

GRADUATE COURSES DESCRIPTIONS for the Degree of Master of Science in Chemical Engineering

Core courses

1410511 Advanced Heat Transfer 3 cr.

1410512 Advanced Mass Transfer 3 cr.

Formulation of mass transfer models, diffusion coefficient and mass transfer coefficient, models for prediction of M. T. coefficient, diffusional mass transfer, convective mass transfer, coupled processes in transport phenomena, multicomponent mass transfer.

1410513 Advanced Fluid Mechanics 3 cr.

1410514 Advanced Numerical Analysis 3 cr.

Approximation and errors, solution techniques of linear and non-linear algebraic equations sets. Interpolation, extrapolation, differentiation and integration. Numerical solution of ordinary differential equations, boundary and initial value problems. Numerical solution of partial differential equations, elliptic, parabolic and hyperbolic equations.

1410515 Advanced Reactor Design 3 cr.

Deviations from ideal flow, Residence time distribution, non-ideal flow models, mixed flow, segregated flow, axial dispersion model, laminar flow in tubular reactor, heterogeneous reactions, kinetics of solid-fluid catalytic reactions, characterization of solid catalysts, reactor design for heterogeneous reactions, fixed-bed reactor, fluidized-bed reactor, slurry reactor, trickle bed reactor, optimization of multiple-reaction systems, non-isothermal reactors.

1410516 Advanced Thermodynamics 3 cr.

Cubic equations of state, virial equations of state, Maxwell equal area rule, Bridgeman tables, fugacity, fugacity coefficients, activity coefficients, Gibbs-Duhem equation, vapor-liquid equilibria, liquid-liquid equilibria, phase stability, chemical reaction equilibria.

1410517 Advanced Mathematics 3 cr.

Mathematical models representation, linear algebra, vectors and matrices, eigenvalue problem, optimization, special function (Gamma, Beta, Bessel, Legendre...), analytical solution techniques of differential equations, Approximate analytical methods of solution, statistical methods, numerical solution techniques of differential equation.

9010608 M.Sc. Project 8 cr.

Advanced Chemical Engineering: Elective courses

1410637 Electrochemical Engineering 3 cr.

This course deals with basic phenomena of electrochemistry such as thermodynamics, electrode kinetics, modeling and simulation, experimental method and applications.

1410532 Advanced Process Control 3 cr.

Process identification, design of feedback control loop, steady state and dynamic response performance. Compensation techniques, lead, lag, lead-lag compensators and control of systems with delay time. Cascade and feedforward control systems. State-space representation and modern control theory. Digital computer control, discrete systems and Z transform, design of digital feedback controller.

1410537 Chemical Processes Design 3 cr.

1410538 Advanced Corrosion 3 cr.

1410572 Biological processes for wastewater treatment 3 cr.

Environmental Microbiology and Biochemistry, Stoichiometry and Energetics of Bacterial reactions; Kinetics of bacterial growth; Water and wastewater characteristics; Biological reactors design and operation, suspension, biofilm, CSTR, Plug, Recycled; Aerobic suspended bioprocesses, activated sludge design, lagoon and oxidation pond; Biofilm and its application, different biofilm reactors and mass transfer phenomena; Anaerobic treatment, suspended and biofilm processes; Nutrient removal, Nitrification, Denitrification, Anammox, Sharon, InNitri, Desulfurization; Biosorption kinetics of heavy metals, different biosorbent and kinetic models.

1410563 Fundamentals of Catalysis 3 cr.

Basic principles in preparation, characterization, testing and theory of heterogeneous and homogenous catalysts. Chemisorption, adsorption isotherms, diffusion, surface kinetics, promoters, poisons, catalyst theory and design, acid based catalysis and soluble transition, metal complexes. Examples of important industrial applications are given.

1410552 Wastewater treatment 3 cr.

Classification of wastewater, composition of wastewater, harmful effects of wastewater; types and amount of wastewater, domestic sewage water, municipal sewage water, commercial and industrial wastewater; technologies for industrial water reuse; methods of physical and physico-chemical wastewater treatment.

1410541 Industrial water treatment 3 cr.

Concepts of various treatment options for producing Industrial waters, Common water contaminants and their affect, Key water quality parameters, Outline of advanced Physico- Chemical treatment processes Options, Concepts in Coagulation and Flocculation processes, Ion Exchange based technologies, Membrane Based Technologies (MF, UF, Cartridge Filter, Reverse Osmosis Processes, Electrodialysis), Minimizing waste water.

1410556 Advanced Biochemical Engineering 3 cr.

1410631 Industrial Processes Design 3 cr.

1410632 Principles of Non-homogeneous Catalyst 3 cr.

14725 Fundamentals of Catalysis 3 cr.

Basic principles in preparation, characterization, testing and theory of heterogeneous and homogenous catalysts. Chemisorption, adsorption isotherms, diffusion, surface kinetics, promoters, poisons, catalyst theory and design, acid based catalysis and soluble transition, metal complexes. Examples of important industrial applications are given.

Separation: Elective courses

1410540 Surface Phenomena 3 cr.

Capillarity, thermodynamics description of interface, surface phenomena in fluid-fluid interfaces, adsorption in fluid-fluid interfaces, stability in suspensions, interfacial turbulency, foam, electro-kinetic phenomena: electrophoresis, electro-osmosis, streaming potential and sedimentation potential.

1410539 Advanced Methods in Separation 3 cr.

The course deals with some selected separation methods in chemical industries, includes ion exchange science & technology, membrane technology (electrodialysis and reverse osmosis), filtration and ultrafiltration, flotation (foam, froth, ion and aphron), adsorption.

1410531 Multicomponent Distillation 3 cr.

1410534 Advanced Unit Operations Design 3 cr.

Choice of separation processes, simplified flow sheet, conceptual design, column hydrodynamic design, reduction of energy consumption, separation factor and molecular properties, solvent extraction.

1410543 Membrane Processes 3 cr.

Introduction to membrane processes; definition of membrane ; introducing different membrane types and membrane modules; synthesis of polymeric membranes and their characterization; introducing driving forces for membrane process followed by detail discussion on different membrane processes such as: reverse-osmosis, micro- and ultra-filtration, membrane gas separation, pervaporation and vapor permeation, electrodialysis; introduction to ceramic and zeolite membranes.

1410542 Mechanical Separation 3 cr.

1410550 Advanced Mechanical Unit Operations 3 cr.

1410554 Advanced Extraction 3 cr.

1410638 Powder Technology 3 cr.

Transport Phenomena: Elective courses

1410555 Simulation of Transport Phenomena 3 cr.

A general processing system is composed of a numerous number of various elements that not only are connected to each other for transfer of momentum, various types of energies, and masses in a complex form, but also it is communicating with its environment. Modeling and simulation of such systems is complex and need a special treatment and management. In this course, besides of discussion on management of such complex systems, various topics such as types of models, dependency of models to their applications, various types of modeling, model simplification, and involved laws and constitute relationships are lectured. In this regards, by introduction of various types of boundary and initial conditions, and common approaches to simulation methods, various solution methods are discussed for simulating behaviors of systems.

1410547 Advanced Convection Heat Transfer 3 cr.

1410548 Boundary Layer Theory 3 cr.

1410551 Suspended Dynamic Fluids 3 cr.

1410644 Two Phase Fluid Mechanics

Polymer Engineering: Elective courses

1410536 Chemistry and Technology of Polymers 3 cr.

Step and chain polymerization kinetics, kinetic models Latex technology, polymer modifications, degradation and stabilization. polymer processings: mixing, vulcanization, formulation design: extrusion, injection, compression moulding of polymers. Advanced methods in polymer analyses(thermal, mechanical, etc).

1410535 Special Topics in Polymer Science 3 cr.

Polymerization and processing of medical grade polymers. Sterilization of medical grade polymers. Polymeric fibers in medicine (hollow fibers, structures). Polymeric adhesives.

1410553 Polymer Technology 3 cr.

Extruders, Single Screw Extruder, Die Design, Pipe Extrusion, Sheet Extrusion, Film Blowing, , Film Casting, Fiber spinning, Injection Molding, Blow Molding, Thermoforming, Compression Molding.

1410544 Polymer Formation Processes (Advanced Polymer Processing) 3 cr.

Extruders, Single Screw Extruder, Twin Screw Extruder, Devolatilization in Extruders, Reactive Extrusion, Mixing Zone in Extruders, Plasticating Extruders, Extrusion Dies, Coextrusion Dies, Die Design, Laminar Mixing, Residence Time Distribution, Strain Distribution, Dispersive Mixing, Distribution Mixing.

1410557 Advanced Rheology 3 cr.

Polymer Rheology, Classification of Non-Newtonian Fluids, Time Dependent Fluids, Time Independent Fluids, Viscoelastic Fluids, Linear Viscoelasticity, Flow of Non-Newtonian Fluids in channels, Mixing of polymeric melts, Capillary Viscometers, Rotational Viscometers, Elastic effects in polymer melt flow, The application of Rheological Studies to polymer Processing, Elongational Flow in Polymer Processing.

1410562 Polymer Modification and Alloys 3 cr.

Free Radical Grafting of Monomers onto Polymers by Reactive Extrusion, Modification of Polypropylene, Modification of polymer melts by reactive mixing, Moisture Cross-Linkable Polyolefins, polymer Blending, Reactive Polymer Blending.

1410545 Advanced Kinetics of Polymerization 3 cr.

1410546 Kinetics & Reactor Polymerization 3 cr.

1410549 Advanced Polymerization Processes 3 cr.

1410560 Polymer Engineering Properties 3 cr.

1410564 Biocompatible and Degradation of Polymers 3 cr.

1410565 Advanced physical chemistry of polymers 3 cr.