MAT 402 Polymer Engineering II

Instructor: Dr. Ozge Akbulut

Course meeting times: -----

There are no recitations for this class, but you are encouraged to make use of the Instructor's office hours for assistance.

Office hours: -----, if this doesn’t fit your schedule; you can always make an appointment by e-mail. (SUNUM 1114)

Scope: The aim of the class is to equip students with 1) polymer processing techniques and the effect of these processing techniques on polymer structure, 2) aspects of designing polymeric devices and polymer additives, 3) the properties of reinforced polymers and related reinforcement methods. Students are assumed to have basic knowledge on polymer structure-property relationship from Polymer Engineering I and/or Introduction to Materials Science classes. Target audience is materials science and engineering, manufacturing systems engineering, and mechatronics majors.

Recommended reading:


Grading: The grading will be based on a lecture given by the student (25%), a design project (40%), class participation (10%), and a final exam (25%)

Design Project: There will be 3–4 students per group. The project will be presented at mid-semester and end of the semester (10% each, 20% total), depending on the number groups the final presentation can be anywhere between 20–50 minutes. The students are expected to submit a written report (10%) and fabricate a prototype.

Week 1

i) Introduction (class mechanics)
ii) Tailoring the properties of polymers (modulus, yield strength, toughness, issues with recycling)
   • Review of main concepts in polymer science such as Tg, molecular weight, polydispersity, semi-crystallinity etc.
   • Flow properties of polymers (rheology)
   • Polymer characterization methods
Week 2
Introduction to the Design Project
Product development for clinical skill development laboratories

Week 3
Extrusion process I

Week 4
Extrusion process II

Week 5
Polymer film production (blown film, cast film)

Week 6
Injection molding
Farplas field visit

Week 7
Fabrication of polymeric fibers
Dow-AKSA field visit

Week 8
Design project presentations

Week 9
Thermoforming, blow molding, compression, and transfer molding

Week 10
Fabrication of reinforced plastics

Week 11
Micro/nanofabrication methods involving polymers
  - Polymers as templates for micro/nanofabrication
  - Nanoimprint Lithography (NIL)
  - Step-and-flash Imprint lithography (SFIL)
  - Soft lithography

Week 12
Electrospinning (Mert)
Review

Week 13
Additive Manufacturing

Week 14
Design project presentations