

- **Course Description (Department of Chemical Engineering)**

Advanced Transport Phenomena
This course provides students the sophisticated ability to derive and take advantage of transport equations of mass, heat, and momentum, especially for the case of analyzing phenomena mainly resulting from fluid transfer in chemical engineering process system.
Advanced Reaction Engineering
This course gives a summary of the reaction engineering such as the rate theory of chemical reactions, analysis of ideal reactors, and the influence of diffusion resistance in non-homogeneous reactors. Based upon it, this course also provides the information needed to analyze and design real chemical reactors. Course Description
Advanced Chemical Engineering Thermodynamics
This course briefly provides basic knowledge of classic thermodynamics and statistical thermodynamics and has the objective to extend the theoretical basis about fluid properties known up to now. This course deals with phase equilibrium and fluid properties and compares with the pros and cons of various state equations.
Advanced Process Control
This course provides the methods of analyzing and designing control system based upon the understanding of the mathematical expressions about physical and chemical phenomena and the structures and characteristics of chemical processes.
Process Modelling and Simulation
This course provides fundamental knowledge of chemical process analysis and discipline to use a computer. Subject contents are unsteady state scheme, steady state scheme, and optimization.
Plant Design
This course provides both the theories and examples about design and synthesis of chemical processes. It also gives strategy for cost minimization.
Advanced Mathematics in Chemical Engineering
This course provides basically mathematical background required to complete graduate courses and to achieve the academic degree. This course deals with theories, solutions and applications of linear algebraic equations and partial differential equations in a large extent. This course also deals with the separation of variables in partial differential equation systems and the representative problems of one-dimensional system and stepwise gives the diversification of geometrical shapes, boundary conditions, non-homogeneous problems and two or three dimensional system.

Advanced Separation Process

This course deals with separation technologies for isolations of various chemical products. Emphasis will be given to the principles of separations and their applications for new bio-products. Topics include centrifugation, extraction, precipitation, and various chromatography from the classical separation procedures to the state-of-the-art technologies.

Advanced Particle Dynamics

This course covers advanced and sophisticated characteristics and analysis of particulate solid operation and its applications such as fluidization, filtration, sedimentation, mixing, etc.

Numerical Analysis in Chemical Engineering

This course provides the introduction and applications of technique to obtain numerical solutions of model equations. This course also gives the introduction and applications of finite difference methods, finite element methods, model differential equations, boundary conditions, and the appropriate numerical method techniques rising from non-linearity.

Advanced Catalyst Engineering

This course provides more advanced and sophisticated knowledge for students with basic principles of catalysis. It deals with applications as well as backgrounds of several specific subjects.

Environmental Engineering

This course deals with the physicochemical principle for environmental engineers. The chemistry for water treatment process and water environment will be introduced. It includes the stability of particle, coagulation, precipitation, disinfection, oxidation, and membrane technology, etc.

Advanced Electrochemical Engineering

This course deals with materials of electrode and electrolyte of cells, fuel cells, and photo cells for energy storage and conversion with electrochemical methods. And this course involves structure and function of electrochemical sensors and the applications of membranes and photoelectrochemistry.

Advanced Fuel Cell

This course introduces students to the fundamental aspects of fuel cell systems, with emphasis placed on proton exchange membrane (PEM) and solid oxide fuel cells (SOFC). Students will learn the basic principles of electrochemical energy conversion while being exposed to relevant topics in materials science, thermodynamics, and fluid mechanics.

Advanced Solar Cell

The main objective of this course is to understand the basic and advanced operational principles of photovoltaics devices. After covering the basic concepts regarding energy bands, charge carriers in semiconductors, light absorption in and emission from semiconductors, and properties of semiconductor junctions and so on, we will focus on the operational principles of solar cells. The knowledge acquired in this course will help students in better utilizing these devices for their research, and also in developing novel devices in the future.

Advanced Lithium Battery

This class includes the materials and system technologies for alkaline, lead-acid, Ni-Cd, and Ni-metal hydride cells, Electrode/electrolyte materials, interface characteristics for lithium secondary cells.

Instrumental Analysis in Chemical Engineering

This course covers basic theories, instrumental principles, as well as methods and applications of modern chemical analysis. Special emphasis will be placed on two representative classes of instrumental analysis, such as spectroscopy and chromatography.

Advanced Organic Chemistry

This course inspects closely advanced theory about organic reactions and classifies the intermediate such as carbocation, carboanion, free radical, carbene and so on, which are lectured. This course also gives structure, reactivity, kinds of reaction and reaction mechanism of each intermediate with sequential examples.

Solution Chemistry

This course covers the various chemical reactions which occur in solution phase and analyze it via the knowledge of physical chemistry

Advanced Rheology

The objectives of this course is to give students ability to understand the principle and applications of state equations of rheology and solve problems related to plastic molding processes on the basis of the mathematical knowledge of vector and tensor and the theoretical background of continuum mechanics.

Master Paper Research Work

Discussions with academic advisor, checking of research progress, and presentation of the current status of thesis progress are made for deeper research content of the master degree dissertation.

Doctor Paper Research Work(1)
Discussions with academic advisor, checking of research progress, and presentation of the current status of thesis progress are made for deeper research content of the Ph. D degree dissertation.
Doctor Paper Research Work(2)
Discussions with academic advisor, checking of research progress, and presentation of the current status of thesis progress are made for deeper research content of the Ph. D degree dissertation.
Nano Technology
This course deals with characterizations of nanopolymers. In addition to the fundamental knowledge, students learn how to apply in-depth understanding of the nanotechnology to composite systems.
Advanced nanobiotechnology
It covers an in-depth understanding of nano and bio-materials and the principle of generating various nano/bio structures.
Seminar in Chemical Engineering 1
Present and cross-discuss recently reported literature on the field of chemical engineering and research carried out by each of the major students.
Seminar in Chemical Engineering 2
Present and cross-discuss recently reported literature on the field of chemical engineering and research carried out by each of the major students.
Soft Nanotechnology
It covers colloidal nanoparticles and self-assembling systems made of soft materials.
Modelling of Polymer Processing
The latest technology, principles, and mathematical modeling of polymeric materials are addressed.
Applied Electrochemical Process
It deals with various energy production systems such as wind, biomass, solar, solar, tidal, etc. as eco-friendly and sustainable energy, and lectures on the status of commercialization in foreign countries and future prospects.