

BME 304 – Material Fundamentals of Biomedical Engineering

3 Credits, 3 Contact hours

Instructor: George Collins, Ph.D.

Course Coordinator: Bryan Pfister, Ph.D.

Textbook(s)/Materials Required:

1) An Introduction to Tissue-Biomaterials Interaction, Kay Dee, David Puleo and Rena Bizios, John Wiley & Sons, Inc., Pub. Date: 2002, ISBN: 0-471-15394-4

2) Biological Performance of Materials: Fundamentals of Biocompatibility, Jonathan Black CRC, Taylor & Francis Group, Published: 2006, ISBN: 0-8493-3959-6

Course Description:

This course is an introduction to the field of biomaterials with an emphasis on the wound healing process and interactions between the human body and implanted devices fabricated from various types of biomaterials. The thrust of this course will be to illuminate the processes occurring at the tissue-biomaterial interface. Attention will be given to the biological events occurring at the molecular level on the surface of an implanted device. The nature of these surfaces and the physiological consequences of these processes will be examined in terms of how the body and functioning of the device are impacted.

Prerequisites:

R120:102-Biology II with a grade of C or better or BME 303 with a grade of C or better.

This is a required course for all students.

Course Learning Outcomes (CLO):

1. Understand the general features of protein structure and the relation of that structure to function.
2. Understand the molecular structure and function of cells and the cellular composition of tissues.
3. Describe the major types of materials that are used in medical device fabrication.
4. Understand the interaction of biomaterials with tissues of the human body and what biocompatibility is in relation to biological response.
5. Describe issues relevant to device function retention and tissue function retention when medical devices implanted in the human body.
6. Be capable of reading, comprehending and communicating the content of current technical articles on biomaterials research and applications.

Student Learning Outcomes:

Student outcome J - Knowledge of contemporary issues.

Related CLO – 6

Student outcome L - Apply bio/physio insight to BME application
Related CLO – 3, 4, 5

Student outcome O - Assess safety and effectiveness of interactions between living & non-living
Related CLO – 4, 5, 6

Course Topics:

Introduction to Materials, Biomaterials and Tissue, Complex Organism Organization: Atomic to Molecular, Complex Organism Organization: Molecular to Cellular, Complex Organism, Organization: Cellular to Tissue, Complex Organism Organization: Cellular to Tissue, Metals for Implants, Ceramic Biomaterials, Polymer Materials, Natural Biomaterials, Cells Sensing, Materials, The Response of Blood to Materials, Biodegradable Materials, Regulatory Affairs and Ethics