MSE/ME 4776 Polymer Science and Engineering II (Elective)

Catalog Description: MSE/ME 4776 Polymer Science and Engineering II (3-0-3)
Prerequisites: MSE/ME 4775 Polymer Science and Engineering I
Crosslisted with CHBE, CHEM, ME, and MSE.
Polymer fabrication processes and methods of characterization and identification of polymers are presented. Experiments in polymerization, processing, and property evaluation of polymers.

Textbook: Paul C. Painter and Michael M. Coleman, *Essentials of Polymer Science and Engineering*, Destech Publications, Inc., 2008.

Topics Covered:

1. Introduction and molecular weights.
2. Step-growth polymerization.
3. Emulsion polymerization.
4. NMR/IR (Nuclear Magnetic Resonance/Infrared) spectroscopy.
5. Dilute solution viscosity.
6. Light scattering.
7. GPC (Gel Permeation Chromatography).
8. Thermal analysis.
9. Rheology.
10. Extrusion.
11. Injection molding.
12. Mechanical properties.
13. Scientific reporting writing and oral reporting of scientific information.

Course Outcomes:

Outcome 1: Students will be able to understand the relationships between polymer molecular weight, molecular weight distribution, and the properties of polymeric materials.

Outcome 2: Students will demonstrate an ability to distinguish different polymerization reactions and their mechanisms/kinetics, and learn how actual polymerization is performed in the laboratory. Students will also be able to analyze polymerization data and predict the conversion and molecular weight, which will lead to critical thinking about how to improve the setup for better polymerization.

Outcome 3: Students will be able to determine polymer molecular weights and molecular weight distributions from different types of experiments. Students will learn about polymer solvent interaction and the effect of the solvents on the dimensions of the polymers in solution.

Outcome 4: Students will improve and expand their skills in performing and analyzing the thermal and mechanical properties of polymers, and demonstrate an ability to predict how the molecular weight will affect these properties.

Outcome 5: Students will be able to describe the viscoelastic behavior of polymers with respect to their chemical structures and molecular weights, and to construct a corresponding master curve from the experimental data, which can be used to predict the material response at different temperatures, times, and/or frequencies.

Outcome 6: Students will be able to run extrusion and injection molding machines, and to collect and analyze data. This will help them to make connections between the polymer molecular weight, viscoelastic properties, and processing conditions.

Correlation between Course Outcomes and Student Outcomes:

ME 4776											
	Mechanical Engineering Student Outcomes										
Course Outcomes	a	b	c	d	e	f	g	h	i	j	k
Course Outcome 1	X										X
Course Outcome 2	X	X					X				X
Course Outcome 3	X	X					X				X
Course Outcome 4	X	X					X				X
Course Outcome 5	X	X					X				X
Course Outcome 6	X	X					X				X

GWW School of Mechanical Engineering Student Outcomes:

(a) an ability to apply knowledge of mathematics, science and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Prepared by: Jung Ok Park