Biomaterials BIOE453, ENMA425

Lecture: 11:00am-12:15pm Tue, Thu CHE 2110
Discussion Sections: 0101 M 10:00am - 10:50am CHE 2145
                      0102 M  4:00pm -  4:50pm EGR 3114
                      0103 F 10:00am - 10:50am JMJZ 2123

Course Description: Examine the relationship between structure and function of biomaterials. Study physical properties of synthetic and natural biomaterials. Understand molecular level interactions between biomolecules and biomaterials to design novel biomaterials with desirable characteristics.

Instructor: Peter Kofinas; Professor, Fischell Department of Bioengineering
Associate Dean for Faculty Affairs and Graduate Programs, A. James Clark School of Engineering; kofinas@umd.edu; 301-405-7335; Office: 1120 Jeong H. Kim Engineering Bldg.

Office hours: I will be available on Tuesday and Thursday 2pm-3pm. Please feel free to stop by my office at any time. If I am in my office, I will either meet with you then, or set up a mutually agreeable time. You can also arrange a specific appointment time by emailing my assistant Jessica Tangarone jrtang@umd.edu.

Teaching Assistants:
John Daristotle jld@umd.edu, Leo Torres ltorres@umd.edu
Office: 1124 Jeong H. Kim Engineering Bldg 301-405-3903
Office Hours: BIOE Lounge Kim Building: Wednesdays 1:00-3:00 pm

Pre-requisites
BIOE453: BIOE120, BIOE121, BIOE241, CHEM231/CHEM 232, MATH246.

Textbooks:

COURSE POLICIES

Academic Integrity
The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. You will fail this course if you cheat. Additionally, you may be suspended or expelled permanently from the University. It is OK to ask questions now about what constitutes cheating. It is not OK later once an event has happened. Additionally, claiming ignorance regarding cheating does not excuse an individual. For more information on the Code of Academic Integrity or the Student Honor Council, please visit http://www.shc.umd.edu. To further exhibit your commitment to academic integrity, remember to sign the Honor Pledge on all assignments: “I pledge on my honor that I have not given or received any unauthorized assistance on this examination (or assignment).”
Participation
Regular attendance and participation in this class is expected. **Material not in the textbook will be covered during lecture and tested in homeworks and exams.** In the event that a class must be missed due to an illness, and are absent on a day when a test or other major assignment is due, you must notify your instructor in advance. Upon returning to class, you must bring documentation of the illness signed by a health care professional. If you miss class, even if it is an excused absence, you are responsible for all information covered that day. During the final grade calculation, additional points may be assigned to individuals who regularly attend class and discussion sections. No make-up quizzes will be administered.

Homework
Homework assignments are due at the beginning of the class period on the date due. Late homework will not be accepted, unless given pre-approval or in the case of unusual circumstances with submission of sufficient documentary evidence. While general concepts may be discussed with classmates, homework is expected to be an individual effort. At the beginning of class, 10 minute quizzes on the week’s homework content may be given. If you are late arriving to class on a quiz day you will receive a grade of 0 on that quiz.

Guidelines for the technical content homework problems and quizzes:
Each problem should be started on a clean sheet of paper. You are not being graded on how little paper you can use or how small you can write! Write on only one side of the paper. All pages should be stapled together and include your name, homework number, and page number (e.g. 1/3 means page 1 of 3) on each sheet. Work should be neat and easily legible. We reserve the option to return work ungraded or deduct points if it does not meet these basic requirements. There is no stapler provided in class.

Exams
Two in class exams and a comprehensive final exam (during the final exam period) will be given. No make-up exams will be administered. In the event the University dismisses classes on a day in which an examination is scheduled, then the exam will be given during the very next class session. Any requests for re-grading in homeworks and exams must be submitted in writing within ten business days of the assignment/exam deadline.

Exam 1: Tuesday March 8, 11:00-12:15
Exam 2: Tuesday April 19, 11:00-12:15
Comprehensive final exam is scheduled on **Thursday, May 12, 2016 8:00-10:00am**

A final examination shall be given in every course. Exceptions may be made with the written approval of the chair, the director, or the dean of the department, non-departmentalized school or college as appropriate. However, a student's final course grade shall be based on a combination of assessments that is at least the equivalent of a comprehensive examination.

No final examination may be given, or equivalent assignment due, during the last week of classes. All in-class final examinations must be held on the date and time listed in the Official Examination Schedule. Out-of-class final examinations or equivalent assessments shall be due on the date and at the time listed in the Official Examination Schedule.

Students whose class schedule requires them to take more than three final examinations on the same day have the right to reschedule examinations so they have no more than three on a given day. The student
must take responsibility for initiating the rescheduling or be responsible for taking the examinations as scheduled. When rescheduling is necessary, the student should first contact the instructor(s) of the class(es). Students who have difficulties rescheduling examinations with their instructors should contact the Dean's Office of their academic program for help. **Students wishing to reschedule a final examination under this rule should contact their instructor(s) by the deadline for dropping courses (2/4/2016).**

The schedule adjustment period deadline for Spring 2016 is Friday February 5, 2016. Since the lecture meets Tuesdays, Thursdays, you are required to submit any documentation to your instructor by the end of class on Thursday 2/4/2016.

**Accommodations**

**Religious observances:** The University System of Maryland policy provides that students should not be penalized because of observances of their religious beliefs, students shall be given an opportunity, whenever feasible, to make up within a reasonable time any academic assignment that is missed due to individual participation in religious observances. It is the responsibility of the student to inform the instructor of any intended absences for religious observances in advance. **Notice by email to kofinas@umd.edu** should be provided as soon as possible but no later than the end of the schedule adjustment period (2/4/2016). Prior notification is especially important in connection with final exams, since failure to reschedule a final exam before the conclusion of the final examination period may result in loss of credits during the semester. The problem is especially likely to arise when final exams are scheduled on Saturdays.

**Disabilities:** If you have a documented disability, you should contact Disability Support Services 0126 Shoemaker Hall. Each semester students with documented disabilities should apply to DSS for accommodation request forms which you should provide to your professors as proof of your eligibility for accommodations. The rules for eligibility and the types of accommodations a student may request can be reviewed on the DSS web site at [http://www.counseling.umd.edu/DSS/receiving_serv.html](http://www.counseling.umd.edu/DSS/receiving_serv.html). Disability documentation must be provided to the instructor by the end of the schedule adjustment period (2/4/2016).

**CourseEvalUM:** Your participation in the evaluation of courses through CourseEvalUM is a responsibility you hold as a student member of our academic community. Your feedback is confidential and important to the improvement of teaching and learning at the University. CourseEvalUM will be open for you to complete your evaluations sometime towards the end of the semester. Please go directly to the website (www.courseevalum.umd.edu) to complete your evaluations. By completing all of your evaluations each semester, you will have the privilege of accessing online, at Testudo, the evaluation reports for the thousands of courses for which 70% or more students submitted their evaluations.
Grading:
25% Exam 1
25% Exam 2
25% Final Exam
5% Homework
20% Quizzes

Relationship of the class to the program outcomes:
BIOE453 is a required class in Bioengineering. ENMA425 is a specialization elective in Materials Science and Engineering. It is also used as a technical elective by MSE students and other engineering majors. This course addresses two program outcomes. First, it emphasizes structure, properties and performance and the interrelations between them as well as how they apply to materials selection in biomedical systems. Second, it is designed to provide students with in-depth knowledge in a specific area of materials science and bioengineering by emphasizing fundamental biological and materials science concepts that reflect the complex environment in which biomaterials are developed and used.

Courtesies: You can help make the classroom conducive to learning if you:
1. Arrive for class on time
2. Do not prepare to leave until the instructor indicates the lecture is over
3. Silence your cell phone
4. Do not eat or drink
Topics Covered
The topic schedule is preliminary and subject to change through the course of the semester. Class notes and homeworks will become available on Canvas as the material is covered.

1. Introduction to Biomaterials Science
2. Types of Bonds, Microstructure
3. Bulk Mechanical Properties
4. Surface Properties and Surface Characterization
5. Polymers: Molecular Weight and Characterization of Molecular Weight Distributions
6. Step Polymerization: Polyurethanes, Polyesters, and Polyureas Biomaterials
7. Multifunctional Polycondensation: Silicones and Network Hydrogel Biomaterials
8. Radical Polymerization: Drug Delivery, Bone Cement, Contact Lenses and Implants
10. Metals and Ceramics: Stents, Orthopaedic, and Dental Biomaterials
11. Microparticles and Nanoparticles
12. Blood Contacting Materials
13. The path from Biomaterial Conception to Clinical Product