I. **Instructor:**
Josephine Allen
jallen@mse.ufl.edu
(352) 846-3328
Office Hours: TBD

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 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 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.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics</td>
<td>Medium</td>
</tr>
<tr>
<td>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</td>
<td>Medium</td>
</tr>
<tr>
<td>3. An ability to communicate effectively with a range of audiences</td>
<td>Medium</td>
</tr>
<tr>
<td>4. An ability to recognize ethical and professional responsibilities in engineering situations and make</td>
<td>Medium</td>
</tr>
</tbody>
</table>
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

6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

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

Biomaterials: Structure and Properties, EMA4061
Josephine Allen  Fall 2019
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**

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Percentage of Final Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exams (x4) weighted equally</td>
<td>60%</td>
</tr>
<tr>
<td>Homework</td>
<td>15%</td>
</tr>
<tr>
<td>Biomaterials Project</td>
<td>25%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Grading Policy**

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

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/scr/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. **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 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.

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**

<table>
<thead>
<tr>
<th>U Matter, We Care:</th>
</tr>
</thead>
<tbody>
<tr>
<td>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 <a href="mailto:umatter@ufl.edu">umatter@ufl.edu</a> 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.</td>
</tr>
</tbody>
</table>

**Counseling and Wellness Center:** [http://www.counseling.ufl.edu/cwc](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. http://lss.at.ufl.edu/help.shtml.


- 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/


- 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