Materials Science and Engineering of Polymers
14:635:361

Required text:	Materials Science of Polymers for Engineers, Osswald & Menges, Hanser Publishing, New York (1996).
Grade Basis	2 Hourly Exams = 25% Final Exam = 35% Homework, attendance and quizzes=15%

Course Outline

Week	Title	Description
1A	Introduction	Scope of polymers studies, statistical data on their use, general properties
1B	Polymerization	Basic step polymerization, basic chain polymerization
2	Structure of Polymers	Bonds and intermolecular attraction, macromolecules, molecular weight, arrangement of molecules (configuration, conformation, stereoregularity), copolymers
3	Characterization in Solution	Solubility, molecular weight, molecular weight distribution, characterization methods
4	Properties of polymers	The glass transition, physical properties, crystallization and structures resulting from crystallization, semicrystalline polymer.
5	Physical measurements	Differential scanning calorimetry, modulated vs. unmodulated mode, the relationships between T_g, T_m, and T_c. Thermomechanical analysis.
6A	Review	
6B	Hourly #1	
7	Rheology of polymer melts	Specialized measurement methods for polymers, including melt flow indexing and capillary flow viscometry. Elongation viscosity. Viscosity of curing thermoset polymers.
8	Stress/strain behaviors	Viscoelasticity, creep and stress relaxation in polymers and polymer composites.
9	Rubber Elasticity	Origin of entropy elasticity, elastomers, thermoplastic elastomers
10	Processing Methods	Extrusion, injection molding, film drawing, fiber spinning, blowing and blow molding.
11A	Hourly #2	
11B	Mixing of polymer blends	Distributive mixing, dispersive mixing, mixing devices; plasticization; polymer additives for stabilization and functional properties.
12	Polymer blends	Alloys, immiscible polymer blends, compatibilizers. Properties of commercial multi-phase systems, block copolymers
13	Failure and damage of polymers	Overview of stress strain curve features, brittle versus ductile failure, impact properties and test methods, chemical degradation
14	Optical properties and permeation behavior	Refractive index, photoelasticity and birefringence; transparency, reflection, absorption, and transmittance. Color. Diffusion and permeation