THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Polymers in Bioengineering

BIOMEDE 5340

Credit Hours:
3.00

Course Levels:
Undergraduate (1000-5000 level)
Graduate (5000-8000 level)

Course Components:
Lecture

Course Description:
This course focuses on polymers (both synthetic and biopolymers) for bioengineering applications. Topics include polymer chemistry and characterization techniques, design criteria for bioengineering applications, nanocomposites, and hydrogels. Applications of polymers in tissue engineering and drug and gene delivery will be covered.

Prerequisites and Co-requisites:
Prereq: BIOMEDE 4310, or CBE 3508; or graduate standing in Engineering, or permission of instructor

Course Goals / Objectives:
- Students will identify chemistry, structure, function, and mechanical properties of polymers and biopolymers.
- Students will be able to know how to select a polymer or biopolymer to solve real-world bioengineering problems
- Students will identify and communicate current polymer research and applications in bioengineering.
- Students will demonstrate curiosity, connections, and creating value through course assessments.
- Apply fundamentals of polymer chemistry, structure, function, and characterization.
- Identify factors critical to a polymer or biopolymer’s function and mechanical properties.
- Identify materials suitable for use in a particular bioengineering application.
- Understand how polymers are used in tissue engineering and drug delivery.

Course Topics:

- Brainstorm and create ideas for new products, process or services that provide a potential economic, social, or biological value; Polymer chemistry fundamentals
- Identify a problem whose solution will create value within the identified opportunity using primary research, secondary research, or by engaging stakeholders; Polymer selection and design criteria for bioengineering applications
- Develop a list of needs from research and stakeholder(s) that support project objectives; Biopolymers, synthetic polymers, and hybrids
- Develop concepts and define solution requirements; Monomers, backbone structure, crosslinking, interpenetrating networks, morphology, mechanical properties, wettability, and optical properties
- Develop process to validate proposed solutions; Polymer characterization; Rheology, imaging, and FTIR
- Collaborate with contacts within the course to gather resources and expertise to inform the design process; Polymer nanocomposites
- Compare the social, financial, and environmental costs, risks, and benefits of proposed solutions to problems; Hydrogels and swelling theory (transport/diffusion)
- Provide peer review on proposed solutions; Design of polymeric scaffolds for tissue engineering
- Test and validate solutions; Polymers in drug and gene delivery; Communicate a technical solution through written documentation and an oral presentation; Biodegradation and host response to polymeric materials

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Designation:
Elective