

# Technical-Elective Biomaterials

## Fall 2020

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Classifications of biomaterials covering metallic, polymeric, ceramic and composite materials; typical structures and properties for biomedical applications. Definitions of biocompatibility and critical design criteria of biomedical devices. Introduction to basic human anatomy, human histology, cells and genes and responses of living tissues to implanted biomaterials including inflammatory responses and blood compatibility. Assessment of biocompatibility of biomaterials, cell-surface interactions, biomaterial surface modification, sterilization procedures and an introduction to ethical and regularity issues with biomedical devices will be introduced.

<b>Mode of Delivery</b>	On campus
<b>Workload</b>	3 hours of lectures/tutorials and 8 hours of private study per week.
<b>Prerequisites</b>	ENGR 0022
<b>Instructor:</b>	Professor Grace Chen
Campus:	Zone 4-204
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### ACADEMIC OVERVIEW

#### Learning Objectives

Upon successful completion of this course, the students will be able to:

1. Understand the principles of biomaterials design and development.
2. Have a broad knowledge of four types of biomaterials; metallic, polymeric, ceramic and composite and their use in typical devices and clinical applications.
3. Have a basic understanding of the human anatomy, human histology, cell and genes in the context for the design requirements of biomedical devices.
4. Understand the responses of living tissues to implanted biomaterials.
5. Be aware of the most threatening human diseases and potential applications of biomaterials - Appreciate basic medical concepts and communicate effectively with the medical community.
6. Be familiar with various evaluation techniques and biomaterials and their medical devices.
7. Understand some of the interactions between cells and biomaterial surfaces
8. Be familiar with methods of biomaterial surface modification to control cell function.
9. Be familiar with methods of assessing the biocompatibility.
10. Understand regulations and ethical responsibilities in the process of developing biomaterials and medical devices.
11. Understand some of the material selection requirements for biomaterials.

## **Grading Policy**

<b>Assessment Task</b>	<b>Value</b>
1. Attendance and Answer questions in class	10 %
2. Homework	30 %
3. Mid-semester examination	20 %
4. Group Presentation	10 %
5. Final three-hour exam	30%

The Instructors reserves the right to moderate the assessment policy. This process will occur at the end of the semester.

## **Teaching and Learning Method**

The unit consists of lectures and problem classes. Learning in the unit is mainly through attending the lectures, problem classes and completing the assignments and group presentations.

## **RECOMMENDED TEXTBOOKS AND READINGS**

### **On Biomaterials:**

1. Biomaterials: A Basic Introduction. By Qizhi Chen and George Thouas.
2. Biomaterials Science: An Introduction to Materials in Medicine. Ed: Buddy D Ratner, Allan S Hoffman, Frederick J. Schoen, Jack E. Lemons. 2<sup>nd</sup> ed. Elsevier Academic Press, c2004.

### **On Anatomy, cell biology and histology**

3. **Excellent websites:**  
<http://www.innerbody.com/htm/body.html> (Excellent illustrations)  
<http://www.free-ed.net/free-ed/HealthCare/Anatomy/default.asp> (concise)  
<http://trc.ucdavis.edu/biosci10v/bis10v/week10/09organsystems.html>

### **On Evaluation and Regulation**

4. Hand Book of Biomaterials Evaluation. AF von Recum (editor). 2nd ed. Scientific, technical, and clinical testing of implant materials. c1999.
5. <http://www.fda.gov/> U.S Food and Drug Administration:  
<http://www.iso.org/iso/home.htm> International Organization for Standardization (ISO)

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