MSE 3230: Polymer & Fiber Processing (required)

Catalog Description: (3-0-3)
Prerequisites: MSE 3210 Transport Phenomena, MSE 3225 Non-Newtonian Fluid Mechanics and Rheology, and MSE 4775 Polymer Science & Engineering I
Discussion of the principles of fiber formation from polymers including rheology, mechanics,energetics, phase transition, and polymer structure. High-performance fiber processing, and plastics processing.

Textbook: Z. Tadmor and C.G. Gogos, Principles of Polymer Processing, Wiley-Interscience, 2006.

Prepared by: Donggang Yao

Topics Covered:

1. Introduction: basics and general background
2. Overview of polymer processing
3. Review of continuum mechanics
4. Thermal, mechanical and rheological properties pertinent to polymer/fiber processing
5. Isothermal flow of purely viscous non-Newtonian fluids
6. Non-isothermal aspects in polymer/fiber processing
7. Melting
8. Pressurization and pumping
9. Mixing
10. Devolatilization
11. Extrusion
12. Injection molding
13. Reactive polymer processing
14. Fiber spinning

Course Outcomes: Specifically, at the end of the course the students will be able to:

1. Describe common polymer/fiber processing techniques, including molding, extrusion, thermoforming, film blowing, melt/solution spinning, casting, etc.
2. Explain general material properties and deformation behaviors of polymeric liquids and solids, which are pertinent to polymer/fiber processing.
3. Analyze mass and heat transfer problems in simple geometries (e.g. 1-D or axi-symmetric) for polymeric materials during polymer/fiber processing.
4. Understand the structural-property relationship and interpret the influence of processing on the structural development during polymer/fiber processing.
5. Select suitable polymer/fiber processing techniques and sequences for product realization.
6. Apply CAD and CAE for solving polymer/fiber engineering problems.

Correlation between Course Outcomes and Student Outcomes:

Course Outcomes	Student Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
1. Describe common polymer/fiber processing techniques, including molding, extrusion, thermoforming, film blowing, melt/solution spinning, casting, etc.			x								
2. Explain general material properties and deformation behaviors of polymeric liquids and solids, which are pertinent to polymer/fiber processing.	x		x								
3. Analyze mass and heat transfer problems in simple geometries (e.g. 1-D or axi-symmetric) for polymeric materials during polymer/fiber processing.	x										
4. Understand the structural-property relationship and interpret the influence of processing on the structural development during polymer/fiber processing.			x								
5. Select suitable polymer/fiber processing techniques and sequences for product realization.			x								
6. Apply CAD and CAE for solving polymer/fiber engineering problems.											x
Entire Course	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**
0 = None or insignificant; 1 = Some; 2 = Moderate; 3 = Strong											

School of Materials Science and 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