ESM369/CME 369/ESM533 Polymers (Elective)

Course Catalog description:

An introductory survey of the physics, chemistry and engineering processes of polymers. Topics covered included classification of polymers, structures of polymers, morphology of polymers, thermodynamics of polymers, phase separation and phase transition of polymers, crystallization of polymers. Case studies of commercial polymer production and processing.
3 credits

Pre- or Corequisite(s): ESG 332 Materials Science I: Structure and Properties of Materials

Text(s) or other required material:

R. J. Young, P. A. Lovell, Introduction to Polymers, 2nd Ed., Chapman & Hall, 1991. ISBN# 0412306409

Course learning outcomes:

Statistical physics and thermodynamics of polymers, Polymer structures and dynamics, Characterization techniques for polymers, Viscoelastic behavior of polymers, Industrial production and processing.

Topics Covered:
Polymer Definitions:
Thermodynamics of Polymeric Systems
Review of ideal solution theory
Formulation of free energies of polymeric systems
Flory-Huggins Free Energies
Phase Diagrams in Polymer Blends and Solutions
Characterization of Polymers
Calculating Molecular weight distributions
Separation processes in Polymeric systems
Viscosity of Polymeric systems
Dimensions of Polymeric molecule
Structure of Polymers
Glass transition
Crystalline vs. Amorphous Polymers
Elastomers
Mechanical Properties
Deformation of Polymers
Stress-Strain Behavior
Introduction to viscoelasticity
Fracture and Adhesion in Polymeric Systems
Green process
X-ray and neutron scattering techniques
Polymer thin film (fundamentals and applications)
Liquid Crystals

Class/ Laboratory Schedule:

ESM	369	Polymer Engineering/ESM 533	LEC	1	TUTH	11:20 AM	12:40 PM

Contribution of Course to meet requirement of Criterion 5:

Students will learn (i) the importance of safety and environmental considerations for polymer processes and recycling, (ii) recent modern nanotechnologies using polymers materials, (iii) modern experimental

techniques for polymer characterization, (iv) how to present results and prepare written reports for non-technical and technical audiences through team projects.

Relationship of course to program outcomes:

(a) ability to apply knowledge of math, engineering, and science (10%)
(b) ability to design and conduct experiments, analyze data (10%)
(c) ability to design system, component or process to meet needs (10%)
(d) ability to function on multi-disciplinary teams(10%)
(e) ability to identify, formulate, and solve engineering problems(10%)
(f) understanding of professional and ethical responsibility(5%)
(g) ability to communicate effectively(10%)
(h) broad education (10%)
(i) recognition of need an ability to engage in life-long learning (5%)
(j) knowledge of contemporary issues (10%)
(k) ability to use techniques, skills, and tools in engineering practice (10%)

Person(s) who prepared this description and date of preparation

Tadanori Koga, Jan. 09, 2009