

Biomaterials: Structure and Properties

EMA 4061 Class Number 14143

Class Periods: Monday, Wednesday, Friday, period 5 (11:45am-12:35pm)

Location: 100%Online (via Canvas and Zoom)

Academic Term: Fall 2020

I. Professor:

Erika Moore (she/her/hers)

moore.erika@ufl.edu

(352) 846-3328

Office Hours: To occur during scheduled course time

II. Teaching Assistants:

- N/A

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 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.

IV. Course Pre-Requisites / Co-Requisites

EMA3066

V. Course Objectives

This course will introduce 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):

3 credits of engineering topics

Relation to Program Outcomes (ABET):

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

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	Medium
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	Medium
3. An ability to communicate effectively with a range of audiences	Medium
4. An ability to recognize ethical and professional responsibilities in engineering situations and make	Medium

informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	Low
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	Low
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	Medium

VIII. **Required Textbooks and Software**

Recommended:

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	Date	Topic (M)	Topic (W)	Topic (F)
1	31-Aug	Intro	History	MSE Review
2	7-Sep	No Class (X)	MSE Review	Biology 101
3	14-Sep	Surface vs. bulk	Surface vs. bulk	Exam #1 Review
4	21-Sep	Exam #1	X (Career Fair)- No Class	Protein/Material Interactions
5	28-Sep	Protein/Material Interactions	Protein/Material Interactions	No Class (X)
6	5-Oct	Protein/Material Interactions	Materials in medicine (metals)	Materials in medicine (metals)
7	12-Oct	Materials in medicine (ceramics)	Materials in medicine (ceramics)	Exam #2 Review
8	19-Oct	Exam #2	Materials in Medicine (Polymers)	Materials in Medicine (Polymers)
9	26-Oct	<i>Materials in Medicine (Polymers)</i>	Cell-Material Interactions	Cell-Material Interactions
10	2-Nov	Inflammatory foreign body response	wound healing	Blood Material Interaction
11	9-Nov	Exam #3 Review	X (Veterans Day)- No Class	Exam #3
12	16-Nov	Presentations	Presentations	Presentations
13	23-Nov	Presentations	X (Thanksgiving)- No Class	X (Thanksgiving)- No Class
14	30-Nov	Presentations	Presentations	Presentations
15	7-Dec	Presentations	Presentations	X (READING DAYS)
16	14-Dec	FINALS	FINALS	

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

- A. Lecture Policy: Lectures will be recorded and accessible through Canvas for one week. Research shows students learn and retain information best taking notes by hand (see Scientific American: A Learning Secret - Don't take Notes with a Laptop). It is highly encouraged that each student put their phone away, turn off notifications on their computer and email, and close irrelevant windows when watching lectures or participating in a group setting for this class.

- B. Privacy Policy for Synchronous Sessions (Office Hours, Exam Review and Discussion Sections): Class sessions may be audio visually recorded for students in the class to refer to and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If a zoom call is being recorded, students will see an indication of this in the window .If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared, except to note who has written in their attendance for participation credit. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.
- C. Attendance Policy- Students are expected to view lectures and participate in the form of quizzes, exams, and discussion participation. Attendance during examinations will occur via Zoom, each student is expected to be present during examinations. Submission of tasks assigned including quizzes and discussion boards is expected prior to the submission deadline. For ease and consistency, all tasks assigned in conjunction with lectures will be due on Mondays at 11:59 pm. **Excused absences must be consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation.**
- D. Class Expectations-
- Contacting the Professor*: Students should use Canvas to contact me. While you may email me at the provided UF email account (with the subject line "EMA 4061"), the university strongly encourages communication via Canvas to avoid the potential of violations of student confidentiality protected by FERPA. I strongly encourage students to attend virtual office hours (during scheduled class time) to discuss any questions or concerns regarding the course. If students do email me, they must use "EMA 4061" in the subject line to ensure a response.
- Messaging/Email Hours*: You may contact me via Canvas or email at any time that is convenient to you. I will respond within two business days between the hours of 9 am and 5 pm. If you do not receive a reply from me after 2 full business days, please resend your message. Responses cannot be guaranteed after 5pm on weekdays, on weekends, or on academic holidays. Please plan accordingly to have your questions answered in advance of assignment and exam deadlines.
- Interpersonal Conduct*: Mutual respect for your classmates, myself, and yourself is expected in all communication; all class members are always expected to treat each other with respect, courtesy, tolerance, fairness, and justice.
- Effort*: The university recommends that students typically spend 9 to 12 h per week for a 3-credit class. This can of course vary, but is a good initial guideline as the term begins.
- Recommendations for the Virtual Classroom*: Set boundaries you need to so you can focus in class: use headphones; tell roommates you're "in class"; and quiet audio and visual distractions from other electronics, books, pets (as feasible). Consider getting ready as though you're going to a physical class, perhaps this can help you focus? Try it out and generally, take ownership of your learning experience.
- Recommendations for This Classroom*: For lectures, assignments, quizzes, and exams, it is in your best interest to ask questions or for clarification when content or a question is not making sense, so that we can review it or I can change approach.
- Referencing the Professor*: Often, students have questions over proper naming or titling etiquette for communicating with their professors. In all communication with me throughout the duration of our course, please refer to me as Dr. Moore or Professor Moore.
- E. 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 prior to 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 (x3) weighted equally	60%
Quizzes (occur weekly)	15%
Biomaterials Project	15%
Participation (including Discussion boards)	10%
Total	100%

Exams: There will be 3 in-class exams that must be taken during the scheduled course time (release of the test and submission online will occur at the beginning and end of the class period, respectively). There will be no Final Exam.

Canvas Quizzes & Discussion Prompts: Lectures will periodically have an associated quiz, question, or discussion prompt, which must be completed by Mondays at 11:59pm. Quizzes must be completed individually with no collaboration and should ideally be completed shortly or immediately after watching the lecture so the professor can assess what concepts or content should be revisited.

You have one week after an exam, homework, or other assignment is returned to resolve any questions about scores and grades. No changes to your assessment grades will be made after that time.

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

The instructor reserves the right to adjust the grade distributions, however, grades will not be adjusted for individuals.

For more information on UF grading policy, please visit: <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

XII. Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/> . It is important for students to share their accommodation letter with the instructor and discuss their access needs, as early as possible in the semester.

XIII. Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/> . Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/> . Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-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://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-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 in this class.

XV. Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

XVI. Software Use

All faculty, staff, and students at 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.

XVII. 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: <https://registrar.ufl.edu/ferpa.html>

XVIII. Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

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 Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the [Office of Title IX Compliance](#), located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

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>.