



WISCONSIN

UNIVERSITY OF WISCONSIN-MADISON

University of Wisconsin - Madison
College of Engineering [EGR]
Last Offered: 2015 Spring [1154]
Direct Link to this Syllabus :

<http://ae fis.engr.wisc.edu/index.cfm/page/CourseAdmin.ViewABET?coursecatalogid=483&pdf=True>

1. **B M E 430, Biological Interactions with Materials**
2. **Credits : 3 Contact Hours : 2.5**
3. **Textbook and Materials :**

Biomaterials Science - An Introduction to Materials in Medicine, Ratner, Buddy D., et al. (ed.). New York: Elsevier, 2004 (2nd Ed).

a. Other Supplemental Materials :

Recorded lectures and discussion sections
<http://mediasite.cae.wisc.edu>

• **Specific Course Information :**

- a. **Brief description of the content of the course (Course Catalog Description) :** This course addresses the range of materials currently being utilized for various biomedical applications, the biological systems governing biomaterial applications, analytical techniques pertinent to biomaterial evaluation, and selected major medical applications in which biomaterials play an important role.
- b. **Pre-requisites or Co-requisites :** 1 yr of general biol or two semesters of zool, & 1 semester of organic chem, or cons inst
- c. **This is a Required course.**

• **Specific Goals for the Course :**

a. Course Outcomes :

1. understand and to integrate biology and material science and engineering
2. apply this integrated knowledge in the design of materials for a specific biomedical application
3. develop critical experimental design and data assessment of data related to biological response to materials
4. be aware of the clinical utility and limitation of materials for biomedical applications

• **ABET Student Learning Outcomes :**

- (a) Ability to apply mathematics, science and engineering principles.
- (b) Ability to design and conduct experiments, analyze and interpret data.
- (d) Ability to function on multidisciplinary teams.
- (e) Ability to identify, formulate and solve engineering problems.
- (f) Understanding of professional and ethical responsibility.
- (g) Ability to communicate effectively.

(h) The broad education necessary to understand the impact of engineering solutions in a global and societal context.

(i) Recognition of the need for and an ability to engage in life-long learning.

- **Program Specific Student Outcomes :** (1) Understanding of biology and physiology as related to biomedical engineering needs.
(3) Ability to design and conduct experiments, including making measurements and interpreting experimental data from living systems and addressing the problems associated with the interaction between living systems and non-living materials and systems
- **Brief List of Topics to be Covered :**

Biomaterials are synthetic or biological materials used for the permanent augmentation or replacement of tissues, as well as for applications that require a relative short duration. A wide range of different materials are employed in the construction of biomedical devices such as artificial blood vessels, mechanical heart valves, breast implants, orthopedic joints, dental fillings, and devices such as intravenous catheters and drug delivery vehicles.

The lecture portion of the course covers:

- Proteins, cells, tissues
- Coagulation, inflammation, immunology, toxicity, infection
- Metals, ceramics, composites
- Polymers, hydrogels, bioresorbables
- Natural materials, auto/allo/xeno-grafts, surface modification
- Biological and Material characterization
- Tissue Engineering, cardiovascular, orthopedic, drug delivery biomaterials

The hands-on laboratories complement the course material and further strengthen course outcomes and learning objectives. Lab exercises include biomaterial fabrication, applications and characterization.