

COURSE SCHEDULE**Tuesday: 2:30 PM - 5:25 PM, MEC 219**

- INSTRUCTOR:** Dr. K.A. Narh, 202 MEC
Phone: (973) 596-3353, Email: narh@njit.edu
- TEXTBOOK:** Principles of Polymer Engineering, N.G. McCrum, C.P. Buckley, and C.B. Bucknall, Hanser Publishers, New York, 1997.
- SUPPLEMENT:** Plastics Handbook, edited by Modern Plastics: McGraw-Hill, Inc.
- REFERENCE BOOK:** (Reserved in NJIT Library) Polymeric Materials and Processing: Plastics, Plastics Product Design and Process Engineering, H. Belofsky, Hanser, 1995.
- PREREQUISITE:** ME 215, Mech 237
- OBJECTIVES:** Students will learn the unique properties of the various commercial thermosetting and thermoplastic resins. An introduction to viscoelastic theory and its relationship to measurable properties of plastics. Students will also be introduced to fracture mechanics of plastics. Other engineering properties such as fatigue resistance, flammability, chemical resistance, and electrical properties will be presented. Material selection procedure for design of plastic products will also be presented.
- LECTURES:** The lectures will be based on the assigned reading from the required textbook, notes and other related materials. A proposed course schedule is attached. This is offered as a guideline and may be changed throughout the semester. The scope of the design project will be discussed in class.
- HOMEWORK:** All homework problems will be reviewed in class no sooner than 2 lectures after their assignment. Homework solutions must be done with a microprocessor and Math software. Use MS Excel or any other Software for ALL your graphs.
- EXAMS & QUIZZES** There will be two exams and 5 quizzes during the semester. There will be NO make up exams.
- FINAL GRADE:** Course average is based on exams, homework and a project paper:
- | <u>Item</u> | <u>Weight (%)</u> |
|--------------------------|-------------------|
| Homework | 10 |
| Exam 1 | 25 |
| Quizzes (5 in total) | 10 |
| Course Project | 25 |
| <u>Final Examination</u> | <u>30</u> |
| <u>TOTAL</u> | <u>100</u> |
- OFFICE HOURS:** Thursday 2 PM - 3:30 PM, or by appointment only. There will be no office hours a day either before any scheduled exam nor during the exam day
- GRADING SCALE:** The grading scale will be as follows: A (90-100); B⁺ (85-89); B (80-84); C⁺ (75-79); C (70-74); D (56-69); F (<55)
- CLASS RULES:** Late Homework submissions NOT ALLOWED.
Sleeping in class unacceptable.

TURN OFF ALL CELL PHONES

| WEEK | TOPIC | READING/ASSIGNMENT |
|-------|---|---|
| 1 | Plastic Materials: An Overview Basic concepts and definitions: Monomers, Polymerization, Polymers Polymeric chains & Molecular Networks: Cross-linking and chain branching Molecular weight and molecular weight distribution Thermoplastics, Thermosets, Elastomers | Identify 30 products manufactured from polymers McCrum et al. 1 |
| 2 | Physical States and Transitions Amorphous, Glassy & Rubbery states: Glass Transition Temperature T_g and T_m Crystalline State: morphology, crystallization kinetics | McCrum et al. 2 |
| 3/4 | Visco-elasticity: Models: Physical, Mathematical. Creep and Stress relaxation Stress dependence of creep Strain dependence of stress relaxation. | McCrum Chapter 4 |
| 5 | Mechanical Properties Types of mechanical behavior Stress-strain behavior Short term Properties: Impact tests Moderate-term Properties: Tensile, flexural, compressive, shear, hardness, Long-term Properties: Creep tests, fatigue test Introduction to Fracture Mechanics of Polymers | Belofsky, 5 McCrum Chapter 5 |
| 6 | Exam 1 | |
| 7 | Additives - effect on properties. Composites - reinforcing fibers, Mechanics of fiber reinforcement | McCrum et al. 6; Belofsky 12 |
| 8 | Manufacturing Methods and Product Characteristics | McCrum et al. 7 Identify Manufacturing Methods for list in Assn. 1 |
| 9 | Thermal Properties Thermal properties - specific heats, thermal conductivity and diffusivity, differential scanning calorimetry (DSC) Measurement of Thermal Data | Belofsky, 3 |
| 10 | Electrical Properties - comparative tracking index, dielectric strength, arc resistance measurement and test methods Optical Properties: color, gloss and haze, measurement and test methods | Belofsky, 6 |
| 11 | Environmental Testing Weathering, Chemically aggressive environment, Flammability & Combustion | Belofsky, 6, 18 |
| 12-14 | Materials Selection Term Project | McCrum et al. 8 |
| 15 | Term Project Due 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 text via lectures and via handouts of additional material.