**Fall Semester 2022**

<table>
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<tr>
<th>COURSE:</th>
<th>Materials Science and Engineering 470</th>
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<tbody>
<tr>
<td>TITLE:</td>
<td>Design and Use of Biomaterials</td>
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<tr>
<td>LEVEL:</td>
<td>Undergraduate</td>
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<td>CREDIT:</td>
<td>3 hours lecture; 3 semester hours.</td>
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<td>TIME:</td>
<td>TR, 12:30-13:50 PM, CDT.</td>
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<td>LOCATION:</td>
<td>1306 Everitt Laboratory. Announcements, Assignment alerts, Discussions, Lecture notes and Links to lecture videos will be available on Canvas (<a href="https://canvas.illinois.edu/courses/30533">https://canvas.illinois.edu/courses/30533</a>)</td>
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**DESCRIPTION:** This course covers the properties and synthesis of various materials, in particular soft biomaterials. The course gives an emphasis to polymeric systems that have been designed and developed for biomedical applications. The course is designed for advanced undergraduate and graduate students who have basic background in organic and polymer chemistry, physics, biochemistry, and materials science and engineering. The course integrates both materials science and biology and is intended to enable students to understand the fundamental principles and knowledge associated with current biomolecular materials research and their application.

**INSTRUCTOR:** Cecilia Leal (She/her)
Office: 204 MSEB
Phone: 217-300-1955
Email: cecilial@illinois.edu

**OFFICE HOURS:** Mondays 5-7 PM, CDT at MSEB room 4101. More office hours available upon demand.

**DISCUSSION FORUM:** Questions related to MSE470 homeworks, exams, and all course contents should be posted in Canvas discussion platforms.

**TEACHING ASST:** Kevin Tan (He/him), email: zt7@illinois.edu

**PREREQUISITES:** Credit or concurrent registration in both MCB 252 and either CHEM 232 or MSE 403 is recommended.

**ASSESSMENT:**
- Homeworks (5 estimate) 25%
- Design challenge 15%
- 1 mid-semester exam, 80 min 30%
- Final, comprehensive exam, 3 hrs. 30%

**TEXTBOOK and COURSE MATERIALS:**
- PowerPoint (PPT) slides, recorded lectures, lecture notes, and readings given in class
- “Biomaterials: The intersection of Biology and Materials Science." By Temenoff and Mikos4
ASSESSMENT

1. ATTENDANCE

Class attendance is not required but is strongly recommended and may be mandatory on certain occasions.

2. HOMEWORKS

Homeworks (HWs) will be posted on Canvas. HWs must be completed by the due date at 5 PM, CDT and posted on Canvas. Leaving HW to the last-minute results in overloading of the system and errors leading to late delivery of the HW. You will have 30% credit if you deliver the HW up to a week late. Do your homework early! Homework solutions: homework questions will be solved in office hours after the HWs are due. No solutions will be posted otherwise.

3. EXAMS

TENTATIVE MIDTERM SCHEDULE
Midterm Exam October 13, 80 min
FINAL EXAM 8:00am-11:00am., Tuesday Dec. 13

4. DESIGN CHALLENGE

Based on all the learnings over the topics covered in MSE470 you will describe an original design of a new material or formulation to employ in a biomedical application of your choice. The design challenge is to be presented in a minimum of 500 and a maximum of 600 words and one figure. (References do not enter the word count). The design challenge will be submitted in pdf format to Canvas. Due: December 1st, 2022.

TENTATIVE TOPICS

a. Brief overview of biomaterials and their applications
b. Polymeric biomaterials: synthesis, design principles, and properties
c. Bioconjugation techniques
d. Degradation of biomaterials
e. Biomaterial surface interactions and biocompatibility of materials
f. Nano-biomaterials
g. Biomaterials for drug delivery (small molecules, genes, and proteins)
h. Biomaterials for imaging and diagnosis
i. Biomaterials for tissue engineering and cell-biomaterials interactions
j. Biodevices and bioimplants

COURSE OBJECTIVES

a. Understand the relationship between biomolecular materials properties and function
b. Learn main routes of biomaterials synthesis
c. Learn the basic materials properties required for application in biomedical systems
d. Learn concepts of bioconjugation for the application in imaging and diagnosis
e. Learn about basic materials interactions with biological interfaces
f. Become familiar with the main processes of biomolecular materials degradati
COVID-19
MSE470 is planned to in-person instruction for the entirety of the Fall 2022 semester. However, we are still dealing with a pandemic and will fully abide to the recommendations of the Center of Disease Control (CDC), the State and the University of Illinois. All participants (instructor and students) shall feel free to protect themselves by wearing a mask inside the classroom. I encourage you to sit in the same place each class. For more information please consult: https://covid19.illinois.edu/on-campus/on-campus-instructors/.

Diversity, Equity, and Inclusion Statement
The University of Illinois, the Grainger College of Engineering, the Materials Science and Engineering department, and MSE470 operate under the guiding principle that “Our entire community benefits when individuals from different personal, cultural, and disciplinary perspectives are working together.” (https://grainger.illinois.edu/about/diversity). MSE470 will be a safe and inclusive place for active learning with no tolerance for discrimination of any kind.

Academic Integrity Policy
The University of Illinois at Urbana-Champaign Student Code should also be considered as a part of this syllabus. According to the Student Code, “It is the responsibility of each student to refrain from infractions of academic integrity, from conduct that may lead to suspicion of such infractions, and from conduct that aids others in such infractions.” Academic dishonesty may result in a failing grade. Every student is expected to review and abide by the Academic Integrity Policy: http://studentcode.illinois.edu/. Ignorance is not an excuse for academic dishonesty. It is your responsibility to read this policy to avoid any misunderstanding. Do not hesitate to ask the instructor if you are ever in doubt about what constitutes plagiarism, cheating, or any other breach of academic integrity. See also this quick reference guide to academic integrity: https://provost.illinois.edu/policies/policies/academic-integrity/students-quick-reference-guide-to-academic-integrity/

Academic Accommodations
To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor and the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES, you may visit 1207 S. Oak St., Champaign, call 333-4603 (V/TDD), or e-mail a message to disability@uiuc.edu. http://www.disability.illinois.edu.

Family Educational Rights and Privacy Act
Any student who has suppressed their directory information pursuant to Family Educational Rights and Privacy Act (FERPA) should self-identify to the instructor to ensure protection of the privacy of their attendance in this course. See https://registrar.illinois.edu/academic-records/ferpa for more information.

Sexual Misconduct Policy and Reporting
The University of Illinois is committed to combating sexual misconduct. Faculty and staff members are required to report any instances of sexual misconduct to the University’s Title IX and Disability Office. In turn, an individual with the Title IX and Disability Office will provide information about rights and options, including accommodations, support services, the campus disciplinary process, and law enforcement options. A list of the designated University employees who, as counselors, confidential advisors, and medical professionals, do not have this reporting responsibility and can maintain confidentiality, can be found at https://wecare.illinois.edu/resources/students/#confidential
Other information about resources and reporting is available at: https://wecare.illinois.edu
Community of Care
As members of the Illinois community, we each have a responsibility to express care and concern for one another. If you come across a classmate whose behavior concerns you, whether in regards to their well-being or yours, we encourage you to refer this behavior to the Student Assistance Center (217-333-0050 or http://odos.illinois.edu/community-ofcare/referral/). Based on your report, the staff in the Student Assistance Center reaches out to students to make sure they have the support they need to be healthy and safe. Further, we understand the impact that struggles with mental health can have on your experience at Illinois. Significant stress, strained relationships, anxiety, excessive worry, alcohol/drug problems, a loss of motivation, or problems with eating and/or sleeping can all interfere with optimal academic performance. We encourage all students to reach out to talk with someone, and we want to make sure you are aware that you can access mental health support at the Counseling Center (https://counselingcenter.illinois.edu/) or McKinley Health Center (https://mckinley.illinois.edu/). For mental health emergencies, you can call 911 or walk in to the Counseling Center, no appointment needed.