EEL 5934

Micro and Nanotechnologies for Medicine, Biology, and Agriculture

Class Periods: Tuesday (1:55 to 2:45 pm) and Thursday (1:55 to 3:50 pm)

Location: MAE B 229

Academic Term: Spring 2024

Instructor:
Prof. Jack Judy
jack.judy@ufl.edu
O: 352-846-1275
Office Hours: Tuesday and Thursday (for the hour right after lecture), Location: 210 NRF

Teaching Assistant/Peer Mentor/Supervised Teaching Student:
Please contact through the Canvas website

- None

Course Description
(3 credits): The focus of this course is in use and adaptation of microtechnologies and nanotechnologies to improve medical devices, enhance clinical therapies, advance fundamental biological science, and progress agricultural methods. Interactive discussion topics will include the materials, fabrication processes, design considerations, characterization methods, and end-use applications for microtechnologies and nanotechnologies in medicine, biology, and agriculture. The course is suitable for graduate students from many different backgrounds (e.g., ECE, MSE, CHE, BME, AEB, MAE, ESSIE, etc.) that have an interest in the medical, biological, and agricultural applications of advanced microscale and nanoscale engineering. A major component of this course will be a project that allows students to focus on a topic of interest and develop professional skills, including performing a literature search, developing a new concept, composing a persuasive proposal for a federal agency, delivering an effective presentation pitch, and reviewing proposals.

Course Pre-Requisites / Co-Requisites
Basic knowledge of physics, chemistry, and math.

Course Objectives
To gain an understanding of state-of-the-art micro and nano technologies and their medical, biological, and agricultural applications. Knowledge will be gained through a review of micro/nano fabrication process as well as the design considerations imposed by those processes and the medical, biological, and agricultural applications in which they are used. Although each student will be permitted to focus their work on a topic of personal interest, all students will improve several key professional skills: literature search, idea development, persuasive concept pitching, proposal writing, and proposal reviewing.

Materials and Supply Fees
None.

Required Textbooks and Software
Paul G. Yock, et al. Biodesign: The Process of Innovating Medical Technologies, *Cambridge University Press*, 2015.

Course Schedule

The following represent current plans and objectives. However, these plans may change to enhance the class learning opportunity. Such changes, communicated clearly, are not unusual and should be expected:

Week	Lecture Topic	Reading	Assignments Due
Week 1	Course Overview Project Overview Needs Finding Student Presentation: Self Introduction (HW 1) Needs Screening	Syllabus Textbook Stage 1: Need Finding Textbook Stage 2: Need Screening	HW 1: Slides introducing self and interest survey
Week 2	Discuss Reading Literature Searches Effective Presentations Hype Cycle	Paper: Can a Biologist Fix a Radio?	Project 1: Candidate Interest Areas Project 2: Discuss Interest Areas with Instructor
Week 3	Concept Generation Microtechnology Microtechnology Applications in Bio/Med/Agri	Textbook Stage 3: Concept Generation Microtechnology Review Papers	Project 3: Perform literature search on project topic
Week 4	Microtechnology Applications in Bio/Med/Agri Student Presentations: Literature Review	Student Presentations: More Microtechnology Med/Bio/Ag Applications Top-Down Nanotechnology	Project 4: Give literature-review presentation on project topic
Week 5	Student Presentations: Microtechnologies (HW 2) Nanotechnology	Nanotechnology Review Papers	HW 2: Microtechnology Applications Project 5: Write literature-review document on project topic
Week 6	Nanotechnology Applications in Bio/Med/Agri Student Presentations: Nanotechnology		Project 6: Explore possible new approaches / concepts HW 3: Nanotechnology Applications Project 7: Discuss concept selection with instructor
Week 7	NIH Funding Mechanisms Specific Aims & Hypotheses	Specific Aims Examples	Project 8: Perform literature search on proposed concept
Week 8	Specific Aims Examples Student Presentations: Concept Literature Review		Project 9: Give literature-review presentation on proposed concept
Week 9	Student Presentations: Concept Literature Review Contemporary Issues		Project 10: Write literature-review document on proposed concept
Week 10	NIH Proposal Structure NIH Proposal Examples		Project 11: Write draft proposed specific aims
Week 11	Student Presentations: Specific Aims NIH Proposal Examples	NIH Proposal Examples	Project 12: Give presentation on proposed specific aims
Week 12	Challenges with Translation and Commercialization of Micro/Nanotech for Med/Bio/Ag Applications Standards and the FDA	Textbook Stage 4: Concept Selection	Project 13: Write draft proposal
Week 13	How to Review Research Proposals Pitching Proposals to Investors		Project 14: Write final proposal
Week 14	Emerging Topics, Entrepreneur Proposal Reviews	Proposals from other students in the class	Project 15: Read proposals and write preliminary reviews Project 16: Participate in proposal reviews
Week 15	Proposal Reviews		Project 17: Finalize preliminary reviews
Finals Week	Student Presentation: Record Proposal Pitch		Project 18: Record proposal-pitch presentation

Required Readings:

- Yuri Lazebnik, "Can a biologist fix a radio?—Or, what I learned while studying apoptosis", *Cancer Cell*, vol. 2, no. 3 (2002): pp. 179-182.
- Jack W. Judy, "Microelectromechanical systems (MEMS): fabrication, design and applications", *Smart Materials and Structures*, vol. 10, no. 6 (2001): p. 1115-1134.
- Jack W. Judy, " Biomedical applications of MEMS", in *Measurement and Science Technology Conference, Anaheim*, CA, (2000): pp. 403-414.

Recommended Materials

- Papers from current literature to be provided by the instructor.
- Books with valuable relevant information
    - Fundamentals of Microfabrication and Nanotechnology by March Madou
      Volume I: Solid-State Physics, Fluidics, and Analytical Techniques in Micro- and Nanotechnology
      Volume II: Manufacturing Techniques for Microfabrication and Nanotechnology
      Volume III: From MEMS to Bio-MEMS and Bio-NEMS: Manufacturing Techniques and Applications
      2011, CRC Press
    - Nanotechnology for Biology and Medicine, Gabriel A. Silva and Vladimir Parpura, 2012, Springer

Attendance Policy, Class Expectations, and Make-Up Policy

State whether attendance is required and if so, how will it be monitored? What are the penalties for absence, tardiness, cell phone policy, laptop policy, etc. What are the arrangements for missed homework, missed quizzes, and missed exams? This statement is required: Excused absences must be in compliance with university policies in the Graduate Catalog (http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance) and require appropriate documentation.

Evaluation of Grades

Assignment	Percentage of Final Grade
HW 1: Slides introducing self and interest survey	3%
HW 2: Microtechnology Applications	6%
HW 3: Nanotechnology Applications	6%
Project 1: Candidate Interest Areas	3%
Project 2: Discuss Interest Areas with Instructor	2%
Project 3: Perform literature search on project topic	5%
Project 4: Give literature-review presentation on project topic	6%
Project 5: Write literature-review document on project topic	6%
Project 6: Explore possible new approaches/concepts	3%
Project 7: Discuss concept selection with instructor	2%
Project 8: Perform literature search on proposed concept	5%
Project 9: Give literature-review presentation on proposed concept	6%
Project 10: Write literature-review document on proposed concept	6%
Project 11: Write draft proposed specific aims	4%
Project 12: Give presentation on proposed specific aims	6%
Project 13: Write draft proposal	6%
Project 14: Write final proposal	8%
Project 15: Read proposals and write preliminary reviews	5%
Project 16: Participate in proposal reviews	5%
Project 17: Finalize preliminary reviews	2%
Project 18: Record proposal-pitch presentation	5%
	Total: 100%

More information on UF grading policy may be found at:
http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades

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.

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/.

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.

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

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.

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

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 suppor*t*, 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.