Polymer Science & Engineering (PSE)

Courses

PSE 409 Composite Materials 3 Credits
Principles and technology of fiber reinforced composite materials. Design, processing, properties, and structural applications of composites, with emphasis on fiber-reinforced polymers.

PSE 419 Polymer Sustainability 3 Credits
Understand the current scenario of the impact of polymers in the environment and what has been done so far to reduce its negative impact. Become equipped and encouraged to think ahead to make polymeric materials more sustainable. Understand the benefits of plastic use vs its impact. Understand the concepts of polymer degradation, biopolymers, recycling techniques and waste management. Overview of health effects of polymeric materials.

PSE 426 Biomimetic and Bio-enabled Materials 3 Credits
The structure, function, properties and use of biopolymers, biocomposites, and biominerals. Biomimetic materials design, including colloids, interfaces, macromolecules, and applications of such materials. Environmental and ethical considerations, such as degradation products when using biomimetic materials. This course is a graduate version of MAT 326 and BIOE 326. Closed to students who have taken MAT/BIOE 326.

PSE 460 Engineering Project 1-6 Credits
In-depth study of a problem in the area of polymers engineering or design. The study is to lead to specific conclusions and be embodied in a written report.
Repeat Status: Course may be repeated.

PSE 462 Independent Study 1-4 Credits
An intensive study, with report, of a topic in polymeric materials and engineering which is not treated in other courses. Consent of instructor required.
Repeat Status: Course may be repeated.

PSE 482 Mechanical Behaviors of Polymers 3 Credits
A treatment of the mechanical behavior of polymers. Characterization of experimentally observed viscoelastic response of polymeric solids with the aid of mechanical model analogs. Topics include time-temperature superposition, experimental characterization of large deformation and fracture processes, polymer adhesion, and the effects of fillers, plasticizers, moisture and aging on mechanical behavior.

PSE 483 (CHE 483, CHM 483, MAT 483) Emulsion Polymers 3 Credits
Examination of fundamental concepts important in the manufacture, characterization, and application of polymer latexes. Topics to be covered will include colloidal stability, polymerization mechanisms and kinetics, reactor design, characterization of particle surfaces, latex rheology, morphology considerations, polymerization with functional groups, film formation and various application problems.

PSE 485 (CHE 485, CHM 485, MAT 485) Polymer Blends 3 Credits
Synthesis, morphology, and mechanical behavior of polymer blends. Polymer/polymer miscibility and thermodynamics of mixing of polymer/solvent and polymer/polymer blends. Prediction of miscibility using various theoretical models and methods that can be used to help enhance miscibility (H bonding etc.). Methods to enhance the compatibility of polymer/polymer blends (e.g., block copolymers, ternary addition, IPNs, etc.). Types of polymer blends. Must have completed any introductory polymer course or equivalent.

PSE 486 Polymer Nanocomposite 3 Credits
Synthesis, morphology and properties of polymer nanocomposites. Comparisons with traditional particulate composites will be made and models predicting properties will be emphasized. Melt viscosity, mechanical properties, barrier properties and flame retardancy will be discussed. This course is a version of MAT 386 for graduate students, with additional research projects and advanced assignments. Closed to students who have taken MAT 386 or MAT 486.
Prerequisites: MAT 393 or PSE 493

PSE 487 Adhesion and Adhesives Techonology 3 Credits
Basics of intermolecular forces, surface science, and mechanics of materials and how these relate to adhesion. Processing and design of adhesive joints. Formulation and behavior of pressure sensitive and structural adhesives. Background in polymers is helpful.

PSE 488 (MAT 488) Polymer Characterization 3 Credits
Description of molecular weight measurements using dilute solutions (solution viscosity, size exclusion chromatography, osmotic pressure, and light scattering). Introduction to polymer thermal analysis techniques such as differential scanning calorimetry (DSC), dynamic mechanical analysis (DMA), and thermomechanical analyzer (TMA). Discussion of structure and morphology of polymers and polymer blends using nuclear magnetic resonance (NMR), infrared spectroscopy (IR), transmission electron microscopy (TEM) and atomic force microscopy (AFM).
Prerequisites: MAT 392 or MAT 393 or PSE 492 or PSE 493

PSE 490 Thesis 1-6 Credits
This course code is designated for thesis credit hours.
Repeat Status: Course may be repeated.

PSE 492 Introduction to Polymer Science 3 Credits
Introduction to concepts of polymer science. Kinetics and mechanism of polymerization, synthesis and processing of polymers, characterization. Relationship of molecular conformation, structure and morphology to physical and mechanical properties. Students cannot receive credit for both CHE/MAT 392 and PSE 492.

PSE 493 Physical Polymer Science 3 Credits
Structural and physical aspects of polymers (organic, inorganic, natural). Molecular and atomic basis for polymer properties and behavior. Characteristics of glassy, crystalline, and paracrystal-line states (including viscoelastic and relaxation behavior) for single-and multi-component systems. Thermodynamics and kinetics of transition phenomena. Structure, morphology, and behavior. Students cannot receive credit for both CHE/MAT 393 and PSE 493.

PSE 494 (MAT 494) Polymer Thermodynamics 3 Credits
Applications of thermodynamics in polymer science and engineering. Topics include: the thermodynamic basis for preparing polymer solutions, polymer blends and polymer composites, the importance of miscibility, phase separation and mechanical compatibilization of polymer solutions, polymer blends, etc., the methods used to characterize the role of thermodynamics; discussion of various thermodynamic models used to predict polymer compatibility and understand the importance of free energy of mixing. Understand the importance of thermodynamics in different application such as polymer crystallization, liquid polymers, etc.

PSE 499 Dissertation 1-15 Credits
This course code is designated for dissertation credit hours.
Repeat Status: Course may be repeated.