Chemical Engineering (CHEG)

Courses

CHEG 1101 Intro Engr, Comp Sci & Tech: 1 semester hour.
Introduction to basic engineering, computer science and technology concepts. Students will become aware of the various disciplines of engineering, computer science and technology, ethical and professional responsibilities in these fields, creativity and design.
Co-requisite: CHEG 1102.

CHEG 1102 Intro CHEG Lab: 1 semester hour.
Introduction to the chemical engineering profession, chemical engineering processes,common chemical engineering measurements with lab experiments, engineering disasters, risk andresponsibility for safety.
Co-requisite: CHEG 1101.

CHEG 1202 Introduction to Computations in CHEG: 2 semester hours.
An introductory course of important chemical engineering concepts and computations. Students will learn how to classify problems based on their mathematical nature. Topics include basic introductory calculations involving material and energy balances, fluid flow phenomena, fundamental thermodynamics and kinetics, and introductory software and simulation tools such as Visual Basic and CHEMCAD.
Prerequisites: CHEG 1102 or CHEG 1021 and (MATH 2413 (may be taken concurrently) or MATH 1124).

CHEG 2215 Biochemical Engineering Fundamentals Lab: 2 semester hours.
This course consists of biochemical engineering laboratory experiments, with emphasis on biochemical reactors, mass transfer in bioreactors, microbial transformations and enzyme catalyzed reactions and their control. Measurement of maximum specific growth rate, saturation constants of substrates, kinetic constants of enzymes and characterization of immobilized enzymes will be carried out. Analysis oxygen absorption rates in shake-flasks in the study of control of respiration and fermentation in baker's yeast, kinetics of yeast growth, kinetics of free and immobilized enzyme reactions and operational decay constant and half-life of immobilized enzymes.

CHEG 2301 Materials Science: 3 semester hours.
Chemical bonding, atomic order and disorder, transport properties, single phase and multiphase materials, heat treatment, corrosion, and composites.
Prerequisites: (CHEM 1304 or CHEM 1043) or (CHEM 1403 or CHEM 1034).

CHEG 2308 Engineering Economics: 3 semester hours.
Fundamental concepts of economic principles. Evaluation of technical alternatives, economic significance of technical proposals; interest, description, analysis, and forecasting.
Prerequisites: MATH 2413 or MATH 1124.

CHEG 2315 Introduction to Biochemical Engineering Fundamentals: 3 semester hours.
This course introduce biology fundamentals and associated subjects required for engineers to understand and design multidisciplinary technology in the complementary areas of biological sciences and engineering. to accommodate those who do not have the biological background, the course covers basic biological principles and physiology. Subsequently, special emphasis is placed on applying engineering concepts to biological problems.
Prerequisites: CHEM 1304 or CHEM 1403.

CHEG 2316 Ethical Engineering in a Global Society: 3 semester hours.
An introductory view into how moral principles and standards are applied to the field of engineering. Students will learn how to navigate ethical problems. Topics include the responsibilities of an engineer, the code of conduct, ethical theories, ethics in the law, and case studies of engineering successes and failures.
Prerequisites: (CHEG 1101 or CHEG 1011) or (CVEG 1101 or CVEG 1011) or (ELEG 1101 or ELEG 1011) or (MCEG 1101 or MCEG 1011).

CHEG 2333 Material and Energy Balances: 3 semester hours.
Application of the laws of conservation of mass and energy to reacting and nonreaction simple and complex chemical systems. Application of both element and species balance to multiple reaction systems. Application of static fluid pressure measurements to safety hazards in vessels, process calculations involving safe handing of fuel-air mixtures between lower and upper flammability limits and purging of gases through relief valves. Application of the degree-of-freedom analysis to single process units and multi-unit process flow-sheets. Numerical solution techniques for the solution of balance equations.
Prerequisites: CHEM 1304 or CHEM 1043 or CHEM 1403 or CHEM 1034 and (PHYS 2325 or PHYS 2513) and (CHEG 1202 or CHEG 1022).

CHEG 2334 Chemical Engineering Thermodynamics I: 3 semester hours.
Introduction to chemical engineering calculations. PVT properties of fluids, equations of state. First and second laws of thermodynamics. Applications to heat effects and flow processes.
Prerequisites: CHEG 2333 or CHEG 2053.

CHEG 2615 Chemical Engineering Internship I: 6 semester hours.
This course is an internship program of work experience with an approved engineering firm.

CHEG 3101 Chemical Engineering Laboratory I: 1 semester hour.
Quantitative experimental study of properties of fluids, fluid mechanics, metering, and heat transfer. Operation and evaluation of equipment, techniques of graphical and statistical data analysis. Study of elements and methods of scientific inquiry and investigation, experimental data analysis, modeling and simulation, and dissemination of scientific results, including: design of experiments, product and process design, model validation and verification, literature survey and review techniques, and effective technical reporting modes. Strong emphasis is placed on safety.
Prerequisites: PHYS 2125 or PHYS 2511 and (PHYS 2126 or PHYS 2521) and (CHEM 1112 or CHEM 1021) and (COMM 1311 or COMM 1003) and (ENGL 1302 or ENGL 1133 or ENGL 1143 or ENGL 2311) and (CHEG 3301 (may be taken concurrently) or CHEG 3013) and (CHEG 3304 (may be taken concurrently) or CHEG 3053) and (MATH 3302 (may be taken concurrently) or MATH 3023).

CHEG 3301 Heat, Mass, and Momentum Transport: 3 semester hours.
Macroscopic and differential balances for heat, mass, and momentum. Energy balances and mechanical energy balances. Ideal Newtonian and non-Newtonian fluid behavior. Comparison of the transport processes in laminar and turbulent flow. Dimensional analysis.
Prerequisites: (CHEG 2334 or CHEG 2043) and (MATH 2320 or MATH 2043).

CHEG 3302 Unit Operations: 3 semester hours.
Application of transport theory to the design of equipment for the pumping and transfer of fluids through pipes, heat exchange, interphase transfer of heat and mass for the separation and purification of process streams.
Prerequisites: CHEG 2333 or (CHEG 2053 or CHEG 2305).

CHEG 3304 Chemical Engineering Thermodynamics II: 3 semester hours.
Properties of ideal and non-ideal binary and multi-component mixtures. Study of phase equilibria for single- and multi-component systems based on methods of corresponding states, equation of states and activity coefficient. Chemical equilibria applied to both homogeneous and heterogeneous systems.
Prerequisites: (CHEG 2043 or CHEG 2334).

CHEG 3305 Equilibrium Stage Separation Processes: 3 semester hours.
Applications of heat and mass balances and phase equilibria to the design of staged separation processes. Use of graphical methods such as McCabe Thiele and Ponchon Savarit for the treatment of binary systems. Application to distillation, absorption, stripping, and extraction.
Prerequisites: CHEG 2333 or CHEG 2053 and (CHEG 3304 or CHEG 3053).

CHEG 3306 Chemical Reaction Kinetics and Reactor Design: 3 semester hours.
Application of fundamental concepts of reaction stoichiometry, chemical and biochemical kinetics, and equilibria to the interpretation of reaction rate data. Design of batch, semi-batch, CSTR, and tubular reactors, heat effects and runaway reaction prevention and introduction to heterogeneous catalysis.
Prerequisites: MATH 2320 or MATH 2043 and (CHEG 3304 or CHEG 3053) and (CHEG 2301 or CHEG 2013).

CHEG 3311 Introduction to Energy Systems: 3 semester hours.
This course introduces fundamental physical and engineering principles associated with various energy systems. Basic energy concepts will be introduced describing the magnitudes and patterns of human energy needs. Historical evolution and present status of the conventional fossil and nuclear-fueled energy will be investigated along with others such as hydropower, biofuels, and the developing renewable energy systems.
Prerequisites: (MATH 2414 or MATH 2024) and (PHYS 2326 or PHYS 2523) and ((CHEM 1403 or CHEM 1034) or (CHEM 1304 or CHEM 1043)).

CHEG 3312 Petroleum Engineering Fundamentals: 3 semester hours.
This course consists of an overview of petroleum industry and petroleum engineering including nature of oil and gas reservoirs, petroleum exploration and drilling, formation evaluation, well completions and production, surface facilities, reservoir mechanics, and improved oil recovery.

CHEG 3315 Introduction to Biotechnology: 3 semester hours.
This course introduces students of chemical engineering, biological sciences, and chemistry to biological concepts and Nano scale considerations in engineering applications. It provides training for effective communication, hands-on skills, and analytical tools needed to pursue careers in biological/biochemical, and biopharmaceutical process industries. Ties to relevant current research will be explored.
Prerequisites: CHEM 1304 or CHEM 1043 or CHEM 1403 or CHEM 1034 and (CHEM 2303 or CHEM 2033).

CHEG 3317 Biomedical Engineering Mass Transport: 3 semester hours.
This course presents an introduction to human physiological based on the concepts of biological transport and physiological fluid mechanics. Students will learn the fundamentals and applications of mass transport in biological systems and effect of mass transport, energy and bioheat transport, and transport through organs.Biomedical devices, artificial kidney devices, artificial hearts, heart valves and Heart Lung Machines (Oxygenators) will be studied.
Prerequisites: BIOL 1501 or BIOL 1015 and (CHEG 2334 or CHEG 2043).

CHEG 3318 Materials Engineering Applications: 3 semester hours.
This course provides a comprehensive overview of the practical applications of materials engineering principles in various industries. Students will learn to select, analyze, and design materials, such as polymer, composite and advanced materials, based on specific engineering requirements, while considering material properties, efficiency, and sustainability.
Prerequisites: CHEG 2301 or CHEG 2013 and (CHEG 2334 or CHEG 2043).

CHEG 3615 Chemical Engineering Internship II: 6 semester hours.
This course is an internship program of work experience with an approved engineering firm.

CHEG 4101 Chemical Engineering Laboratory II: 1 semester hour.
Chemical engineering laboratory directed to separation processes such as gas absorption, fractional distillation, extraction, and drying. Study of reaction rates and equilibria in simple chemical systems. Emphasis is placed upon experimental data required for the scale-up to commercial scale equipment.
Prerequisites: (CHEG 3302 or CHEG 3023) and (CHEG 3304 or CHEG 3053) and (COMM 1311 or COMM 1003 and (ENGL 1302 or ENGL 1133) or ENGL 2311 or ENGL 1143) and (PHYS 2125 or PHYS 2511) and (PHYS 2126 or PHYS 2521) and (CHEM 1112 or CHEM 1021).

CHEG 4104 Chemical Engineering Laboratory III: 1 semester hour.
Chemical engineering laboratory with emphasis on reactive and control systems. Measurement of reaction conversion, determination of reaction order and rate in a tubular reactor. Analysis of the dynamic responses of stirred tanks in series. Experimental study of the use of analog and digital controller for heat exchanger and flow and level control systems.
Prerequisites: CHEG 4303 or CHEG 4033 and (COMM 1311 or COMM 1003 or SPCH 1003) and (ENGL 1302 or ENGL 1133 or ENGL 1143 or ENGL 2311) and (PHYS 2125 or PHYS 2511) and (PHYS 2126 or PHYS 2521) and (CHEM 1112 or CHEM 1021).

CHEG 4247 Senior Design and Professionalism -I: 2 semester hours.
This is the first course of a two-semester capstone experience (CHEG 4248 must immediately follow 4247 or sequence must restart with 4247) involving engineering design of an industrial or advanced team project. Elements of ethics and professionalism in engineering practice are integrated into the project experience. The project will include application of relevant engineering codes and standards, as well as realistic constraints. Design achievements are demonstrated with written reports, and oral presentation, and professional standards and ethics examinations.
Prerequisites: (CHEG 3301 or CHEG 3013) and (CHEG 3023 or CHEG 3302) and (CHEG 3043 or CHEG 3305) and (CHEG 3063 or CHEG 3306).

CHEG 4248 Senior Design and Professionalism - II: 2 semester hours.
A continuation of the CHEG 4247 course emphasizing the analysis and design of a complete chemical processes and prepares students for engineering practice. The team projects use chemical engineering and economic principles to solve design and optimization problems of chemical processing systems. Projects include extensive use of simulation packages such as ASPEN PLUS and use of hazard analysis techniques such as Hazard and Operatbility (HAZOP) studies determining an optimum selection of process variables .
Prerequisites: CHEG 4247 or CHEG 4472.

CHEG 4303 Process Dynamics and Control: 3 semester hours.
Dynamic response and control of chemical process equipment such as reactors, heat exchangers, distillation columns. Use is made of fundamental techniques of servomechanism theory such as block diagrams, transfer functions, and frequency response; stability analysis and control loop design. Unsteady state modeling and computer simulation of simple control systems.
Prerequisites: (CHEG 3306 or CHEG 3063) and (MATH 4317 or MATH 4173).

CHEG 4304 Chemical Process Design and Analysis: 3 semester hours.
Use of material and energy balance calculations, thermodynamics, transfer operations, reaction kinetics and process economics for the synthesis and analysis of chemical processing systems. Design alternatives are analyzed by the use of case studies, computerized flow sheet modeling and simulation, and optimization methods. Safety and design codes are emphasized.
Prerequisites: (CHEG 3301 or CHEG 3013) and (CHEG 3302 or CHEG 3023) and (CHEG 3305 or CHEG 3043) and (CHEG 3306 or CHEG 3063).

CHEG 4310 Special Topics in Chemical Engineering: 3 semester hours.
This course presents selected current and emerging topics in chemical engineering depending on need as determined by the department faculty.

CHEG 4312 Process Safety Engineering Fundamentals: 3 semester hours.
This course addresses aspects of chemical process safety and loss prevention, such as identification of potential hazards and hazardous conditions associated with processes and equipment involved in the chemical process industries. It includes methods of predicting the severity of the associated hazards and preventing, controlling or mitigating them. It emphasizes quantitative engineering analysis; techniques for performing process hazard analysis, risk assessment, and accident investigation are introduced.

CHEG 4313 Process Modeling and Simulation: 3 semester hours.
Construction and solution of mathematical models of process units and integrated systems for computer simulation. Both steady and dynamic models will be developed. Students will make use of one or more of the commercial flow sheet simulation programs for the analysis of specific systems.

CHEG 4315 Bioengineering: 3 semester hours.
Design and analysis of biochemical systems with applications in biomedical engineering and metabolic processes, enzyme catalyzed reactions and product separation, biomass production, and wastewater treatment. Emphasis is placed upon the application of biochemical systems structure, reaction kinetics, transport processes, and control in the design and use of biochemical reactors and separation units.

CHEG 4316 Polymer Science and Engineering: 3 semester hours.
This course examines the principles and applications of polymer science and engineering. Students will cover topics such as the synthesis of polymers through various techniques such as addition and condensation polymerization, the characterization of polymers using techniques such as spectroscopy, chromatography, and rheology, and polymer processing methods such as extrusion and injection molding.
Prerequisites: CHEM 2033 or CHEM 2303.

CHEG 4317 Bioreactions in Human Physiology: 3 semester hours.
This course emphasizes the importance of bioreactions in maintaining health and responding to diseases. Students will examine key metabolic pathways to understand how the body produces and utilizes energy. Students will develop critical analytical skills and a comprehensive understanding of how biochemical processes are integrated with human physiology.
Prerequisites: CHEG 3317 and (CHEG 3306 or CHEG 3063).

CHEG 4318 Design of Process Engineering Systems: 3 semester hours.
The course will stress the interdisciplinary nature of systems design and will include structural, hydraulic, process, utilities and control concepts. Development of one or more selected applications in optimal design of continuous and batch systems. Studies will involve the use of computer-aided design, cost estimation, engineering data bases, and project scheduling.
Prerequisites: CHEG 3301 or CHEG 3013 and (CHEG 3302 or CHEG 3023) and (CHEG 3304 or CHEG 3053) and (CHEG 3306 or CHEG 3063).

CHEG 4319 Solids Process Engineering: 3 semester hours.
This course covers concepts in bulk solid characterization, processing (granulation, fluidization), size reduction/enlargement, (agglomeration, crystallization, comminution), storage and transport, and separation (filtration, sedimentation); unit operation equipment (silos, hoppers, filters, conveyors, cyclones).
Prerequisites: CHEG 3301 or CHEG 3013 and (CHEG 3304 or CHEG 3053).

CHEG 4321 Nuclear Science Fundamentals: 3 semester hours.
An interdisciplinary survey course introducing the basics of atomic and nuclear science, radiation physics and their relation to engineering problems and applications. Specific applications to nuclear materials, nuclear safety, nuclear forensics, radiation detection, radiation safety, and radiation effects on humans and technology. Technical background assumed is the standard physics, mathematics and chemistry required for an undergraduate engineering degree.

CHEG 4322 Nuclear Forensic Analysis: 3 semester hours.
The course introduces methods important to the investigation of nuclear materials to identify the source, trafficking mode, and level of enrichment of particular nuclear materials recovered from various sources such as dust at a nuclear facility locale, or post-nuclear explosion debris. Topics include radiochemistry review, nuclear applications for power and defense, contemporary issues in forensics and proliferation, methods for forensics analysis, and case studies.

CHEG 4399 Independent Study: 1-3 semester hour.
Readings, research and/or field work on selected topics. This course is intended as a curriculum supplement for highly motivated students with special areas of interest. An individualized course of study, planned by student and advisor, is executed under the direction of the advisor.

CHEG 5301 Advanced Reaction Engineering: 3 semester hours.
Rates and mechanisms of chemical reactions. Thermo and catalytic reactions both homogeneous and heterogeneous with applications. Applications to design of new materials.

CHEG 5302 Microelectronics Materials: 3 semester hours.
Heterogeneous chemical reactions. Chemical engineering aspects of materials fabrication and processing. CVD thin film deposition techniques. Preparation of superconducting powders. Composites. Modeling and practical applications.

CHEG 5303 Environmental Processes: 3 semester hours.
Fundamentals of environmental engineering, chemistry, physical-chemistry and transport properties. Energy and mass balances. Reactions and reactors. Biological processes. Bioremediation.

CHEG 5304 Remediation Technologies: 3 semester hours.
Fundamentals of environmental remediation. Physical-chemical processes. Bioremediation. Stabilization and solidification. Thermal methods. Site characterization. Risk assessment. Containment. Remedial Alternatives Applications to real contaminated sites.

CHEG 5305 Chemical Engineering Thermodynamics: 3 semester hours.
This is a survey course starting with a review of thermodynamic laws then proceeding to examine ways that thermodynamics apply to various systems from static to dynamic, inert to reactive, and ultimately from abiotic to living systems. The approach will be to engage in readings (articles, book chapters, media releases), viewings (lectures, photos, videos), discussion (face to face and web assisted), and project based design and evaluation activities.

CHEG 5306 Transport Phenomena: 3 semester hours.
Transport Phenomena provides a unified treatment of momentum, mass, and energy transport in chemical engineering problems. Vector and tensor notations and mathematics will be used in expressing equations of continuity, motion, energy. Further develops the foundations of transport phenomena to apply this knowledge to the solution of problems of interest to the engineer.

CHEG 5311 Petroleum Engineering: 3 semester hours.
This course examines the petroleum industry and petroleum engineering including nature of oil and gas reservoirs, petroleum exploration and drilling, formation evaluation, well completions and production, surface facilities, reservoir mechanics, and improved oil recovery.

CHEG 5312 Process Safety Engineering: 3 semester hours.
This course addresses multiple aspects of chemical process safety and loss prevention in chemical manufacturing. Includes methods of predicting severity of hazards and preventing/controlling/mitigating them. Emphasizes quantitative engineering analysis based on applications of engineering principles.

CHEG 5321 Nuclear Science: 3 semester hours.
The objective of this course is to explore the fundamental aspects of nuclear and radiochemistry, with emphasis on the determination of radioactive species and the application of nuclear processes, radioactive materials, and radiochemical techniques in major applications such as medicine, nuclear power, national defense, and threat reduction.

CHEG 5322 Nuclear Forensics: 3 semester hours.
This course develops nuclear forensic skills needed for potential future terrorist attempted or actual events. Students learn to answer the questions where did the nuclear material come from (attribution), what routed did it follow to the interdiction site (route attribution), what route did it follow to the interdiction site (route attribution), how to safely collect nuclear materials for an interdiction site, how nuclear materials (pre-detonation and post-detonation) are analyzed, how to evaluate of pre-detonation nuclear materials' capabilities and how to interface with emergency response, law enforcement (FBI, UHP), Intelligence community, State Department and International Treaties.