



FACULTY OF ENGINEERING



DEPARTMENT OF CHEMICAL ENGINEERING

Bachelor of Science (BS) Degree – 109 Credits

Sem	Course Code	Course Title	Credit	Pre-Req	Co-Req
1	CHEM 202	Basic Chemistry	3		
1	CHEM 203	Basic Chemistry Laboratory	1		CHEM 202
1	CHEN 206	Instrumentation Lab And Research Methods	1		
1	CHEN 212	Chemical Engineering I	3		MATH 200
1	ENGL 203	English Communication Skills III	3		
1	MATH 200	Calculus I	3		
1	MATH 211	Linear Algebra I	3		
Sem	Course Code	Course Title	Credit	Pre-Req	Co-Req
2	CHEM 262	Physical and Chemical Kinetics	3	CHEM 202	
2	CHEN 290	Introduction to the Engineering Design Fundamentals	1		
2	CHEN 312	Mass Transfer	3	CHEN 212	
2	CSIS 206	Principles of Programming	3		
2	LISP 200	Information Skills and Search Techniques	1		ENGL 102
2	MATH 270	Differential Equations	3	MATH 200	
2	MECH 232 or CHEN 232	Thermodynamics	3		
Sem	Course Code	Course Title	Credit	Pre-Req	Co-Req
3	CHEM 242	Organic Chemistry I	3	CHEM 202	
3	CHEN 215	Materials Science and Engineering	3		
3	CHEN 303	Unit Operations	3	CHEN 312	MECH 243
3	GENG 221	Engineering Ethics	3	CHEN 290 ENGL 203	
3	MATH 202	Calculus II	3	MATH 200	
3	MECH 243	Fluid Mechanics	3	MECH 232	
Sem	Course Code	Course Title	Credit	Pre-Req	Co-Req
4	CHEM 244	Organic Chemistry II	3	CHEM 242	

4	CHEM 245	Organic Chemistry Laboratory	1	CHEM 242	
4	CHEN XXX	Option Elective	3		
4	CHEN 325	Chemical Reactions and Reactor Design	3	CHEN 312	CHEM 262
4	ENGL 2XX	English Elective	3	ENGL 203	
4	GENG 222	Sustainable Development for Engineers	3	CHEN 290 ENGL 203	
4	MATH 230	Numerical Analysis I	3	CSIS 206 MATH 200	
Sem	Course Code	Course Title	Credit	Pre-Req	Co-Req
5	CHEN XXX	Option Elective	3		
5	CHEN 322	Petroleum Refinery Engineering	3		CHEN 324
5	CHEN 324	Petroleum Engineering Lab	1		CHEN 322
5	CHEN 332	Safety, Health, and Environment	3	CHEN 303	
5	CHEN 362	Chemical Process Simulation and Design	1	CHEN 303	CHEN 391
5	CHEN 377	Chemical Engineering Thermodynamics II	3	MECH 232	
5	CHEN 391	Senior Design 1	2	CHEN 290 CHEN 325 CHEN 303 MATH 202 GENG 221 GENG 222	CHEN 362
5	MATH 246	Probability For Engineers	3	MATH 200	
Sem	Course Code	Course Title	Credit	Pre-Req	Co-Req
6	CHEN XXX	Option Elective	3		
6	CHEN 326	Chemical Engineering Lab	1		CHEN 392
6	CHEN 336	Separation Processes	3	CHEN 303	
6	CHEN 360	Chemical Process Control	3	MATH 270 CSIS 206	CHEN 361
6	CHEN 361	Process Control Lab	1		CHEN 360
6	CHEN 392	Senior Design 2	2	CHEN 391	CHEN 326
6	CSPR XXX	Cultural Studies	3	ENGL 203	
6	MECH 321	Heat Transfer	3	MECH 243	
		TOTAL	109		

Option Electives (9 credits from the following list)					
	CHEN 211	Fundamentals of Geology	3		
	CHEN 246	Chemical Engineering Instrumentation	3		
	CHEN 299	Introduction to Renewable Energy	3		
	CHEN 311	Petroleum Fluids	3		
	CHEN 321	Fundamentals of Petroleum Engineering	3		
	CHEN 329	Plant Economics	3		
	CHEN 333	Food Chemistry and Technology Principles	3		
	CHEN 340	Food Engineering Fundamentals	3		
	CHEN 350	Methods of Food Preservation	3		
	CHEN 378	Living Cells Engineering	3		
	CHEN 388	Biofuel Engineering	3		
Students can take only one elective course from outside the department from the following list: CIVE 212, CIVE 309, CIVE 311, GENG 311, MGMT 220 or an approved course by the department					

COURSE DESCRIPTIONS

CHEN 206 INSTRUMENTATION LAB AND RESEARCH METHODS

0.3: 1 cr. E

This laboratory introduces students to experimental work and the use of measurement instruments. The laboratory course also introduces the methodology of writing technical reports will be covered. Students will also learn to identify important and relevant information from different sources (books, journal papers, patents, etc.) and how to use practically use essential software tools (Microsoft Office Suite) for experimental data processing.

CHEN 211 FUNDAMENTALS OF GEOLOGY

3.0: 3 cr. E

This course provides an introduction to Earth geology. Topics include plate tectonics, the makeup of continents and mountain building. Heat flow, magnetism, gravity, rock deformation, earthquakes and the earth's interior are also covered. The course discusses surface processes including weathering, erosion, transport and deposition. Landforms, rivers, groundwater, glaciers, ocean processes, and volcanoes. Minerals and rocks.

CHEN 212 CHEMICAL ENGINEERING I

3.0: 3 cr. E

This course provides an introduction to the engineering profession in general and the discipline of chemical engineering in particular. It gives an overview of the chemical engineering profession and career choices. This course is designed to introduce chemical engineering sophomores to basic principles in chemical engineering.

The material covered builds a foundation for subsequent courses in the program (e.g., thermodynamics, reaction engineering, fluid mechanics, process design, heat and mass transfer, etc.).

Co-requisite: MATH 200

CHEN 215 MATERIALS SCIENCE AND ENGINEERING

3.0: 3 cr. E

This course introduces fundamental concepts in materials science. The main purpose of this course is to provide a good understanding of the materials science and engineering. Topics covered include: atomic structure and interatomic bonding, crystalline structure, crystal defects, diffusion, phase diagrams, mechanical properties of metals, corrosion and degradation of materials.

CHEN 232 THERMODYNAMICS

3.0: 3 cr. E

This is an introductory course which aims at providing engineering students with theoretical background necessary to perform classical engineering analysis of basic open and closed thermodynamic systems; Properties of pure substance; Heat; Work; First Law of Thermodynamics; Second Law of Thermodynamics; Entropy; Reversibility and Irreversibility; Power and Refrigeration Cycles.

CHEN 290 INTRODUCTION TO THE ENGINEERING DESIGN FUNDAMENTALS

0.3: 1cr. E

This course focuses on the engineering design process along with the utilization of standards and constraints. Students will be introduced to needs identification and solution finding, project management skills, technical writing and presenting, effective multidisciplinary teamwork, and will be exposed to the qualities and attributes of a modern day engineer as expected by professional engineering societies, including integrity, professionalism, ethical commitment and environmental requirements, as well as the role of the engineer in society.

CHEN 299 INTRODUCTION TO RENEWABLE ENERGY

3.0: 3 cr. E

This course covers renewable energy technologies and potentials (solar, wind, hydro, biomass, tidal and geothermal energy). It introduces a general engineering audience to the basic concepts of renewable energy. Illustrated examples for each lecture are from industrial developments and real world applications.

CHEN 303 UNIT OPERATIONS**3.0: 3 cr. E**

This course covers the design and analysis of unit operations with emphasis on distillation, absorption, and extraction. Topics include: design problems of batch and continuous operations of single and multistage equilibrium distillation processes with binary and multicomponent compositions, single and multi-cascade of co current and counter current liquid-liquid extraction. Graphical and analytical design techniques, efficiency and capacity of separation processes are covered.

Pre-requisite: CHEN 312

Co-requisite: MECH 243

CHEN 311 PETROLEUM FLUIDS**3.0: 3 cr. E**

This course covers properties of natural gases; properties of crude oils; fluid phase behavior; vapor-liquid equilibria; equations of state theory and applications; petroleum fluid characterization; petroleum product specifications; surface separations; H₂O/hydrocarbon phase behavior; introduction to PVT phase behaviour; simulation software.

CHEN 312 MASS TRANSFER**3.0: 3 cr. E**

This course provides an introduction to the basic principles of mass transfer and applications. The principal topics covered include principles of molecular diffusion, Fick's law, molecular diffusion in fluids, diffusion in solids, convective mass transfer, interfacial mass transfer, mass transfer coefficient and fluxes, correlation of mass transfer coefficients, interphase mass transfer, theories of mass transfer, individual gas and liquid phase mass transfer coefficient, overall mass transfer coefficient, design and operation of equipment for absorption, mechanism of absorption, Kremser equation, packed tower design, height of column based on conditions in the gas film, height of column based on conditions in the liquid film, height of column based on overall coefficients, calculation of number of plates by graphical methods, total and minimum reflux ratio.

Pre-requisite: CHEN 212

CHEN 321 FUNDAMENTALS OF PETROLEUM ENGINEERING**3.0: 3 cr. E**

This course provides an overview of petroleum engineering systems including: uses of petroleum products, exploration, exploitation subjects such as drilling, production, reservoir and formation evaluation, transportation and refining; design of the reservoir management plan; performance prediction; marketing; government regulation.

CHEN 322 PETROLEUM REFINERY ENGINEERING**3.0: 3 cr. E**

This course introduces fundamental concepts in petroleum refinery processes. An overview of petroleum refinery, its feedstocks, and the processes employed to convert crude oil and intermediate streams into finished products are presented. Crude oil composition and classification, hydrocarbon chemistry, crude oil properties and preparation, refinery products quality and test methods are discussed. Every refining process is presented, including operating conditions and description, feedstock composition and catalyst selection, product yields, and the relationship between process parameters, unit performance and product output/properties. This course delivers major insights into several processes such as Atmospheric Distillation (CDU), Vacuum Distillation (VDU), Cracking, Hydrocracking, Catalytic Reforming, Coking, Visbreaking.

Co-requisite: CHEN 324

CHEN 324 PETROLEUM ENGINEERING LAB**3.0: 3 cr. E**

The purpose of this lab course is to provide students with an understanding of Petroleum Chemistry.

The lab course addresses the chemical composition and properties of petroleum (oil and gas), and provide knowledge of petroleum products and alternative fuels. Minimum of 20 experiments is to be conducted, testing of petroleum and its analysis. All experiments are demonstrated and manipulated by the students.

Co-requisite: CHEN 322

CHEN 325 CHEMICAL REACTIONS AND REACTOR DESIGN **3.0: 3 cr. E**

This course explains the principles of chemical reactions and isothermal reactor design. Batch, continuous stirred-tank, plug flow and packed-bed reactors are introduced in addition to semi-batch and membrane reactors. Multiple reactions, enzymatic reactions and bioreactors are also studied.

Pre-requisite: CHEN 312

Co-requisite: CHEM 262

CHEN 326 CHEMICAL ENGINEERING LAB **3.0: 1 cr. E**

This course covers experiments in the area of unit operations and chemical engineering reactor design including fluid-flow phenomena through various media such as: friction in conduits, filtration, pressure drop in packed towers and, fluidization of solids/drying. Moreover, basic chemical engineering concepts regarding heat and mass transfer processes in evaporation, absorption, extraction and distillation operations are covered.

Co-requisite: CHEN 392

CHEN 329 PLANT ECONOMICS **3.0: 3 cr. E**

This course introduces concepts of design of equipment, systems and plants; discussion of factors important in chemical plant design such as: economics, cost estimation, profitability, process selection, materials of construction, process control, plant location and safety. Introduction to optimization and computer-aided design. Principles are illustrated with short industrial-type problems. Recommended background: thermodynamics; heat, mass and momentum transfer; inorganic and organic chemistry; chemical kinetics and reactor design.

CHEN 332 SAFETY, HEALTH, AND ENVIRONMENT **3.0: 3 cr. E**

The course is designed to acquaint students to topics of the safety, health and environment (SHE) in the chemical plants like: temperature and pressure hazards, fire and explosion hazards, radioactive wastes hazards, equipment, energy and electrical hazards, construction and tool hazards, personal protective equipment hazards, engineering controls, administrative controls, vehicle and transportation hazards, working area and height hazards, hearing and noise hazards, fire, rescue, and emergency response equipment.

Pre-requisite: CHEN 303

CHEN 333 FOOD CHEMISTRY AND TECHNOLOGY PRINCIPLES **3.0: 3 cr. E**

This course aims to provide an introduction to the chemistry of the major food constituents carbohydrates, proteins, lipids, water, and minor components. This course introduces students to nutrition, food preservation, and different food processing technologies (wine fermentation, dairy products processing, poultry, meat, and seafood products processing, etc.).

CHEN 336 SEPARATION PROCESSES **3.0: 3 cr. E**

This course involves the analysis and design of separation processes involving adsorption, chromatography, membrane separation, and crystallization techniques. The basic mechanisms and the

mathematical description of mass and heat transfer rates, and phase equilibria used for the design of these separation processes are addressed.

Pre-requisite: CHEN 303

CHEN 340 FOOD ENGINEERING FUNDAMENTALS **3.0: 3 cr. E**

This course covers the multidisciplinary field of applied physical sciences which combines science, microbiology, and engineering education for food and related industries; the application of agricultural engineering and chemical engineering principles to food materials; many challenges to employ modern tools, knowledge and technology to develop new products and processes.

CHEN 350 METHODS OF FOOD PRESERVATION **3.0: 3 cr. E**

This course covers the common methods of preservation and techniques used in commercial food processing methods. These methods are used to treat and handle food to stop or greatly slow down microbial growth in order to preserve the foods quality and nutritive value.

CHEN 360 CHEMICAL PROCESS CONTROL **3.0: 3 cr. E**

This course covers continuous-time signal transformations and system classifications; Fourier series and transform, Laplace transform, block diagram algebra and signal flow graph, stability analysis techniques (Routh-Hurwitz Criterion), root locus, state space analysis, modern control design (State Feedback Control) and classical control design (PID and phase compensation).

Pre-requisites: MATH 270, CSIS 206

Co-requisite: CHEN 361

CHEN 361 PROCESS CONTROL LAB **0.3: 1 cr. E**

This laboratory complements the theoretical concepts of chemical process control. The course involves extensive use of computer software such as MATLAB and Simulink. Topics include: dynamic simulation of linear and nonlinear mathematical models of chemical processes, design of PID controllers, tuning of controller to accommodate process model uncertainty.

Co-requisite: CHEN 360

CHEN 362 CHEMICAL PROCESS SIMULATION AND DESIGN **0.3: 1 cr. E**

This course introduces students to process simulation and design of various chemical and related process industries. Major emphasis is placed on the simulation of chemical engineering units (reactors, distillation columns, heat exchangers, etc.) used for plant design on Aspen Plus software. Proper unit sizing and cost analysis are covered to understand how various costs affect the process economics involved in industrial processes.

Pre-requisite: CHEN303

Co-requisite: CHEN 391

CHEN 377 CHEMICAL ENGINEERING THERMODYNAMICS II **3.0: 3 cr. E**

This course covers the second law of thermodynamics, entropy, thermodynamic properties of fluids and thermodynamic diagrams. Topics of application of thermodynamics to flow processes, power production, and refrigeration are also covered. Vapor-liquid equilibrium, solution thermodynamics, fugacity, and chemical reaction equilibria are explained.

Pre-requisite: MECH 232

CHEN 378 LIVING CELLS ENGINEERING**3.0: 3 cr. E**

This course covers concepts of engineering of the living systems, biomolecules, biological catalysers, living cells, basic concepts and applications related to chemical engineering. The course also includes the topics of structure and role of the cellular components in bioprocesses, cell and enzyme types, kinetics of enzymatic reactions, cell growth, operating conditions, selection of bioreactors, and metabolic pathways and regulation. The course includes examples of bioprocesses using different types of cells and applications in biotechnology, environmental engineering, pulp and paper, food technology and energy.

CHEN 388 BIOFUEL ENGINEERING**3.0: 3 cr. E**

This course emphasizes the importance of biofuel engineering process technology. It will cover the following topics: the harvesting of energy from biochemical reactions, the modeling of biofuel production, the biofuel feedstocks, the ethanol production, the different kinds of biodiesel, the microbial fuel cell, and the methane production.

CHEN 391 SENIOR DESIGN 1**3.0: 2 cr. E**

This course covers the first part of a capstone design project, for which teams of students are formed and real-world engineering problems are chosen. Students should identify the problem(s), scope, relevance, and objectives. Throughout this course, they conduct extensive research and literature review and learn to analyze and understand the design requirements, with consideration of different factors (i.e., public health, safety, ethics, and environment).

Pre-requisites: CHEN 290, CHEN 303, CHEN 325, GENG 221, GENG 222, LISP 200, MATH 202

Co- requisite: CHEN 362

CHEN 392 SENIOR DESIGN 2**3.0: 2 cr. E**

This course constitutes the second semester of a year-long culminating senior project. In this course, the teams of students must complete the capstone project selected in CHEN391 to finish the second phase of the design process namely, (1) carry on the culminating design by selecting different case studies, (2) build, test, and evaluate the physical/virtual model and (3) optimize the final design by improving the process parameters (T, P, flowrate, etc.) and the topology of the process flowchart. At the end of the semester, teams will present/demonstrate their final design process/prototype/product and convey to the public their findings through a comprehensive report and presentation that synthesizes all steps of the simulation and design process and exhibits individual team members' contributions.

Pre-requisite: CHEN 391

Co-requisite: CHEN 326

FACULTY OF ENGINEERING GENERAL COURSES

GENG 221 ENGINEERING ETHICS

3.0: 3 cr. E

This course introduces and reinforces the concepts, theories, and practice of engineering ethics and aims at providing basic knowledge of ethics for engineers in different types of work roles. It prepares the engineering students for identifying, taking responsibility for, and finding solutions to potential ethical problems/cases. It provides students with an interactive study of ethical theory and the development of professionalism and helps them think more clearly and deeply about ethical issues of the natures that engineers often face in professional practice, and explore resources, strategies, and options for dealing with such complications. Students review case studies of ethical conflicts in engineering practice. The course also covers engineering codes of ethics and requires students to resolve theoretical situations through the application of ethical codes.

(A core BS course as of 2023/24 to replace a CSPR XXX course for students who started from year 2022/2023. Previous students can take it as an equivalent of a CSPR XXX course if they have not already taken the required 3 CSPR XXX courses)

Pre-requisite: CHEN/CIVE/ELCP/MECH/290 (according to discipline), ENGL 203

GENG 222 SUSTAINABLE DEVELOPMENT FOR ENGINEERS

3.0: 3 cr. E

This course introduces the fundamental and advanced concepts of sustainable development. It transitions students' understanding of the UN Sustainable Development Goals (SDGs) to focus specifically on the critical role of engineers in achieving these SDGs. Students should then be able to resolve problems by adopting sustainability principles, which should in turn reflect on the students' multidisciplinary design ability to ensure a proper sustainable design process to improve and preserve the quality of life for future generations.

(A core BS course as of 2023/24 to replace a CSPR XXX course for students who started from year 2022/2023. Previous students can take it as an equivalent of a CSPR XXX course if they have not already taken the required 3 CSPR XXX courses)

Pre-requisite: CHEN/CIVE/ELCP/MECH/290 (according to discipline), ENGL 203

GENG 311 ENGINEERING MANAGEMENT AND ECONOMICS

3.0: 3 cr. E

Engineers with excellent managerial skills and superior economic acumen are needed as leader of the new century engineering world. This course prepares engineers to fulfill their managerial responsibilities and acquire useful economic perspectives. This course is organized to contain two major parts: (I) Functions of engineering management, and (II) Economic fundamentals for engineering managers. Part (I) introduces the basic functions on engineering management such as planning, organizing, leading and controlling, while part (II) covers the fundamentals of engineering economics.

Refer to General Listing of Course Descriptions for:

CHEM XXX

Refer to Faculty of Arts and Sciences

CIVE XXX

Refer to the Department of Civil Engineering

CSIS XXX

Refer to Faculty of Arts and Sciences

CSPR XXX

Refer to the Faculty of Arts and Sciences

ENGL XXX

Refer to the Faculty of Arts and Sciences

ENMG XXX

Refer to the Department of Engineering Management

GENG XXX

Refer to the Faculty of Engineering Requirements

LISP XXX

Refer to the Faculty of Arts and Sciences

MATH XXX

Refer to the Faculty of Arts and Sciences

MECH XXX

Refer to the Department of Mechanical Engineering

MGMT XXX

Refer to the Faculty of Business and Management

MRKT XXX

Refer to the Faculty of Business and Management