

## **MSE 4571: Introduction to Biomaterials (required)**

### **Catalog Description:** (3-0-3)

Prerequisites: MSE 2001

A broad-based introduction for undergraduates to different types of biomaterials (metals, ceramics, polymers) and physiological responses to biomaterials.

**Textbook:** J.S. Temenoff & A.G. Mikos. "Biomaterials: The Intersection of Biology and Materials Science." Pearson Education International

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### **Topics Covered:**

1. Survey of fundamental cell biology concepts
2. Overview of innate immune response to implanted biomaterials.
3. Inflammatory response to biomaterials.
4. Survey of adaptive response and blood clotting cascade response to implanted biomaterials
5. Overview of metallic, polymeric, ceramic-based biomaterials.
6. Polymerization and biodegradation of polymeric-based biomaterials.
7. Protein adsorption to biomaterial surfaces.
8. Thermal, spectroscopic, electrophoresis-based characterization approaches.

### **Course Outcomes:**

1. Understand fundamentals of inflammatory response to synthetic biomaterials
2. Understand electrophoretic, colorimetric, and fluorescence characterization approaches for biological species
3. Understand fundamental structure-property correlations in metallic, ceramic, and polymeric biomaterials
4. Understand spectroscopic and thermal characterization approaches for biomaterials

**Correlation between Course Outcomes and Student Outcomes:**

Course Outcomes	Student Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
1. Understand fundamentals of inflammatory response to synthetic biomaterials	x						x			x	
2. Understand electrophoretic, colorimetric, and fluorescence characterization approaches for biological species	x				x		x				x
3. Understand fundamental structure-property correlations in metallic, ceramic, and polymeric biomaterials	x				x		x			x	
4. Understand spectroscopic and thermal characterization approaches for biomaterials	x				x		x				x
<b>Entire Course</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>0 = None or insignificant; 1 = Some; 2 = Moderate; 3 = Strong</b>											

**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