NJIT | DEPARTMENT OF BIOMEDICAL ENGINEERING

BME 304 – Material Fundamentals of Biomedical Engineering

3 Credits, 3 Contact hours
Instructor: Zain Siddiqui, Ph.D.
Course Coordinator: Zain Siddiqui, Ph.D.

Suggested Textbook(s)/Materials:

1. Agrawal, C. Mauli. *Introduction to Biomaterials: Basic Theory with Engineering Applications*. Cambridge: Cambridge UP, 2014. Print.
2. Alberts, Bruce. *Molecular Biology of the Cell*. New York: Garland Science, 2014. Print.

Course Description:
This course is an introduction to the field of biomaterials with an emphasis on interactions between the human body and implanted devices fabricated from various types of biomaterials. Attention will be given to the biological events occurring at the tissue-biomaterial interface and in particular 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. Students will also practice skills for effective written and oral communication of complex scientific material.

Prerequisites:
Grade of C or higher in Chem 126 and Phys 11. This is a required course for all students.

Course Learning Outcomes (CLO):

Some of the specific skills I hope you will obtain in this course are listed below. Being a critical consumer of information about materials and biological systems is important; all of these activities will help you become a critical thinker, and it is my hope that you will use the skills throughout your career as a BME

1. Learn the fundamental properties of metals, polymers, ceramics, and natural biomaterials and their utility for biomedical applications.

2. Understand the molecular structure and function of cells and the cellular composition of tissues.
3. Understand the interaction of biomaterials with tissues of the human body and what biocompatibility is in relation to biological response.
4. Define design criteria for a material for a clinical need utilizing material science knowledge to predict the performance of a material *in vivo*.
5. Describe issues relevant to device function retention and tissue function retention when medical devices are implanted in the human body.
6. Read, comprehend, interpret, and communicate the content of current technical articles on biomaterials research and applications.

Student Outcomes:

ABET Student Outcomes	Related CLO
1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	4
2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of **public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors**	4,5
3) an ability to communicate effectively with a **range of audiences.**	6
6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and **use engineering judgment to draw conclusions**	6
7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	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