microbial kinetics, application of industrial enzymes, and cell growth cycle.

Pre: ChE 431 or Co

ChE 484 Air Pollution 3 C.H

Introduction to air pollution. Clean air act, quality and emission standards. Criteria pollutants. Air pollution and meteorology. Atmospheric dispersion. Emission control. Effect of pollutants on the global atmosphere.

Pre: ChE 362 and ChE 461

ChE 490 Engineering Training 3 C.H

Practical training for 8 weeks after the completion of 117 credit hours (See Engineering Training Regulations of the College of Engineering).

Pre: Completion of 117 Cr. Hr. and ChE 400

ChE 518 Electrochemical Engineering 3 C.H

Basics of electrochemistry. Mass transfer in electrochemical systems. Electrochemical applications: batteries, fuel cells, electroplating, electrolytic industries. Metal recovery from electrochemical process wastes. *Pre: ChE 431 & ChE 461*

ChE 521 Chemical Industries 3 C.H

Fundamentals of chemical industries. Study of selected industries such as water treatment; industrial gases; ceramic, cement and glass industries; fertilizers industries; sulfuric acid; phosphoric acid; etc. case studies on industries related to consumer products.

Pre: ChE 464 or Co

ChE 524 Food Engineering 3 C.H

Rheological properties of food. Phase transitions and transformations in food systems. Food freezing. Food dehydration. Transport phenomena in food systems. Food packaging. *Pre: ChE 362 and ChE 461*

ChE 535 Chemical Processing Lab. 1 C.H, 3Hr Lab

The following experiments are expected to be performed: Batch reactor, tubular reactor, CSTR, dynamics of stirred tanks in series, residence time distribution, water treatment, flocculation, oil extraction, and phosphoric acid production. *Pre: ChE 432*

ChE 543 Renewable Energy 3 C.H

Wind, solar, hydraulic, geothermal, tidal power, solid wastes, biofuels, ...etc. Nuclear energy. Fuel cells, hybrid systems. *Pre: ChE 342 and ChE 346*

ChE 551 Process Dynamics and Control 3 C.H

Process dynamics in time and Laplace domains. Input/output relationships. Basic components of control systems. Design of single-loop feedback control systems: stability, tuning, and synthesis techniques. Applications to chemical engineering processes.

Pre: ChE 452

ChE 552 Process Control Lab. (1C.H . Hr, 3Hr. Lab.)

The following experiments are expected to be performed: Temperature control, level control, pressure control, flow control, and process module.

Pre: ChE 551

ChE 555 Computer Applications Lab. for Chemical Engineers 1 C.H, 3 H Lab

Usage of commercial process simulation packages; Aspen, Chemcad, Hysys, or others. *Pre: ChE 472 or Co*

ChE 557 Instrumental Analysis 3 C.H

Analytical measurements and measurement systems, separation methods of analysis, spectroscopic methods of analysis, thermal methods of analysis, electrochemical methods of analysis, Mass and NMR spectroscopy, Automated methods of analysis. *Pre: ChE 464 or Co*

ChE 563 Mineral Processing 3 C.H

Classification of ores and metals. Ore preparation. Extraction of metals from ores. Pyrometallurgy and hydrometallurgy. Thermodynamics and kinetics of extractive processes. Metallurgical furnaces. Metal refining. *Pre: ChE 362 and ChE 461*

ChE 565 Unit Operations Lab. 1 C.H, 3 H. Lab

The following experiments are expected to be performed: packed and tray distillation, packed-column gas absorption, liquid-liquid extraction, humidification/dehumidification in cooling towers, spray drying, tray drying, evaporation, filtration, fluidization, screen analysis and size reduction. *Pre: ChE 362 & ChE 464*

ChE 566 Desalination 3 C.H

Physical and chemical properties of sea water, scale formation and control. Distillation processes. Membrane processes. Energy consumption in the different desalting systems. *Pre: ChE 461*

ChE 568 Gas Processing and Treatment 3 C.H

Natural and refinery gases. Liquefied petroleum gases. Water-hydrocarbon system, hydrate formation and inhibition. Dehydration and sweetening, sulfur dioxide removal. Conversion of gas impurities. Removal of nitrogen compounds from gas streams. Equipment sizing, selection and design. *Pre: ChE 464 or Co*

ChE 575 Plant Design 3 C.H

Process design development. General plant design considerations: health and safety, environmental factors, plant location and plant layout. Computer aided design. Economic principles including cost estimation. Design optimization. Report writing. Case studies. *Pre: IE 341, ChE 472 or Co*

ChE 577 Chemical Process Safety 3 C.H

Importance of safety in industry. Accident analysis. Hazards of fires, explosions, dust, noise, radiation, electrical current and preventive methods. Hazards of toxic, corrosive, and carcinogenic chemicals and threshold limit values. Risk analysis exceeding the operating conditions. Required safety tools. Case Studies. *Pre: ChE 575 or Co*

ChE 581 Membrane Separation Processes 3 C.H

Membranes and module preparation: symmetrical, asymmetrical, ceramic and metal, and liquid membranes. Microfiltration, ultrafiltration, reverse osmosis, gas separation, pervaporation, electrodialysis, facilitated transport, membrane distillation. *Pre: ChE 461*

ChE 583 Physical and Chemical Water Treatment 3 C.H

Water quality. Sedimentation, thickening and flotation. Filtration and centrifugation. Adsorption. Membrane separation processes. Chemical equilibria in aqueous systems. Coagulation. Ion exchange. Oxidation and disinfection. *Pre: ChE 464 or Co*

ChE 585 Biochemical Engineering

An Integrated approach to the application of engineering principles to biochemical processes. Quantitative, problem-solving methods are emphasized. Topics include: enzyme immobilization, transport phenomena in biological systems, design of bioreactors, sterilization, scale-up of bioreactors, and bioseparation. *Pre: ChE 461 & ChE 483*

ChE 587 Biological Wastewater Treatment 3 C.H

Wastewater characterization. Aeration and mass transfer. Biological mechanisms and kinetics. Models for biological reactors. Biological design parameters. Biological nutrient removal (BOD, nitrogen and phosphorous). Activated sludge processes. Anaerobic digestion. Fixed-film biological systems. Sludge treatment and disposal. *Pre: ChE 483*

ChE 588 Pharmaceutical Process Engineering 3 C.H

Application of transport processes and unit operations in pharmaceutical engineering such as particle size reduction, sieving, blending, drying, granulation, tableting, coating, encapsulation, sterilization. Crystallization processes for concentrated drug solutions and solids. *Pre: ChE 362 & ChE 464*

ChE 590A Special Topics A 3 C.H

Title and course contents of the topic must be approved by the Department's Council and pre-announced by the Department of Chemical Engineering.

ChE 590B Special Topics B 2 C.H

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: Department Council Approval*

ChE 590C Special Topics C (1 C.H . Hr.)

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: Department Council Approval*

ChE 591 Graduation Project I 1 C.H

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. The general objectives are to improve the student's skills and creativity, and to give him/her the experience of problem solving through integration of chemical engineering principles. *Pre: Completion of 114 Cr. Hr. & ChE 575 or Co*

ChE 592 Graduation Project II 3 C.H

Completion of the same project started in CHE 591 with more details, theoretical and/or experimental work, design and calculations. *Pre: ChE 591*