EMA 4061 Fall 2014 (Chris Batich)

Syllabus: Section 2839

Biomaterials: Structure and Properties
1. Course Description: (3 credit hours) – Materials commonly used for biomedical application, such as their properties from a biocompatibility or medical device perspective. In addition, materials interactions with biological systems will be examined from the molecular (e.g., protein), cellular, tissue and systemic (whole body) perspective. This course is the foundation for the second biomaterials class, which applies these principles toward the application of biomaterials in medical implants, prostheses and devices, along with the regulatory issues associated with biomaterials development.

2. **Pre-requisites and Co-requisites**: EMA3066 Introduction to Organic Materials

3. **Course Objectives:** This course will provide an introduction to the field of biomaterials used in the design of medical devices, and to augment or replace soft and hard tissues. Discussion will include the bulk properties, applications, and in vivo behavior of different classes of natural and synthetic biomaterials. Analysis of the biological response including biocompatibility and hemocompatibility as well as failure processes of implantable biomaterials/devices. Finally, evaluations of relevant case studies covering biomaterial approaches will be conducted.

4. **Instructor**: Dr. Chris Batich
a. Office location: MAE 317
b. Telephone: 352-392-6630
c. E-mail address: cbati@.ufl.edu
d. Class Web site: The course website can be found on the Sakai system http://lss.at.ufl.edu, there you can find the course syllabus, lecture notes, grades, and announcements. Check it frequently.

5. **Teaching Assistant**: Brian Wingender b.wing@ufl.edu

6. **Office hours**- Dr. Batich will have office hours by appointment, and Mr. Wingender will be Wednesday after class.

7. **Meeting Times**- Monday, Wednesday, and Friday, period 6 (12:50-1:40)

8. **Meeting Location**- Weil 0273

9. **Material and Supply Fees**: None

10. **Communication:** Please only communicate with me through your official UF e-mail account. The UF e-mail system is secure, and this will ensure your privacy as a UF student.

11. **Textbooks and Software Required**-

Biomaterial Science: An Introduction to Materials in Medicine (3rd Edition, 2013)
B. Ratner, A. Hoffman, F. Schoen, and J. Lemons Academic Press ISBN: 978-0-12-374626-9
If you are majoring in biomaterials, this is an excellent reference book to have. .NOTE: THIS BOOK IS AVAILBLE ONLINE FOR FREE AT THE UF LIBRARY WEBSITE (but only 3 students at one time may view it. Let me know if this is a problem, and we can see about expanded options.)

12. **Supplemental reference materials:** Other reference material will be used throughout the class. These will be indicated by the instructor and provided as used or needed.

13. **Attendance and Expectations-** Lecture attendance is highly recommended. While attendance is not mandatory, experience has shown that those who attend lectures earn higher grades in the course. Arrival on time is expected. Please turn off all cell phones upon entering class. Reading of newspapers, work on assignments for this or other classes, or other activities that are not part of the class are not allowed during lecture.

14. **Exams-** You will be given 3 exams during the semester, the exam content may change but the dates will not. There will be NO Final Exam. Each exam is weighted equally and each exam will be worth 30% of your final grade. Exams will be given during the class period. Exam dates are as follows:

Exam #1: Monday, September 15, 2014
Exam #2: Friday, October 31, 2014
Exam #3: Wednesday, December 3, 2014
Students have one week after test results are posted to resolve questions about scores/grades. No changes to your exam grade will be made after that time.

15. **Exam Conflicts with other course exams**- The official UF policy on exam conflict resolution states that when two exams conflict, the course with the higher number will take priority. There will be no exceptions to this rule.

16. **Make-up exams**- Make up exams will be provided only with the ***prior approval of the instructor in accordance with university policies.*** (In general, acceptable reasons for excused absence include illness, serious family emergencies, special curricular requirements, military obligation, court-imposed legal obligations, and religious holidays. In all cases, you will be required to provide written documentation, and obtain prior instructor approval. In the case of an emergency that prevents prior notification of an anticipated missed exam, you must notify the instructor as soon as possible. You will not be excused from any exam without following the policy above, with no exceptions. Students not in attendance for the scheduled exam will receive a score of zero. To be clear, Make-up exams will only be allowed in exceptional cases, with prior instructor approval, sufficient documentation, and in accordance of university policies. (https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx)

You must notify the instructor no less than 1 week of the scheduled exam.
Make-up exams for excused absences as well as exam conflicts must occur within 1 week of the missed exam, and may occur before the missed exam.

17. **Case Study Reports*:*** Throughout the semester you will be given case studies that will be used for in-class discussions. On the day of the case study discussion, you will be required to submit a report for each study. The report ensures that everyone has read the case study ahead of our discussion and thought about the questions we will raise during the discussion. The case studies will be provided by the instructor and will be given to students in advance of the discussion. The specific instructions for the preparation of case study reports will be provided separately.

18. **Presentation and Paper:** Students will prepare a written report and an oral presentation on an area of biomaterial research. Details will be provided separately.

19. **Grading:** 90%: Three exams (equally weighted)

10%: Oral Presentation and Written report as well as Participation

20. **Grading Scale**:

Percentage	≥92	≥88	≥84	≥80	≥76	≥72	≥68	≥65	≥62	≥59	≥56	<56
Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E
Grade Points	4.0	3.67	3.33	3.0	2.67	2.33	2.0	1.67	1.33	1.0	0.67	0

A "C-" will not be a qualifying grade for critical tracking courses. In order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). Note: a C- average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

21. **Contribution of course to meeting the professional component-**

(ABET only – undergraduate courses)
This is a 3 credit course. It provides 1 credit towards basic sciences (biomedical) and 2 credits towards engineering sciences.
This course addresses the following MSE Program outcomes (note: Numbers refer to the list of MSE Program outcomes):
1. Ability to apply knowledge of mathematics, science, and engineering to materials systems. (low coverage)
2. Ability to conduct experiments, analyze and interpret data. (low coverage)
3. (skipped)
4. Ability to apply and integrate knowledge of structure, properties, processing, and performance to solve materials selection and design problems within realistic constraints. (medium coverage)
5. Ability to function on multi-disciplinary teams.(low coverage, but not assessed)
6. Ability to identify, formulate, and solve engineering problems. (medium coverage)
7. Understanding of professional and ethical responsibility. (medium coverage)
8. Ability to communicate effectively in both oral and written form. (medium coverage)
9. Understanding of the economic impact of engineering solutions. (some discussion, but not assessed)
10. Understanding of the global, societal, and environmental impact of engineering solutions. (some discussion , not assessed)
11. Ability to engage in lifelong learning.(medium coverage)
12. Knowledge of contemporary issues. (some discussion, not assessed)
13. Ability to use the techniques, skills, and tools needed for practice as a materials engineer. (low coverage)

22. **Honesty Policy** – All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.

Note that failure to comply with this commitment will result in disciplinary action compliant with the UF Student Honor Code Procedures.
See http://www.dso.ufl.edu/sccr/procedures/honorcode.php
23. **Accommodation for Students with Disabilities** – Students Requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.

24. **UF Counseling Services** –Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:

· UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services.
· Career Resource Center, Reitz Union, 392-1601, career and job search services.
25. **Software Use** – All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Biomaterials EMA 4061
Tentative Schedule of Topics
Fall 2014

Unit I. Historical Perspective and review of MSE and Biology basic concepts

Week 1: Introduction and Biomaterials History
Week 2: MSE Review fundamental concepts and "Biology Basics 101"
Week 3: Surface vs. Bulk Properties and surface characterization techniques

Unit II. Types of Materials used for Biological and Medical applications

Week 4: Metals and Ceramics
Week 5: Polymers and Biodegradable and Resorbable Materials
Week 6: Hydrogels and Natural Materials
Exam #1: Monday, September 15, 2014

Unit III. Interaction of materials with biological systems

Week 7: Protein Structure, Proteins on Biomaterials, Surface immobilized biomolecules
Week 8: Surface patterning, Cells and Surfaces, cell function and response to injury
Week 9: Tissues and ECM and cell-biomaterial interactions
Week 10: Inflammation, Foreign body response, and wound healing
Week 11: Tumorigenesis and Blood Material interaction
Exam #2: Friday, October 31, 2014

Unit IV. Case Studies

Week 12: Student Presentations
Week 13: Student Presentations
Week 14: Student Presentations
Week 15: Student Presentations/Thanksgiving Break
Week 16: Student Presentations

Exam #3: Wednesday, December 3, 2014