



Cleveland State University

Department of Chemical and Biomedical Engineering, Fall 2013

Course Biomaterials, BME 655, BME 755, CHE 655 (3 credits)

Class Schedule MC 426; Mon, Wed: 4:30 – 5:45 PM

Instructor Chandra Kothapalli, Ph.D.
Assistant Professor
Chemical and Biomedical Engineering, SH 460
Email: c.kothapalli@csuohio.edu
Office Tel: 216-687-2562

Office Hours Thursday 10:00 AM – 12:00 PM, 2-3 PM
Email to setup an appointment outside office hours

Goals and Overview:

Biomaterials have been extensively used over the past two decades for a range of applications including organ replacements, regenerative medicine and cosmetic surgery. Broadly, biomaterials include metals, ceramics, synthetic or biological polymers and various composites. This course will provide students and biomedical professionals with a solid foundation in biomaterial design and fabrication, structure-function relationship, surface engineering of materials for implantation, cell-biomaterial interactions, and applications of biomaterials in cardiovascular, orthopedic, dentistry and drug delivery. The procedures involved in obtaining FDA approval for implantable biomaterials will also be discussed. Upon completion of this course, students will be able to:

- Distinguish the key structure-property-performance relationships of various classes of biomaterials
- Identify materials currently approved for clinical applications, and describe their practical aspects
- Understand the significance of biocompatibility - which determines how the body responds to implanted materials
- Justify the choice of a particular biomaterial to be used as an implant, based on function, composition, and clinical risks

Prerequisites: Students registered for this course are expected to have basic knowledge of Materials Science, Molecular and Cell Biology and Human Physiology. Please let instructor know of your deficiencies, so that remedial material can be provided.

Textbooks ([strongly recommend purchasing](#)):

- Biomaterials Science: An Introduction to Materials in Medicine by Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen and Jack E. Lemons, Academic Press, San Diego, 2nd Edition.

- Materials Science and Engineering: An Introduction, by William D. Callister, John Wiley & Sons, 3rd Edition.

Reference Reading:

- Biomaterials: The Intersection of Biology and Materials Science, by Johnna S. Temenoff and Antonios G. Mikos, Prentice Hall; 1 edition, 2008.
- Biomaterials: Principles and Applications, by Joon B. Park (Editor), Joseph D. Bronzino (Editor), CRC Press; 1 edition.
- Medical Dictionary, (Dorland's or Taber's).

Class Policy:

- Students are expected to attend the classes regularly and complete all the course requirements, unless there is a well-documented emergency. Failure to attend classes would result in overall grade penalty.
- Class begins at 4.30 PM sharp, and late arrivals are discouraged.
- Some lecture slides and relevant handout materials will be uploaded to the course website prior to the beginning of each class. Students are expected to take notes in the class.
- Students are expected to purchase the textbook, read the material, and develop a thorough understanding of biomaterials. Lecture slides will only be supplemental.
- Homework and final reports are due on assigned date, unless there is a well-documented emergency.
- Since students from various undergraduate backgrounds register for this course, student participation and discussion during the lecture is expected and highly encouraged.
- Students will be asked to complete at least four assignments (homework) during the semester, on a wide range of topics, to make sure they understand and follow the material discussed in class. Partial credit will be given for well-written, complete solutions to homework problems.
- Details on project and homework will be provided as the semester progresses.
- Do not hesitate to ask me in person, by email or on the phone, if you need additional help with concepts, course material or homework.

Grading Policy:

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| • Homework | 20 % |
| • Mid-terms (2 x 20%) | 40 % |
| • Final exam | 20 % |
| • Project report (Team effort) | 20 % |

Letter grades for this course are defined as follows:

- A ≥ 95%
- A- 90-95%
- B+ 85-90%
- B 80-85%

- B- 75-80%
- C 65-75%
- F ≤ 65%
- 2-3 students every semester receive a C grade. So, don't take the course or lectures lightly.

Academic Integrity:

Homework and exams should be completed individually and are considered intellectual property of the student. Consultations with other students are not encouraged without prior approval of the instructor. However project reports and presentations can be completed in collaboration with other team members. Consultation with the course instructor is always encouraged.

Plagiarism in any form is considered academic misconduct, and automatically eligible for F grade. Please refer to the CSU student handbook for more information on what constitutes an act of plagiarism.

(<http://www.csuohio.edu/academic/writingcenter/WAC/Plagiarism.html>).

Students interested in improving their writing and presentation skills can solicit further assistance (free) from CSU writing center.

(<http://www.csuohio.edu/writingcenter/>).

Disability act:

CSU is committed to providing equal educational opportunities to all the students regardless of their disability. For accommodations based on disability, please refer to the CSU handbook on disability services. The office of Disability Services can be reached at 216-687-2015, and the office is located at MC 147. Please inform the instructor prior to the beginning of the course, so that necessary arrangements can be made.

(<http://www.csuohio.edu/offices/disability/students/handbook/enableleg.html>)

Class Calendar: *This calendar is just a guide for the schedule of topics to be covered this semester. There may be minor changes in this schedule as we move along, depending on how much material we can cover in each class.*

Class #	Date	Topic
1	Monday, Aug 26 th	Course Introduction & Overview of biomaterials
2	Wednesday, Aug 28 th	Metallic Biomaterials
Monday, Sep 2nd		Labor Day Holiday
3	Wednesday, Sep 4 th	Metallic Biomaterials
4	Monday, Sep 9 th	Ceramic Biomaterials
5	Wednesday, Sep 11 th	Introduction to Polymers & Polymeric Biomaterials
6	Monday, Sep 16 th	
7	Wednesday, Sep 18 th	
8	Monday, Sep 23 rd	Ceramic Biomaterials
9	Wednesday, Sep 25 th	Composite Biomaterials

Monday, Sep 30th		<u>First Mid-term exam</u> (in class, closed book)	
10	Wednesday, Oct 2 nd	Biological scaffolds and hydrogels	
11	Monday, Oct 7 th		
12	Wednesday, Oct 9 th		
Monday, Oct 14th		Columbus Day, Holiday	
13	Wednesday, Oct 16 th	Structure-function relationship	
14	Monday, Oct 21 st	Surface Modification and Characterization	
15	Wednesday, Oct 23 rd		
16	Monday, Oct 28 th		
17	Wednesday, Oct 30 th	Cell-biomaterial interactions	
18	Monday, Nov 4 th	Inflammation	Term project assigned
19	Wednesday, Nov 6 th		
Monday, Nov 11th Wednesday, Nov 13th		No Classes – Out for Conference <u>Second Mid-term exam</u> (take-home)	
Tuesday, Nov 12th		Veterans Day, No classes	
20	Monday, Nov 18 th	Wound healing	
21	Wednesday, Nov 20 th	Orthopedic biomaterials	
22	Monday, Nov 25 th	Vascular biomaterials	
23	Wednesday, Nov 27 th	Dental biomaterials	
24	Monday, Dec 2 nd	Biocompatibility testing	
25	Wednesday, Dec 4 th	FDA approval process	Project reports due
Monday, Dec 9th, 4-6 PM		FINAL EXAM (in-class, closed book)	