

## **Future Micro/Nano Systems and their Applications**

EEL 5934 Section 6

**Class Periods:** 8 (3:00 – 3:50 PM)

**Location:** CHE 316

**Academic Term:** Fall 2022

### ***Instructor:***

Jack Judy

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M: 352-672-1787

Office Hours: Tuesdays 3-4 pm, Wednesdays 4-5 pm, and Thursdays 4-5 pm (NRF 210)

### ***Teaching Assistant/Peer Mentor/Supervised Teaching Student:***

None

### ***Course Description:***

(1 unit): Introduction to the wide range of exciting new applications for microscale and nanoscale devices and systems, including electrical, optical, magnetic, chemical, thermal, mechanical, and biological transducers, as well as their use in quantum engineering, metamaterials, biological science, medical diagnostics, aerospace, defense molecular/cellular engineering, environmental, IoT, biometric cyber security, neural interfaces, multi-functional micro/nanosystems, and other application areas.

### ***Course Pre-Requisites / Co-Requisites***

None

### ***Course Objectives***

The objective of this course is to introduce students to the wide range of emerging and existing applications that are enabled by start-of-the-art and future microscale and nanoscale devices and systems. Students will hear from several faculty that are actively pushing the boundaries of their fields using advanced micro/nano devices and systems.

### ***Materials and Supply Fees***

None

### ***Required Textbooks and Software***

None

### ***Recommended Materials***

1. Primary Journals:
  - J. Microelectromechanical Systems (IEEE/ASME)
  - J. Micromechanics and Microengineering (IoP)
  - Sensors and Actuators (Elsevier)
  - IEEE Sensors Journal (IEEE)
2. Major Conferences:

- Transducers 'XX, Int. Conf. on Solid-State Sensors and Actuators, odd-numbered years since 1983, proceedings available from IEEE (US meetings), Elsevier (European meetings), IEE Japan (Japanese meetings).
  - IEEE MEMS 'XX, annual since 1989, proceedings available from IEEE.
  - IEEE Sensors 'XX, annual since 2002, proceedings available from IEEE.
  - Hilton Head 'XX, Solid-State Sensors and Actuators Workshop, Hilton Head, SC, even-numbered years since 1984, proceedings available from Transducer Research Foundation.
  - Eurosensors 'XX, annual since 1987, proceedings published in special issues of Sensors and Actuators.
  - Napa 'XX, Topical meetings, Napa, CA, held in odd-numbered years annual since 2011.
  - ... plus many more area-specific conferences, e.g. PowerMEMS,  $\mu$ TAS, Optical MEMS, BioMedical, etc.
3. Informative Websites:
- [www.memsjournal.com](http://www.memsjournal.com) (Premiere online journal of MEMS-related news)
  - [www.semi.org/en/msig-information-hub](http://www.semi.org/en/msig-information-hub) (MEMS & Sensors Industry Group)
  - [www.memsnet.org](http://www.memsnet.org) (General MEMS and Nanotechnology Information)
  - [www.mems-exchange.org](http://www.mems-exchange.org) (MEMS Exchange – MEMS Foundry Services)

### Course Schedule

<b>Week #:</b>	<b>Lecturer</b>	<b>Topic - HW # (due date)</b>
Week 1:	Jack Judy	Welcome, introductions, course structure, schedule and admin topics. Introduction to the broad range of applications for microscale and nanoscale systems and the many different technical disciplines involved.
Week 2:	Jack Judy	Markets for microscale and nanoscale systems. Sources of literature (journals, conferences) and related UF research groups
Week 3:	Roozbeh Tabrizian	Resonant Micro/Nano Systems for Frequency Control
Week 4:	Mark Sheplak	Microsystems for Aerospace Testing - HW 1 (due next week)
Week 5:	Adam Khalifa	Micro/Nanotechnologies for Neural Interfaces
Week 6:	Toshi Nishida	Ferroelectric Multi-functional Microsystems – HW 2 (due next week)
Week 7:	Y-K Yoon	Micro/nano Machined Metamaterials for 5G/6G Systems
Week 8:	Jennifer Andrew	Magnetoelectric Materials – HW 3 (due next week)
Week 9:	Jack Judy	Micro/Nano Systems for Neural Science and Therapies
Week 10:	Philip Feng	Micro/Nano Systems for Quantum Engineering – HW 4 (due next week)
Week 11:	David Arnold	Magnetic Microsystems
Week 12:	Saeed Moghaddam	MEMS for Thermal Management of Electronics – HW 5 (due next week)
Week 13:	Hugh Fan	MEMS for Biological Science and Medical Diagnostics
Week 14:	No Class (Thanksgiving)	
Week 15:	Jing Pan	Micro/Nano Systems for Molecular/Cellular Engineering – HW 6 (due next)
Week 16:	Jack Judy	Class Summary and Review and Group Discussion

### Attendance Policy, Class Expectations, and Make-Up Policy

Excused absences must be consistent with university policies in the Graduate Catalog (<https://catalog.ufl.edu/graduate/regulations>) and require appropriate documentation. Additional information can be found here: <https://catalog.ufl.edu/graduate/regulations/>

### Evaluation of Grades

<b>Assignment</b>	<b>Total Points</b>	<b>Percentage of Final Grade Graduate Section</b>
Attendance	1 each lecture	50%
Homework Sets (6)	10 each set	50%
		100%

Homework sets consist of a one-page write up summarizing one of the two prior presentations and their impressions of the topic and its potential use to beneficially impact society.

### ***Grading Policy***

<b>Percent</b>	<b>Grade</b>	<b>Grade Points</b>
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

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 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 their instructor and discuss their access needs, as early as possible in the semester.

### ***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/>.

### ***In-Class Recording***

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons),

including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

### ***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 Conduct Code (<https://sccr.dso.ufl.edu/process/student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. 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
- Jennifer Nappo, Director of Human Resources, 352-392-0904, [jpennacc@ufl.edu](mailto:jpennacc@ufl.edu)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, [taylor@eng.ufl.edu](mailto:taylor@eng.ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@eng.ufl.edu](mailto: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***

##### **Covid-19 Protocols:**

- You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated. Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.
- If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email [covid@shcc.ufl.edu](mailto:covid@shcc.ufl.edu)) to be evaluated for testing and to receive further instructions about returning to campus. UF Health Screen, Test & Protect offers guidance when

you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the [UF Health Screen, Test & Protect website](#) for more information.

**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](mailto: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:** <https://counseling.ufl.edu>, 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](mailto: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](mailto:Learning-support@ufl.edu).  
<https://lss.at.ufl.edu/help.shtml>.

**Career Resource Center**, Reitz Union, 392-1601. Career assistance and counseling; <https://career.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://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>; <https://care.dso.ufl.edu>.

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