

EMA 4061 BIOMATERIALS: STRUCTURE & PROPERTIES

(Section 21313/1284)

1. **Catalog Description:**

Materials commonly used for biomedical application, such as their properties from a biocompatibility or medical device perspective. In addition, materials interactions with biological systems are examined from the molecular (e.g., protein), cellular, tissue and systemic (whole body) perspective. This 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. (3 credits)

2. **Pre-requisites and Co-requisites:** Co-requisite: EMA 3066

3. **Course Objectives:**

The objectives of this course are to lay the foundation of biomaterials terminology and technology for students seeking a career in either the biomedical industry or in academic research related to biomedical materials. Many of our engineering students have had very little biological or medical coursework, so the introductory aspects of the course will delve into fundamental terminology, while using specific engineering examples of relevance to the biomaterials specialty. Once the fundamentals of biological materials are mastered, students will learn the basic types of biocompatibility issues that can arise from biomaterials contact or implantation into the body, and what approaches are currently being used to optimize biomaterials properties for such applications.

4. Contribution of course to meeting the professional component (ABET only – undergraduate courses): Not applicable

5. Relationship of course to program outcomes: Skills student will develop in this course (ABET only undergraduate courses): Not applicable

6. **Instructor:** Laurie Gower, Ph.D.; Professor of Materials Science & Engineering

- Office location: 210A Rhines Hall (ring doorbell to reach my inner office)
- Telephone: 846-3336
- E-mail address: LGower@mse.ufl.edu
- Class Web site: Canvas
- Office hours: To be determined

7. **Teaching Assistant:** None

8. **Meeting Times:** M,W,F 5th period (11:45am to 12:35pm)

9. **Class/laboratory schedule:** separate course EMA4061L

10. **Meeting Location:** MCCA 2196

11. **Material and Supply Fees:** Not applicable

12. **Textbooks and Software Required:**

- Title: Biomaterials science : an introduction to materials in medicine
- Authors: Ratner, Hoffman, Schoen, Lemons

- c. Publication date and edition: 2013 (3rd edition)
- d. ISBN number: 978-0-08-087780-8 (electronic bk.)
 - UF ONLINE See Link to Connect -- R857.M3B56 2013
 - Access this e-book through the Knovel platform - <https://app.knovel.com/hotlink/toc/id:kpBSAIMM06/biomaterials-science/biomaterials-science>
 - IMPORTANT: If you are off-campus, first login to the UF VPN to ensure your access
 - Create a Knovel account to use advanced features like making and saving highlights/notes in the e-book.
 - Save this e-book to your **My Knovel** for easier repeated access.
 - If you use Pop-up Blockers in your browser, add **app.knovel.com** to your safe list so you can print from the e-book

13. **Recommended Reading:** Assigned articles in addition to text

14. **Course Outline** (tentative: 08/20/2018)

Lecture #	Month	Date	Subject	Reading Material
1	Aug.	W 22	Introduction	Book Intro. Section
2		F 24	Historical Perspective on Biomaterials	Chapt.1.1 – 1.2
3		M 27	Microscopy- Resolution & Contrast	11.3.8
4		W 29	Fluorescence Microscopy	11.3.8 , handout
5		F 31	Confocal microscopy	11.3.8 , handout
	Sept.	M 3	Labor Day Holiday	
6		W 5	Scanning Probe Microscopies	11.3.8 , handout
7		F 7	Natural Materials: Biopolymers-Proteins	handout
8		M 10	Natural Materials: Protein structure	handout
		W 12	<i>Homework: Teams Debate</i>	
		F 14	<i>Homework: Teams Debate</i>	
9		M 17	Natural Materials: Polysaccharides	handout
10		W 19	Natural Materials: Polynucleotides	handout
11		F 21	Natural Materials: Lipids	handout
12		M 24	Tissues, ECM	II.1.5
		W 26	<i>Catchup day (Career Showcase)</i>	
13		F 28	Hard Tissues	I.2.4A, II..6.7
14	Oct.	M 1	Protein Adsorption	II.1.1-II.1.2

15		W 3	Protein Adsorption	
	<i>evening</i>	W 3	Exam 1 (covers lectures 1- 11)	7:30-9:30pm
16		F 5	Cells and cell injury	II.1.3
17		M 8	Cells and cell injury	II.1.4
18		W 10	Guest Lecture	
19		F 12	Organs & Stem Cells	II.1.7
20		M 15	Tissue Injury	II.2.1
21		W 17	Host Reactions to Biomaterials	II.2.2
22		F 19	Defense System: Immune response	II.2.3
23		M 22	Immune System Cont.- Complement system	II.2.4
24		W 24	Systemic toxicity and hypersensitivity	II.2.5
25		F 26	Blood-Materials interaction	II.2.6
26		M 29	Tumorigenesis	II.2.7
		W 31	<i>Catch up day</i>	
	<i>evening</i>	W 31	Exam 2 (covers lectures 12- 19)	7:30-9:30pm
	Nov.	F 2	Homecoming Holiday	
27		M 5	Biofilms & Infections	II.2.8
28		W 7	Surface properties of Materials	I.1.5: pp34-38
29		F 9	Surface Characterization – Contact Angle	I.1.5: pp38-40
		M 12	Veterans Day Holiday	handout
30		W 14	Surface Characterization- ESCA	I.1.5: pp41-46
31		F 16	Surface Characterization.: ATR-FTIR	I.1.5: pp41-46
32		M 19	Physicochemical Surface Modification	I.2.12
		W 21	Thanksgiving Holiday	
		F 23	Thanksgiving Holiday	
33		M 26	Physicochemical Surface Modification	I.2.13
34		W 28	Non-fouling surfaces	I.2.10, I.2.13, I.2.17
	<i>evening</i>	W 28	Exam 3 (covers lectures 19- 27)	7:30-9:30pm
35		F 30	Orthopedic Biomaterials	I.2.3 - I.2.4

36	Dec.	M 3	Bioresorbable, Hydrogels	I.2.5 - I.2.7, I.2.11, II.4
37		W 5	Textured, porous, fibrous materials	I.2.15
		TBD	Optional review for Final Exam	
		W 12	Final Exam (3:00pm – 5:00pm)	Cumulative

15. Attendance and Expectations:

- **Policy on Class Attendance:** Lecture attendance is recommended. While attendance is not mandatory, experience has shown that those who attend lectures earn higher grades in the course. It is also required that you bring a printout of the lecture notes to every class because they are a template for adding further information and note taking during class.
- **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.
- **Make-up Exam Policy-** Make-up exams will be provided only with the prior approval of the instructor or excused absence. In general, acceptable reasons for excused absence include illness, serious family emergencies, special curricular requirements, military obligation, court-imposed legal obligations, religious holidays and participation in official university activities such as music performances, athletic competition or debate.
- **Homework:** Homework and grades will be posted on the class Canvas website, approximately weekly Homework should be turned in at the beginning of class. No late submissions will be accepted in order that solutions can be posted after class.
- **Grade changes:** Requests for adjustment to any grade should occur within the 2 week period following the posted grade in question, and must be approved by the course instructor (you can discuss your concerns with the TA, but the TA cannot change grades without final approval from the instructor).
- **Policy on Cell Phones, Laptops, and General Behavior during class:** Cell phones should be turned off during class, with the exception of a primary care giver or other situation where urgent contact may be required. In those cases, please use vibrate mode, and if/when receiving a call, promptly move to outside the classroom. Laptops may be used in class for taking notes. Cell phones, Laptops, or other distractors are NOT to be used for social or entertainment activities during class. If such activities are observed, the user(s) will be asked to leave the classroom.

16. Grading:

Homeworks-	10%
First exam-	20%
Second exam-	20%
Third Exam-	20%
<u>Final exam-</u>	<u>30%</u>
Total-	100%

17. Grading Scale

Grades are not curved, but points are occasionally added to everyone's score if a problem is deemed to have been too difficult or unfair. When determining the final grade, the final point value score will be rounded up for values of #.5 and above.

Percent	Grade	Grade Points
92 - 100	A	4.00
88 - 91.9	A-	3.67
84 - 87.9	B+	3.33
80 - 83.9	B	3.00
76 - 79.9	B-	2.67
72 - 75.9	C+	2.33
68 - 71.9	C	2.00
65 - 67.9	C-	1.67
62 - 64.9	D+	1.33
59 - 61.9	D	1.00
56 - 58.9	D-	0.67
0 - 55.9	E	0.00

“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>

18. **Requirements** for class attendance and make-up exams, assignments, and other work are consistent with university policies that can be found at: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

19. **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 (<http://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.

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>

20. **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.
21. **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, <http://www.counseling.ufl.edu/cwc/Default.aspx>, counseling services and mental health services.
 - Career Resource Center, Reitz Union, 392-1601, career and job search services.
- University Police Department 392-1111
22. **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.
23. **Students are expected to provide feedback on the quality of instruction** in this course by completing online evaluations at <https://evaluations.ufl.edu>. 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/>.

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](https://www.dso.ufl.edu/documents/UF%20Complaints%20policy.pdf).

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