

Biomaterials: Structure and Properties

EMA 4061 Section 2839

Class Periods: Tuesday, period 7 (1:55pm-2:45pm) and Thursday, periods 7&8 (1:55-2:45pm and 3:00-3:50pm)

Location: Turlington Hall, Room 2346

Academic Term: Fall 2017

I. Instructor:

Josephine Allen

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(352) 846-3328

Office Hours: By appointment

II. Teaching Assistants:

Please contact through the Canvas website

- Ahmed Hemeid (Ahemeid@ufl.edu) Office Hours to be determined

III. 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.

IV. Course Pre-Requisites / Co-Requisites

EMA3066 Introduction to Organic Materials

V. 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.

VI. Materials and Supply Fees:

None

VII. Professional Component (ABET):

This is a 3 credit course. It provides 1 credit towards basic sciences (biomedical) and 2 credits towards engineering sciences.

Relation to Program Outcomes (ABET):

| Outcome | Coverage* |
|---|-----------|
| a. Apply knowledge | Low |
| b1. Conduct experiments | Low |
| b2. Statistical design of experiments | |
| c. Design | Medium |
| d. Function on teams | Low |
| e. Solve problems | Medium |
| f. Professional and ethical responsibility | Medium |
| g. Communicate | Medium |
| h1. Economic impact | Low |
| h2. Global, societal, and environmental impact | |
| i. Lifelong learning | Medium |
| j. Contemporary issues | |
| k. Techniques, skills, and tools for degree program | Low |

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not part of the course.

VIII. **Required Textbooks and Software**

Introduction to Biomaterials: Basic Theory with Engineering Applications
C. Mauli Agrawal, Joo I. Ong, Mark R. Appleford, Gopinath Mani
2014 (1st Edition)
Cambridge University Press ISBN: 0521116902

Other reference material will be provided throughout the class.

IX. **Course Schedule (tentative and subject to change)**

- Week 1: Introduction, History of Biomaterials, MSE Review fundamental concepts
- Week 2: Biology "101", Characterization of Biomaterials
- Week 3: Metals in Medicine
- Week 4: Ceramics in Medicine
- Week 5: Polymers in Medicine
- Week 6: **Exam #1**
- Week 7: Proteins and Biomaterials, Drug Delivery
- Week 8: Cell-Biomaterial Interactions
- Week 9: Tissue, Extracellular Matrix, Inflammation, foreign body response
- Week 10: Tumorigenesis and Blood-Materials Interactions
- Week 11: **Exam #2**
- Week 12: Student Presentations
- Week 13: Student Presentations
- Week 14: Student Presentations, **Thanksgiving Break**
- Week 15: Student presentations
- Week 16: Student Presentations

X. **Class Policies (Attendance Policy, Class Expectations, and Make-Up Policy)**

- A. **Attendance Policy**- Lecture attendance is highly recommended. During certain parts of the class, attendance will be mandatory and a lack of attendance will affect your grade. Experience has shown that those who attend lectures earn higher grades in the course. Arrival on time is expected. Excused absences are consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation.
- B. **Class Expectations**- 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. Students who do not comply with these requirements or who behave disorderly or disrespectfully may be asked to leave the classroom.
- C. **Exams**- All of our exams will be during our regular scheduled class time, therefore there should be no exam conflicts.

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 must occur within 1 week of the missed exam, and may occur before the missed exam.

XI. *Evaluation of Grades*

| Assignment | Percentage of Final Grade |
|-----------------------------|---------------------------|
| Exams (x2) weighted equally | 50% |
| Case Study Reports | 15% |
| Oral Presentation | 10% |
| Written Report | 15% |
| Attendance/Participation | 10% |

- A. Exams- You will be given 2 exams throughout 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 25% of your final grade. Exams will be given during our normal class time (periods 7 and 8) on Thursdays.

Exam #1: Thursday, September 28, 2017

Exam #2: Thursday, November 2, 2017

Students have two weeks after test results are posted to resolve questions about scores/grades. No changes to your exam grade will be made after that time.

- B. 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.
- C. Presentation and Paper- Students will prepare a written report and an oral presentation on an area of biomaterial research. Details will be provided separately.

Grading Policy

| Percent | Grade | Grade Points |
|-------------|-------|--------------|
| 93.4 - 100 | A | 4.00 |
| 90.0 - 93.3 | A- | 3.67 |
| 86.7 - 89.9 | B+ | 3.33 |
| 83.4 - 86.6 | B | 3.00 |
| 80.0 - 83.3 | B- | 2.67 |
| 76.7 - 79.9 | C+ | 2.33 |
| 73.4 - 76.6 | C | 2.00 |
| 70.0 - 73.3 | C- | 1.67 |
| 66.7 - 69.9 | D+ | 1.33 |
| 63.4 - 66.6 | D | 1.00 |
| 60.0 - 63.3 | D- | 0.67 |
| 0 - 59.9 | E | 0.00 |

More information on UF grading policy may be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

XII. *Students Requiring Accommodations*

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

XIII. *Course Evaluation*

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu/evals>. Evaluations are typically open during the last two or three

weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

XIV. *University Honesty Policy*

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

XV. *Software Use*

All faculty, staff, and students 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.

XVI. *Student Privacy*

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>

XVII. *Campus Resources:*

Health and Wellness

U Matter, We Care:

If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.

Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. <https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. <https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. <https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.