

Textbook: Engineering Design with Polymers and Composites, James C. Gerdeen, Harold W. Lord and Ronald A.L. Rorrer (2006); ISBN: 0-8247-2379-1

Assignment Sheet

Week	TOPICS	Reading Material
1,2	Introduction/Overview to Plastics Definitions and Classifications Thermoplastics, Thermosets, Elastomers (Rubbers): Family Characteristics Special Systems: Liquid crystalline polymers, Copolymers (random, block, graft), Polyalloys (blends and alloys); Cross-linking Physical States and Transitions: States: Melt; Solid; Crystalline State, Amorphous (Glassy and Rubbery States): Crystallinity and its Measurement Thermal Transitions: 1) Glass Transition Temp. T_g ; 2) Melting Temp. T_m Molecular weight and molecular weight distribution. Measurements of T_g and T_m	Chapter 1 Chapter 1: Chapter 1 Belofsky Chapter 4
3,4	Mechanical Properties of Solid Polymers Time-Independent Properties: short-term Properties: Tensile Properties; Stress-Strain Relations; Flexural, Compressive, Shear, Hardness. Factors Affecting Short-Term Properties: Temp, Strain Rate, MW, Cross-Linking Time-Dependent Properties: Short Term Properties: Impact Properties; Fracture Mechanics of Polymers Long Term Properties: Creep/Stress Relaxation; Fatigue Additives and Modifiers - Effect on properties. Composites - reinforcing fibers, Mechanics of fiber reinforcement	Chapter 2 Chapter 6 Chapter 4
5	Viscoelasticity: Creep/Stress Relaxation (Details), Mechanical and Models. Non-Mechanical Properties: (a) Thermal Properties (b) Optical, Electrical and Environmental Properties	Chapter 3 Chapter 6 Belofsky Chapter 6
6	EXAM 1	
7	Fundamentals of Melt Rheology: Classification of fluid behavior, Generalized Newton's Law of Viscosity, Effect of temperature and pressure on melt viscosity, Effect of molecular weight and MWD on viscosity, Viscosity, Temp, free volume & WLF Equation, Power Law fluids, Flow models: How to interpret rheology graphs	Belofsky Chapter 7
8	PROCESSING GUIDE (with focus on Injection Molding) 1) A Video on Manufacturing of Plastics Products: Extrusion, Blown Film Extrusion, Blow Molding, Injection Molding, Compression Molding, Transfer Molding Thermoforming, Rotational Molding. 2) Focus on Injection Molding: Process Overview: The Injection Molding Machine: Process Procedure: The process Cycle: Mold Filling, Mold Packing, Cooling, Ejection, Flowability; Product Description; Mold Design: Basic Geometric Requirements, Gating: Gate Types, Location. Runners: Balancing (Shear versus Pressure), Flow Length, Venting, Mold cooling..	Also Belofsky Chapters 9 Chapter 9
9	The Design Process: Guidelines for Material Selection, Process Selection, and Product Design Introduction to MOLDFLOW	Chapter 7
10-13	EXAM 2/TERM PAPER Design Project: Computer Lab	MOLDFLOW
14	Project Reports and Oral Presentation	
15	Final Examination	

NOTE:

*The reading assignments for the textbook are listed in the syllabus. Unfortunately, there are topics that will be covered that are not covered as well as I would like or are not covered at all. I will supplement the textbook material via lectures, reference books, and via handouts of additional material. **Students will be contacted before any changes are made to the above syllabus.***