EGR 215 Introduction to Thermodynamics (Lec. 2 Credits 2)

Course Description: This course provides an introduction to engineering thermodynamics. Starting with the review of the terminology, the course covers the application of the first and second law of thermodynamics to non-flow and steady-flow processes.

Course Content:

- Applications of the first and second law of thermodynamics to engineering systems
- Pressure-volume-temperature behavior of fluid
- Thermodynamic properties of fluids
- Thermodynamics of flow processes
- Conversion of heat to work (power cycles)

Prerequisites: MAT 152, PHY 203

EGR 216 Introduction to Transport Phenomena (Lec. 3 Credits 3)

Course Description: This course introduces the student to the general property balance equation and to various transport mechanisms for energy, mass, and momentum. Differential and integral energy, mass, and momentum balances will be derived and applied to engineering problems involving steady transport in one dimension.

Course Content:

- General property balance
- Differential heat, mass and momentum balance
- Molecular transport mechanisms (Newton's law of viscosity, Fourier's law of heat conduction, and Fick's law of diffusion)
- Steady transport in one dimension
- Transport with convective flux
- Integral heat, mass, and momentum balances

Prerequisites: PHY 204, MAT 260, EGR 215

CME 302 Transport Phenomena (Lec. 3 Credits 3)

Course Description: This course expands the student's understanding of transport phenomena. Particular emphasis is placed on developing and applying differential and integral balances.

Course Content:

- Analysis of molecular and convective transport processes
- Transport in turbulent flow
- Momentum, heat and mass transfer in ducts

- Momentum, heat and mass transfer in flows past immersed bodies
- Boiling and condensation
- Heat transfer by radiation
- Unsteady state transport.

Prerequisites: EGR 216, CME 305

CME 305 Chemical Engineering Calculations (Lec. 4 Credits 4)

Course Description: This course provides an introduction to chemical engineering. The concepts introduced in EGR 215 and 216 are applied to chemical processes to obtain stream properties.

Course Content:
- Material balances in non-reactive and reactive systems
- Single and multiphase systems
- Review of the concept of energy and the first law of thermodynamics
- Energy balances in non-reactive and reactive processes
- Applications in simultaneous material and energy balances
- Transient processes.

Prerequisites: EGR 216

CME 306 Separation Operations (Lec. 4 Credits 4)

Course Description: This course provides an introduction to equilibrium stage and continuous contact mass transfer operations. Design and operation of gas absorption, distillation, extraction, and membrane separation equipment are emphasized.

Course Content:
- Overview of separation processes
- Distillation
- Equipment for gas-liquid operations
- Gas absorption
- Extraction
- Membrane separations

Prerequisites: CME 305, CME 307

CME 307 Chemical Engineering Thermodynamics (Lec. 3 Credits 3)

Course Description: This course covers the application of thermodynamics to fluid mixtures, solutions, phase equilibria and chemical reaction equilibria.

Course Content:

- Residual properties
- Thermodynamics of flow processes
- Systems of variable composition: ideal and non-ideal behavior
- Phase equilibria at low to moderate pressures
- Solution thermodynamics
- Vapor-liquid equilibria from equations of state
- Chemical reaction equilibria
- Thermodynamic analysis of processes

Prerequisites: EGR 215

CME 308 Chemical Reaction Engineering (Lec. 3 Credits 3)

Course Description: This course covers the acquisition and analysis of kinetic data for chemical reactions and the design of reactors or multiple reactor systems to carry out industrial reactions.
Course Content:

- Homogeneous reactions
- Derivations of rate expressions from experimental data
- Design of ideal reactors for isothermal and non-isothermal operations
- Applications of reactor design to multiple reactor and reaction systems
- Heterogeneous catalysis.

Prerequisites: CME 307; Co-requisite: CME 302

CME 411 - 412 Chemical Engineering Laboratory I - II (Lab. 6 Credit 2)

Course Description: This is a two-semester laboratory course sequence involving experiments covering the application of fundamental principles of chemical engineering to unit operations, chemical reaction engineering, and process control.

Course Content:

- Calibration of orifice and venturi meters
- Friction losses in circular tubes
- Vapor-liquid equilibria
- Diffusion coefficient determination

- Concentric tube heat exchanger
- Boiling heat transfer
- Fluidization and fluid bed heat transfer
- Liquid-phase chemical reactor
- Tray dryer
- Packed absorption column
- Distillation
- Liquid-liquid extraction
- Process controller design

Prerequisites: CME 302, CME 306, CME 308; Co-requisite: CME 405 and CME 409

CME 409 Data Analysis and Design of Experiments (Lec. 1 Credit 1)

Course Description: This course introduces the student to the application of several statistical topics of practical interest.

Course Content:
- Model diagnostics
- Analysis of variance
- Error analysis
- Methods of designing experiments that will yield the maximum useful information.

Prerequisite: CME 308

CME 405 Process Control (Lec. 3 Credits 3)

Course Description: This course involves the analysis and design of chemical process control systems; feedback and feedforward controllers for a single process; stability, tuning and simulation of PID controllers.

Course Content:
- Control aspects of a chemical process
- Linear open-loop systems
- Linear closed-loop systems
- Frequency response
- Process applications
- Computers in process control

Prerequisites: EGR 208, CME 302

CME 407 - 408 Chemical Process Design I and II (Lec. 2 Lab. 3 Credits 3)

Course Description: This two-course sequence introduces the systems viewpoint in process design and discusses process synthesis and analysis, screening of alternatives, and economic decision making. Special emphasis is placed on process simulation and use of commercial process simulators in process design. Several small exercises and one comprehensive design project.

Course Content:

- Flowsheet synthesis
- Process material and energy balances
- Equipment sizing and costing
- Economic evaluation of processes
- Thermodynamic options for process simulation
- Process simulation
- Process flowsheet optimization
- Heat and power integration
- Cost diagrams and quick screening of alternatives
- Designing for safety
- Environmental considerations

Prerequisites CME 302, CME 306, CME 308

CME 420 Chemical Engineering Seminar (Lec. 1 Credits 1)

Course Description: Presentation and discussion of selected topics in chemical engineering, professionalism, career, and graduate school. Each student is assigned topics of current importance to chemical engineering to prepare and present a seminar.

Prerequisites: CME302, CME 308