EEL5225 Principles of MEMS Transducers  
Fall 2014 Semester

1. **Catalog Description** (including credit hours): Introduction to principles and fabrication techniques of micro-electro-mechanical devices and systems. 3 credits.

2. **Pre-requisites**: Basic semiconductor theory (EEL 3396), differential and integral calculus, introductory circuit theory, statics and dynamics, or with permission of the instructor.

3. **Course Objectives**: To introduce MEMS transducers through exploration of sensing/actuation mechanisms, materials, and microfabrication technologies and to model multi-energy-domain systems using lumped-element models.

4. **Contribution of course to meeting the professional component** (ABET only): N/A

5. **Relationship of course to program outcomes** (ABET only): N/A

6. **Instructor**: Dr. Huikai Xie  
   - Office location: 221 Larsen Hall  
   - Telephone: 846-0441  
   - E-mail address: hkx@ufl.edu  
   - Web site: https://lss.at.ufl.edu/  
   - Office hours: 5:00-6:00pm, T/R

7. **Teaching Assistant**: TBA

8. **Meeting Times**: 8-9 T, 9 R

9. **Class/laboratory schedule**:  
   - Three 50 minutes lectures per week.

10. **Meeting Location**: 328 Benton Hall

11. **Material and Supply Fees**: None

12. **Textbooks and Software Required**:  
   - MATLAB, MathCAD, Excel, or equivalent may be needed for homework.

13. **Recommended Reading**:  
   - Books:  
Primary Journals:
- *J. Microelectromechanical Systems* (IEEE/ASME)
- *J. Micromechanics and Microengineering* (IoP)
- *Sensors and Actuators* (Elsevier)

14. **Course Outline** (provide topics covered by week or by class period)

**Introduction and Orientation**
- Overview of MEMS
- Transducer Basics

**Fabrication Technology**
- Review of standard IC fabrication technologies - diode, BJT, CMOS
- MEMS fabrication technologies - bulk micromachining, surface micromachining, and CMOS micromachining; bonding technologies

**Transduction Principles**
- Capacitive, inductive, magnetic, optical, thermal, piezoresistive, and piezoelectric methods

**Modeling**
- Mechanics: stress, strain, bending, beam-mass systems
- Lumped-element modeling (LEM)
- Linear system dynamics

**Domain Specifics**
- Mechanics
- Thermodynamics
- Fluidics
- Acoustics
- Optics
- MEMS interface electronics

15. **Attendance and Expectations:** Attendance is required and no cell phone use is allowed in the class.

16. **Grading:**
- Homework 20%
- Mini-projects 20%
- Exams 60%
17. **Grading Scale:**

≥92 A; 88-91 A-; 84-87 B+; 80-83 B; 75-79 C+; 70-74 C; 65-69 D+; 60-64 D; and <60 E

Undergraduate students, in order to graduate, must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). Note: a C- average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. Graduate students, in order to graduate, must have an overall GPA of 3.0 or better (B or better). Note: a B-average is equivalent to a GPA of 2.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit:

[https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx](https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx)

18. **Make-up Exam Policy:** No make-up exam

19. **Honesty Policy** – All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.

20. **Accommodation for Students with Disabilities** – Students Requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.

21. **UF Counseling Services** – Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:
   - UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services.
   - Career Resource Center, Reitz Union, 392-1601, career and job search services.

22. **Software Use** – All faculty, staff and student 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.