Courses Description

1. GENERAL ENGINEERING

CS 108	**Computer Programming**	**3 Credit Hours**

The course introduces students to structured programming techniques. Topics include different control statements (sequence, selection, and repetition), functions, fundamental data types, and data structures (arrays and pointers). Upon successful completion of the course, students will solve computer problems by using structured programming techniques and adequate tools (text editor, compiler, and debugger).

GE 100	**Introduction to Engineering**	**0 Credit Hours**

Introduction to the engineering profession, roles and responsibilities of engineers, professional and ethical aspects of the profession, major engineering disciplines, academic background and requirements of each discipline, sub-specialties within each discipline, jobs availability and financial benefits, role of professional engineering bodies and societies, teamwork.

GE 103	**Engineering Graphics and Design**	**3 Credit Hours**

Use of computer drafting software (AutoCAD) to model parts and assemblies. Use of parametric and non-parametric solids, surface and wire frame models. Part editing, two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multi-view, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerance techniques. Team or individual design project.

GE 201	**Statics**	**3 Credit Hours**

Vector analysis, forces, moments, and couples, resultants of force systems, equilibrium analysis and free-body diagrams, analysis of forces acting on members of trusses and frames. Shear-force and bending-moment distributions, centroids, center of mass, hydrostatic pressure, moment of inertia, parallel axis theorem, polar moment of inertia, and product of inertia.

GE 202	**Dynamics**	**3 Credit Hours**

Kinematics and kinetics of particles including Newton's second law, energy-work principles, and impulse-momentum methods. Planar kinematics and planar kinetics of rigid bodies: translation, rotation about a fixed axis, and general plane motion. Introduction to three-dimensional dynamics of rigid bodies.

GE 302	**Professional Ethics for Engineers**	**2 Credit Hours**

Introduction to engineering ethics; definition of a profession, personal and professional ethics, explore many of the ethical issues, discussion of ethical theories, code of ethics, problem solving

techniques. Introduce engineer's rights and responsibilities. Asses Safety, risk and accidents. Explain the Rights and Responsibilities of Engineers.

GE 303	Engineering Economy	3 Credit Hours

This course investigates methods of economic analysis for decision making among alternative courses of action in engineering, business and government applications. Topics include: Time value of money, Money management, and Equivalence calculations under inflation, Present worth analysis, Annual Equivalence Analysis, Rate of return analysis. Benefit-Cost ratio & profitability index analyses.

GE 399	Engineering Training	0 Credit Hours

8 weeks training in a relevant industry under the supervision of an external supervisor from industry. Each student must submit a technical report about his learning experience during training in addition to fulfilling any other requirements as determined by the department.

2. CHEMICAL ENGINEERING CORE COURSES

ChE 211	Principles of Chemical Engineering I	3 Credit Hours

Introduction to chemical engineering and the role of the chemical engineer. The emphasis on engineering problem analysis, units and dimensions, engineering calculations, processes and process variables, and fundamentals of material balances that involve single-phase and multiphase systems.

ChE 213	Principles of Chemical Engineering II	2 Credit Hours

Energy balance: Energy and energy balances, balances on nonreactive processes, balances on reactive processes.

ChE 221	Chemical Engineering Thermodynamics I	3 Credit Hours

Fundamental concepts of thermodynamic systems, heat and work, properties of pure substances, first and second laws, entropy and exergy analysis.

ChE 223	Fluid Mechanics	3 Credit Hours

This course will provide the student with a basic understanding of fluid properties, fluid statics and dynamics, and fluid flow. The flow of incompressible fluids in pressure systems constitutes the major portion of this course. It covers also the momentum balance and fluid measurements.

ChE 224	Heat Transfer I	2 Credit Hour

Fundamentals of heat transfer. Theory of heat transfer and solution methods for heat transfer problems. Introduction to the concept of heat transfer; introduction to conduction; one-dimensional steady-state conduction; two-dimensional steady-state conduction; transient Conduction.

ChE 241	Materials Science and Engineering	3 Credit Hours

Atomic structure and interatomic bonding. Material microstructures, dislocations and defects in solids. Diffusion in solid materials. Mechanical properties of metals, polymers, and ceramics. Fracture, fracture mechanics, fatigue, and creep. Phase diagrams.

ChE 311	Chemical Reaction Engineering	3 Credit Hours

Reaction kinetics: batch reactor system, CSTR reactor, tubular reactor, CSTR in series, reaction conversion and rate, adiabatic reaction, Isothermal and Non-Isothermal reaction- catalytic reactions.

ChE 322	Heat Transfer II	2 Credit Hours

Introduction to convection: external flow, internal flow; free convection; boiling and condensation; Condensation and boiling heat transfer. Heat exchanger design, applications of heat transfer in engineering Systems.

ChE 325	Unit Operations	3 Credit Hours

Chemical unit operations encompass all the processes that run through the influence of mechanical forces or force fields. The basic operations include: 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; crystallization processes; separation by filtration and evaporation.

ChE 326	Mass Transfer	3 Credit Hours

Introduction to mass transfer and diffusion, molecular diffusion in gases and liquids, convective mass transfer coefficients, mass transfer between phases, membrane, absorption with and without Chemical reactions, and principles of unsteady-state mass transfer.

ChE 327	Fluid Mechanics and Heat Transfer Lab	1 Credit Hours

Thermal Conductivity, double pipe heat exchanger, free convection, forced convection, extended surface, Flow Measurements, Laminar and turbulent Flow, Flowing Fluids and Pressure Variation, Flow in Conduits, Cavitation.

ChE 328	Separation Processes	3 Credit Hours

Equilibrium stage approach to absorption/stripping, distillation, solvent extraction. Graphical methods are introduced as well as the concepts of minimum number of stages, minimum solvent or stripping agent rate and minimum reflux ratio. The concept of humidity and the use of psychrometric charts are introduced. Membrane separation processes.

ChE 329	Chemical Engineering Thermodynamics II	3 Credit Hours

Multicomponent systems, phase equilibria, prediction of thermodynamic properties and reaction equilibria.

ChE 351	Petrochemicals	3 Credit Hours

Technologies used in petrochemical industries such as thermal and catalytic cracking processes. Basic, intermediate and final petrochemicals. Synthesis gas and derivatives, ethylene, propylene, butene, BTX, and their derivatives. Competing technologies.

ChE 371	Biochemical Engineering	3 Credit Hours

Introduction to the principles of biochemical technology, application biochemical technology chemical engineering field, biological reactors systems, Flow Measurements, food and medicine applications.

ChE 423	Unit Operations & Separation Processes Lab	1 Credit Hours

Packed and tray distillation, packed-column gas absorption, liquid-liquid extraction, humidification/dehumidification in cooling towers, tray drying, evaporation, filtration, fluidization, screen analysis and size reduction

ChE 431	Process Control	3 Credit Hours

Process flow sheet development –Process modeling: closed loop system, load variables and controlled variables ,transient response, first and higher order system, integrated system control, advanced control configurations.

ChE 434	Reaction Engineering & Process Control Lab	1 Credit Hours

Reaction kinetics: batch reactor system, CSTR reactor, tubular reactor, CSTR in series, reaction conversion and rate, adiabatic reaction, Isothermal and Non-Isothermal reaction (practical study), automatic process control, PID control, control gain, unsteady state transition, damping, controlled and manipulated variables, closed loop, cascade control, feedforward control.

ChE 454	Petroleum Refining	2 Credit Hours

The origin and composition of petroleum. Crude oil analysis and evaluation. Petroleum products and their uses. Refinery structure. The main unit operation in the different refinery processes: Atmospheric & vacuum distillation, fluid catalytic cracking, platforming, hydro-desulfurization and hydrotreating processes. Chemical treatment. Asphalt production. Lube oils production. Refinery Utilities. Standards and specifications of fuels.

ChE 461	Chemical Processes and Plant Design	3 Credit Hours

Process flow sheet development – Energy-efficient design – Control Philosophy – materials of constructions – safety – Plant layout – equipment selection and specification – Design of pressure vessels, columns internals and heat exchangers – Transport of fluids.

ChE 462	Process Synthesis and Modeling	3 Credit Hours

Conceptualization of Chemical processes, engineering economic analysis, computer-aided design of Chemical processes with emphasis on process economics, profitability analysis, and optimum operating conditions

ChE 463	Environmental and Safety Management	2 Credit Hours

The course provides a comprehensive guide to process safety and environmental management. It covers the theories and procedures for applying safety and environmental procedures in the process industry.

ChE 493	Graduation Project I	2 Credit Hours

The course enables the students to be able to write a technical report and conduct an effective oral presentation, select most suitable process, and apply of chemical engineering design principles to conduct material and energy balance.

ChE 494	Graduation Project II	2 Credit Hours

The course enables the students to be able to apply chemical engineering design principles to simulate a process, fully design of some equipment (chemical and mechanical design), implement economic calculations for a process, write a technical report, design a poster, and present their results.

3. TECHNICAL ELECTIVES

ChE 412	Energy Conversion and Management	3 Credit Hours

The principles of energy conversion, steam generation and steam turbine performance, gas turbine, dual cycle analysis, types of fuels, combustion of fuels, heating value of fuels (GHV, NHV); production and combustion of biomass fuels. Energy consumption and Environmental pollution.

ChE 413	Renewable Energy	3 Credit Hours

The concept of sustainability, wind energy, solar energy, hydraulic energy, geothermal energy, tidal power, solid wastes energy, and biofuel energy; nuclear energy; fuel cells, hybrid systems.

ChE 414	Solar Energy	3 Credit Hours

Sun nature, sun-earth movement; calculation of extraterrestrial solar radiation; solar angles; measurements and calculations of hourly, daily, and monthly insolation on horizontal and inclined surfaces; solar energy collection systems; solar energy storage systems; industrial utilization of solar energy.

ChE 415	Fuel Cells	3 Credit Hours

Introduce the student to the theory and applications of fuel cells. Topics to be covered: fuel cell concept, hydrogen generation and storage, electrode reactions, types of fuel cells. Electrodes materials, performance of a fuel cell and factors which affect the performance of a fuel cell.

ChE 416	Air Pollution Engineering	3 Credit Hours

Formalize students with techniques for measuring and controlling pollutants in order to design the pollution control equipment. Topics to be covered: Specific pollutants, sources and effects, particle dynamics and deposition mechanisms. Effects of particulate matter, control of particulate matter, photoChemistry, combustion-related pollutants, role of the automobile and power plant, air pollution meteorology, air pollution transport, building ventilation and pollutant penetration, sources and major indoor air pollutants, radon, global warming and greenhouse gases.

ChE 417	Special Topics in Energy and Air Pollution Control

This course covers special advanced topics in Energy and Air Pollution Control. The contents vary depending on the topic.

ChE 441	Electrochemical Engineering	3 Credit Hours

Elements of electrochemical processing as they derive from electrochemical fundamentals. Of Electrochemistry application in engineering. Basic thermodynamics and kinetics of electrochemical reactions, with emphasis on electrochemical techniques in order to illustrate how electrochemical parameters of electrode reactions can be determined and used for different applications. The use of electrochemistry in the field of corrosion, electroplating ،extractive metallurgy and fuel cells will be highlighted.

ChE 442	Nanomaterials Technology	3 Credit Hours

Principles and theories relevant at the nanoscale dimension, properties and characterization of nonmaterial, current and future nanotechnology applications in engineering materials, electronics, energy and desalination.

ChE 443	Polymer Chemistry and Engineering	3 Credit Hours

The polymer Chemistry and reactions; polymerization mechanisms; thermodynamics of polymer solutions, morphology, crystallization and mechanical properties; polymer processing equipment and technology; reactive polymeric resins and biological applications of macromolecules.

ChE 444	Special Topics in Materials Engineering	3 Credit Hours

This course covers special advanced topics in Materials Engineering. The contents vary depending on the topic.

ChE 451	Desalination	3 Credit Hours

Fundamentals of desalination and other industrial aspects. These fundamentals are necessary to analyze and evaluate the performance for any of the existing and known desalination processes. The content is: Introduction. Single Effect Evaporation, Vapor compression, Multi Effect Evaporation and Multi Stage Flash distillation. Reverse Osmosis, Associated processes. Economic analysis.

ChE 452	Membrane Technology	3 Credit Hours

Introduction of detailed descriptions of the fundamentals and applications of the membrane separation processes. Membrane module designs is presented besides the following: Overview of membrane science and technology. Membrane transport theory, Membrane and modules and Concentration polarization. Reverse osmosis. Ultra-filtration, Micro filtration. Gas separation. Pervaporization, Ion exchange membrane and electrodialysis. Carrier facilitated transport, Medical application and other membrane processes.

ChE 453	Water and Wastewater Treatment	1 Credit Hours

This course covers the technologies that are applied to the treatment and purification of drinking water and wastewater. The methods and technologies discussed are a combination of physical, Chemical and thermal techniques. The following topics are covered: an overview of water and wastewater characterization and treatment, filtration, Chemical additives to enhance filtration, filter media, pressure and cake filtration, cartridge filters, sand filtration, sedimentation, clarification, flotation, and coalescence membrane separation technologies, ion exchange and carbon adsorption, water sterilization technologies, treating the sludge, microbiology of wastewater treatment.

ChE 455	Special Topics in desalination	3 Credit Hours

This course covers special advanced topics in desalination engineering and technology. The contents vary depending on the topic.

ChE 456	Special Topics in Petroleum and Petrochemical Industries	3 Credit Hours

This course covers special advanced topics in Petroleum and Petrochemical Industries. The contents vary depending on the topic.

ChE 472	Bioprocess Engineering	3 Credit Hours

Emphasis the engineering principles of biochemical processes and conversion of biological agents to food, pharmaceuticals, biofuels, and chemicals. Microbiology and metabolic pathways, and enzyme reactions. Concept of dissolved oxygen demand (DOD), and Chemical oxygen demand (COD). Gas and liquid system (aeration). Fermentation kinetics. Enzyme immobilization, transport phenomena in biological systems. Design and modeling of single and multi-stage bioreactors. Sterilization. Scale-up of bioreactors.

ChE 473	Bioseparation Engineering	3 Credit Hours

Identify the role of equilibrium and biochemical separation to demonstrate how they are used in the analysis and design of different bioseparators.

ChE 474	Application in Biological Engineering	3 Credit Hours

Overview of the research and applications of Biological Engineering such as bio processing, biotechnology, transport processes, biosensors, bioremediation, biological materials, and biomedicine.

ChE 475	Special topics in Bioengineering	3 Credit Hours

This course covers special advanced topics in Bioengineering technology. The contents vary depending on the topic.