

MSE 4751: Introduction to Biomaterials

Credit hours and contact hours: 3-0-0-3

Instructor: Valeria Milam

Textbook: J.S. Temenoff and A.G. Mikos, *Biomaterials: The Intersection of Biology and Materials Science*, 8th Edition, Pearson, 2008.

Specific course information

Catalog description: Introduction to different classes of biomaterials (polymers, metals, ceramics) and physiological responses to biomaterial implantation. Topics include material properties, host response, and biomaterial characterization techniques.

Prerequisites: MSE 2001 – Principles & Applications of Engineering Materials

Course: Selected Elective

Specific goals for the course

Outcomes of instruction:

1. Understand fundamentals of inflammatory and wound healing responses to 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 thermal and mechanical characterization approaches for biomaterials

Student Outcomes:

- (1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- (3) An ability to communicate effectively with a range of audiences.
- (6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

Topics covered:

1. Survey of fundamental cell biology concepts
2. Overview of innate immune response to implanted biomaterials.
3. Inflammatory and wound healing responses 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.

Correlation between Course Outcomes and Student Outcomes:

Course Outcomes	Student Outcomes						
	1	2	3	4	5	6	7
1. Understand fundamentals of inflammatory and wound healing responses to biomaterials	X		X				
2. Understand electrophoretic, colorimetric, and fluorescence characterization approaches for biological species	X		X			X	
3. Understand fundamental structure-property correlations in metallic, ceramic, and polymeric biomaterials	X		X				
4. Understand thermal and mechanical characterization approaches for biomaterials	X		X			X	

School of Material Science and Engineering Student Outcomes:

- (1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- (2) An ability to apply engineering design to produce solutions that meet specified needs with consideration for public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
- (3) An ability to communicate effectively with a range of audiences.
- (4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
- (5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
- (6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- (7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.