Descriptions of Courses

PSE501 Polymer Materials
The properties and application of various polymer materials will be covered. The course also covers new polymeric functional and structural materials applied in advanced technology of IT, BT and NT.

CBE552 Polymer Processing
This course covers several different processes related to the fabrication parts from polymeric materials and relevant mathematical modeling. Extrusion, injection and elongational processes are main concerns along with heat and mass transfer problem in these processes.
* Prerequisites: CBE451 (Polymer Structure and Bulk Properties)

CBE556 Structure and Properites of Macromolecules
The effects of the polymer structure (chemical structure, molecular weight, intermolecular structure and morphology) on physical, mechanical and electrical properties are studied. The property estimation scheme originating from the structure-property correlation is also studied.

CBE554 Polymer Physics
This course intends to provide a solid base for the understanding of polymeric materials. The microstructure of the chain molecule, the physical behavior and state of polymers are treated in this course. The emphasis of this course lies on fundamental physical concepts, terminology, and an overview of the phenomenology of polymer materials.

CBE651 Multicomponent Polymer Materials
The synthesis, morphology, properties and application of the multi-component polymer materials are studied. Block and graft copolymer, polymer alloy and interpenetrating polymer networks (IPN) are studied as the multi-component polymer materials.

CH671 Organic Chemistry of High Polymers
This course is designed to give graduate students in Chemistry a survey of the synthesis and reactions of organic polymers and their physical characterization including kinetics of radical species and condensation polymerization, stereochemistry of polymers, ionic polymerizations and other organic chemistry of polymers.

PSE511 Reactions of Polymers
The course reviews various chemical reactions between polymers. Several applications are introduced which can lead to new applications.

PSE512 Surface and Interface Properties of Polymers
The course correlates the chemical structure and surface characteristics. The surface exposed to air, the interface between two polymers are studied and the influence on aging, adhesion and mixing will be discussed. The surface treatment of biomedical polymers and the surface of membrane will also be studied.

CH522 Organic Synthesis I
The lecture covers carbon-carbon bond formation of organic syntheses including alkylation, aldol condensation, free radical reaction rearrangement and cycloaddition reaction.

CBE533 Fundamentals of Microstructured Fluid Flow
This course deals with flows of complex imcrostructured fluids in continua emphasizing the microscopic behavior. Continuum hypothesis and its consequences, equations of motion, continuity equation, transport equations of heat and mass will be covered for the systems of complex fluids. Examples of flowing systems to be considered include Brownian motions, particulate suspensions and heat and mass transfer at low Reynolds numbers.

MAE537 Optimal design of Composite Structures
This course is an introduction of anisotropic solid mechanics based on the classical plate theory (CLT). This course gives an insight on the properties of composite materials and helps to prepare computer programs for the stress and strain analyses. A brief experiment using an autoclave vacuum bag molding method is offered to

manufacture a sand composite structure.

CH542 Organometallic Chemistry
This course is designed for senior undergraduate and graduate students in teaching reaction mechanisms, and synthetic and catalytic aspects of transition metal organometallic compounds.
Prerequisite Courses : CH341 and CH342

MS542 Nanoscale Surface Analysis
This course provides the fundamental principles of Scanning Probe Microscope (SPM) which has become a powerful technique on the science of nanoscale materials through the lecture and experimental. The applications of SPM to the nanoscale surface analysis will be also introduced.

MS544 Engineering of Soft Materials
In this course, the basic concepts for soft condensed matter, which includes polymers, colloidal dispersion, amphiphiles and liquid crystal, are presented with the particular emphasis on their structure formation and the corresponding physical properties.

CBE551 Polymer Rheology
Constitutive equations are needed to describe the flow behaviors of polymeric liquids. In this course, differential and integral types of constitutive equations are derived using the continuum theory and the non-equilibrium thermodynamics. They are applied to the flow system of fluid.

CBE555 Biopolymer
Introduction and classification of the biopolymers, their chemical and physical structures are studied. The application of biopolymers in biomedical, sensor, drug delivery, etc, are also studied.

CBE573 Fuel Cell Processes and Materials
Unit process analysis and materials design for fuel cell core technology will be discussed. State-of art fuel cell unit process and computer simulation will be understood. Optimal design of MEA preparation, cathode and anode materials, electrolytes, stack, bipolar plate, and diffusion layer will be introduced. Recent trends of primary fuel cell technology will be included.

BS584 Novel Drug Delivery Systems
This is a general education course of novel drug delivery systems (DDS), introducing sustained-release DDS formulation and targeted drug delivery systems. The importance and current problems concerning stabilization and formulation of DDS and gene delivery systems are the major topics of discussion in this course, as well as the design of polymeric scaffold system for effective drug delivery.

MS613 Solid State Physics
This course is designed for beginning graduate students of materials science and engineering. It will cover crystal structure, lattice vibration, the theory of electron gas, the quantum electron theory and the concept of band theory.

MS620 Optical Materials
This course deals with physical and chemical properties of the materials used for optical devices and consists of three parts. The first part consists of nature of electromagnetic waves, light propagation, refraction, reflection, reflection, scattering and absorption, and color generation in materials. The second part consists of light course, modulation, and detection (including human eyes) of light. Third part consists of electro-optical phenomena and optical integrated circuits.

MS642 Electronic Packaging Technology
This course covers electronic packaging technologies such as electronic design, thermal consideration, mechanical design, reliability and failure mechanism, chip interconnection, chip packaging, printed board technology, soldering, ceramic packaging, and multi chip packaging.

IE 643 Design and Analysis of Experiments
Theories of experimental design and analysis methods of experimental data with applications to industrial problems are introduced. Characteristics of various experimental designs and analysis of variance method are covered. Emphasis is placed on experimental methods for the design and improvement of products or processes and on optimal experimental design considering the cost and statistical efficiency.

CBE652 Polymer Characterization
Theories and experimental method for the characterization of polymer materials are studied. Theories on molecular conformation, osmometry, X-ray, light scattering, rheometry, gel permeation chromatography are also studied.

CBE653 Mechanical Properties of Polymers
The equations to describe the elasticity and viscoelasticity of polymer solid are derived by using the continuum and statistical theories. They are applied to the analyses of isotropic and anisotropic polymers. The theories are compared with the experimental results of polymers with linear and nonlinear visco-elasticities. The yield and fracture behaviors of polymers are also studied.

MS670 Sol-Gel Nano Materials and Process
In this course, fundamentals of sol-gel process and fabrication of ceramics and glasses by sol-gel process are studied. Also, synthesis and application of nano materials such as nano composites, nano hybrids, nano structured materials, mesoporous materials, and biomaterials prepares by sol-gel nano process are introduced

CH672 Specialty Polymer Chemistry
This course involves synthesis and properties of photonically and electronically functional polymers. Focus is on conducting polymers, photoconducting polymers, photoresponsive polymers, nonlinear optical polymer, electroluminescent polymers, polymer batteries, and photoresists.

CH673 Polymer Physical Chemistry
This course involves thermodynamic analysis of structure and properties of polymer systems. The focus here is on polymer structure, thermodynamics of polymer solutons, elasticity of rubber, phase equilibrium, friction, and transport processes.

CH674 Organic Electronic Materials
The course provides the basic principles, various organic and polymeric materials as well as their syntheses and the device fabrications of organic thin-film transistor, organic light-emitting diode and organic photovoltaic cell which are strongly connected with industrial fields.

CH675 Introduction to Lithography
Lithography is applied widely to manufacturing of semiconductor microchips, displays, and MEMS devices. This course discusses the physics of lithographic process, resist materials, resist processing, and emerging lithographic technologies such as nanoimprint lithography, interference lithography, immersion lithography, and scanning probe lithography.

CBE682 Organic Nano-Structured Materials
This topics of this course includes: non-crystal, crystals, liquid crystals, imperfections in ordered media, and finally nano-structure. Because the properties of nanomaterials are structure-sensitive, numerous associations in this class will be made to establish structure-property relations for advanced organic materials using very useful experimental techniques, in particular, diffraction and microscopy. Applications to IT and BT devices using nanostructured materials are also discussed.

MS684 Principles of Semiconductor Devices
This course covers the basic physics, operation principles, and processes of semiconductor devices. This course provides the thinking tools for materials scientist to develop or improve the device characteristics, which are closely related to materials science such as structures, bulk defects, interface defects, thermodynamics, and kinetics.

PSE711 Special Topics in Polymer Materials Ⅰ
Engineering plastics, high performance polymers, and functional polymers will be introduced and their characteristic properties are studied.

PSE712 Special Topics in Polymer Materials Ⅱ
Engineering plastics, high performance polymers, and polymers for electronic application will be introduced and their characteristic properties are studied.

CBE731 Polymer Fluid Dynamics
Molecular approaches for the understanding of flows in the polymeric systems are the main issues here and rheo-optical experiments are also dealt to study the relationship between microstructure and properties of these system.

CBE751 Advanced Rheology of Polymer
Probability theories for the Rouse motion, hydrodynamic interaction and conformation of polymer are introduced to derive the diffusion equations and constitutive equation. The constitutive equations derived using phase-space and reptation theories are used to calculate the rheological properties of flexible and liquid crystalline polymers in dilute, concentrated or melt state.

CH773 Special Topics in Polymers Chemistry I
This course is composed of lectures on special topics selected from recent "hot topics" in polymer chemistry. The topics include synthetic metals, liquid crystals, photonic polymers, degradable polymers, thermoresistant polymers and new materials.

CBE851 Special Topics in Polymer Engineering
This course deals with recent trends of the properties of polymers, such as solution properties, solid properties, electrical properties, optical properties and mechanical properties. Recent topics on polymer characterization methods are also discussed.

PSE960 Thesis <Master Student>

PSE966 Seminar <Master Student>

PSE980 Thesis <Ph.D. Student>

PSE986 Seminar <Ph.D. Student>