BME 304 - MATERIAL FUNDAMENTALS OF BME - *3 Credits, 3 Contact hours*

Instructor: Penelope Georges, Ph.D. (pgeorges@njit.edu)

Suggested Textbook(s)/Materials (not required):

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, 2008. Print.

Office Hours

FENSTER 624 :: make appointment using this link: bit.ly/1nmOxuE

Course Description

Prerequisites

Grade of C or higher in (CHEM 126 or CHEM 122), & (BME105 or BME 111).

Narrative 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. 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. Students will practice skills for effective written and oral communication of complex scientific material.

Course Learning Outcomes (CLO):

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. Describe issues relevant to device function retention and tissue function retention when medical devices implanted in the human body.
5. Be capable of reading, comprehending and communicating the content of current technical articles on biomaterials research and applications.

Grading

[30%] EXAMS: 3 exams weighted equally
[30%] Essay: 3 pages. Review article of an engineering topic related to biomaterials
[30%] Research Presentation: A presentation to the class describing topics in your essay

[10%] Homework & Class Participation

Week	TOPIC
1	Class Intr :: Overview of course goals & syllabus - Introduction to Biomaterials
	Basic Properties of Materials
2	Biological Systems: Membrane Structure & Receptors
	Biological Systems: Cytoskeleton
3	Biological Systems: Extracellular Matrix
	Biological Systems: Cell Adhesion
4	Cell-Biomaterial Interactions
	Cell Mechanics & Biological Forces
5	Laboratory Demonstration - Endothelial Cells embedded in Collagen gels
	QUIZ 1
6	Metals for Implants
	Metals for Implants
7	Ceramics
	Polymers
8	Synthetic Polymers
	Natural Biomaterials
9	Characterization of Biomaterials
	QUIZ 2
10	Principles of Tissue Engineering
	Principles of Tissue Engineering
11	Laboratory Demonstration: TE Scaffold Development **WRITING ASSIGNMENT DUE**
	Immune Response and Biological Testing techniques
12	Clinical Applications
	THANKSGIVING RECESS
13	Student presentations / Journal Club
	Student presentations / Journal Club

14	Student presentations / Journal Club
	Student presentations / Journal Club
15	**QUIZ 3**

*The Course Outline may be modified at the discretion of the instructor or in the event of extenuating circumstances. Students will be notified in class of any changes to the Course outline and schedule of studio sessions.

Attendance Policy

Attendance is mandatory. All absences must be pre-approved – Inform the instructor in advance. In case of extenuating circumstances, justification for any lates or absences must be validated by the Office of the Dean of Students (i.e. doctor's note, etc.). Attendance will be taken 10 minutes into class, and anyone not present will be marked absent. Any student that comes in after attendance is taken, is responsible for speaking to the Instructor **at the end of the class**, to have the absence turned into a late. 2 Lates will be considered an absence.

Students who accrue 4 or more unexcused absences will receive a maximum of a C for the course.

Makeup Policy

Assignments

Only documents approved by the Office of the Dean of the students will be accepted for any makeups. If any of the above items are missed, and no validated excuse is provided, a zero will be given for that item. If a validated excuse is provided, the student may be allowed to makeup the item if it has not yet been graded and returned, or if the item has been graded and returned, the missed item will be dropped from that category.

Exams

No makeup examinations will be administered unless the reason for the absence is approved by the Office of the Dean of Students, along with any necessary documentation. If the absence is approved by the Office of the Dean of Students, the student will have the option, depending on availability, of either having a makeup exam, or having the weight of the missed exam transferred to the weight of the Final Exam. Failure to provide an approved reason for the absence will result in a zero on the exam.