BioE/ME C223 SAMPLE SYLLABUS
Polymer Engineering: Fundamental Principles
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Tu-Th 12:30-2, 3113 EH

This course provides an overview of engineering polymers and their applications in engineering and medicine. The basic structures and various molecular variables that play a role in mechanical performance of polymer systems are examined. Quantitative assessment of mechanical behavior of macromolecules is covered in order to design for structural function. Several case studies are presented.

I. Polymer Structure
What are polymers? How are they made? How are they classified? Where are they used? How is the molecular structure characterized? How are polymers formulated and evaluated for various applications?
Introduction to polymers
Synthesis
Molecular weight distribution and characterization
Manufacturing, processing and rheology
Characterization of polymer systems: plastics, elastomers, fibers
Bulk structure of polymers
Glass transition and thermal behavior
Methods for structural characterization
Degradation, stability and environmental issues

II. Mechanical Behavior
What is rubber elasticity? What is viscoelasticity? How do we quantify this behavior and its affect on mechanical properties? What are some relationships that exist between structure and mechanical properties? How do we predict yield, fracture, and fatigue resistance in polymers? How are polymers developed with specific mechanical properties for structural applications?
Rubber elasticity
Viscoelasticity
Yield criteria
Crazing and breaking phenomena
Fatigue, Fracture and Wear

III. Designing with polymers
How are polymers used in engineering applications and medical applications? What are the design requirements for such systems? How do we creatively design with polymers in novel applications?
Medical Polymers
Engineering Polymers
Novel Polymers: hydrogels, resorbables, electroactive

ASSESSMENT
This class will utilize cooperative project-based learning. There will be a design project for each part of this course.