# EE5344: Introduction to Microelectromechanical Systems (MEMS) and Devices

Professor Zeynep Celik-Butler

Electrical Engineering Department

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### Fall 2015

**1. Catalog Description:**

This course develops the basics for microelectromechanical devices and systems including microactuators, microsensors, and micromotors, principles of operation, different micromachining techniques (surface and bulk micromachining), IC-derived microfabrication techniques, thin-film technologies as they apply to MEMS.

**2. Prerequisites:**

For undergraduate EE’s: junior standing, or graduate standing.

**3. Degrees for which the course can be used:** BSEE, MSEE, Ph.D.

**4. Textbook:**

1. Text/ **Microsensors, MEMS and Smart Devices**, by Julian W. Gardner, Vijay K. Varadan, John Wiley & Sons; ISBN: 047186109X; 1st edition (December 15, 2001).
2. Reference/ Semiconductor Sensors, by S. M. Sze, Wiley Interscience, ISBN 0-471-54609-7, 1994.
3. Reference: *Micromechanics and MEMS*  by William Trimmer, IEEE press, ISBN 0-7803-1085-3, 1997.
4. Reference: *Microsensors,* by Richard Muller, Roger T. Howe, Stephen Senturia, Rosemary Smith, and Richard White, IEEE press, ISBN 0-87942-245-9, 1991.

**5. Office Hours**:

Teaching Assistant: TBA

Office hours: TBA.

Professor: Tuesday and Thursday 2:30 – 3:30 PM at NanoFab Center 202D

**6. Office Location**

Professor: Zeynep Celik-Butler

NanoFab Center

Room 202D

**7. Important Dates:**

Project Proposal: Thursday, October 29, 2015

Midterm Examination 1: Tuesday, November 3, 2015

Term Project: Thursday, December 3, 2015

Midterm Examination 2: Tuesday December 8, 2015

**All DFW Metroplex Students need to take the exam on Campus.**

**7. Grade Composition:**

On campus Students

Pop Quizzes: 20%

1st Midterm 25%

2ndMidterm 25%

Project 30%

Distance Education Students

No pop quizzes

1st Midterm 30%

2ndMidterm 30%

Project 40%

Graduate students will be required prepare a more detailed project report, at a higher level than the undergraduates.

**8. Course Topics and Tentative Schedule**

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|  | ***TOPICS*** |
| 1. | Introduction to MEMS |
| 2. | Microsensor circuit interfaces |
| 3. | General silicon processing |
| 4. | Bulk micromachining techniques |
| 5. | Surface micromachining techniques |
| 6. | MEMS-specific processing techniques |
| 7. | Thermal Microsensors |
| 8. | Review + Exam |
| 9. | Radiation microsensors |
| 10. | Biochemical microsensors |
| 11. | Mechanical microsensors |
| 12. | Project report draft check |
| 13. | Review + Exam |

# UTA Policies and Legal Statements

Academic Honesty: All students are expected to pursue their academic careers with honesty and integrity. Academic dishonesty includes, but is not limited to, cheating on a test or other course work, plagiarism (offering the work of another as one's own) and unauthorized collaboration with another person. Students found guilty of dishonesty in their academic pursuits are subject to penalties that may include expulsion from the University.

In accordance with the Rules and Regulations of the Board of Regents of The University of Texas System (Part One, Chapter VI), institutional procedures regarding charges of academic dishonesty are outlined in Part Two, Chapter 2, of the Handbook of Operating Procedures of The University of Texas at Arlington. Copies of the handbook are available at more than 75 locations on campus, including the Student Development Office, the Central Library and departmental offices.

**Disability Accommodations:** If you need academic accommodations for a disability, please contact the Office for Students with Disabilities at (817) 272-3364 or refer to the web page http://www.uta.edu/disability/ .

**UTA Incomplete Grade Policy:** A graduate student who has been unable to complete all class or laboratory assignments in a regular semester or summer session may, at the discretion of the instructor, receive an X designating a temporary grade. The following deadlines for completing an incomplete grade X apply to all graduate students regardless of the level of the course in which the incomplete grade was received: An X must be removed no later than the official midsemester deadline of the following regular semester; an X received in fall semester must be removed by the following spring midsemester deadline; an X received in spring semester or summer session must be removed no later than the following fall midsemester deadline. See the official Graduate School Calendar in this catalog for midsemester deadlines. An incomplete grade not removed by the specified deadline will be automatically changed to an F. All incomplete grades must be removed from the student's record before a graduate degree will be awarded.

**Religious Holiday Policy:**    A student who misses an examination, work assignment or other project because of an observance of a religious holy day will be given the opportunity to complete work missed within a reasonable time, provided that the student has properly notified the instructor. To meet notification requirements, the student must notify each instructor in writing of classes scheduled on dates he/she will be absent in observance of a religious holy day. Notification must be made within the first 15 class days and either personally delivered, acknowledged and dated by the instructor or sent by certified mail, return receipt requested. The student may not be penalized for these excused absences, but the instructor may respond appropriately if the student fails to complete satisfactorily the missed assignment or examination within a reasonable time after the excused absence. A "religious holy day" means a holy day observed by a religion whose places of worship are exempt from property taxation under Section 11.20 of the Tax Code.

The following is an excerpt from the College of Engineering's statement on Ethics, Professionalism, and Conduct of Engineering Students. Read the statement carefully, sign it, and return it to your instructor. You are being provided with a copy for your records. Additional copies of this statement can be obtained from your instructor or the Office of the Dean of Engineering.

**STATEMENT ON ETHICS, PROFESSIONALISM, AND CONDUCT**

**FOR ENGINEERING STUDENTS**

COLLEGE OF ENGINEERING

THE UNIVERSITY OF TEXAS AT ARLINGTON

The College cannot and will not tolerate any form of academic dishonesty by its students. This includes, but is not limited to cheating on examination, plagiarism, or collusion.

**Cheating** on an examination includes:

1. Copying from another's paper, any means of communication with another during examination, giving aid to or receiving aid from another during examination;

2. Using any material during examination that is unauthorized by the proctor;

3. Taking or attempting to take an examination for another student or allowing another student to take or attempt to take an examination for oneself.

4. Using, obtaining, or attempting to obtain by any means the whole or any part of an unadministered examination.

**Plagiarism** is the unacknowledged incorporation of another's work into work which the student offers for credit.

**Collusion** is the unauthorized collaboration of another in preparing work that a student offers for credit.

**Student Responsibility Regarding Academic Dishonesty**

1) Students who choose to take the risk associated with scholastic dishonesty and any other violation of the Code of Student Conduct and Discipline must assume responsibility for their behavior and accept the consequences. These consequences are described on the back of this statement and elsewhere including UTA policies and class syllabi. In an academic community, the standards for integrity are high.

2) Students who are aware of scholastic dishonesty and any other academic policy or conduct violations, have the responsibility to report academic policy violations to their professor, to a College of Engineering administrator, or to the Office of Student Judicial Affairs. The decision to do so is one of many moral dilemmas to be faced as students define who they are. [paraphrased from the Office of Student Judicial Affairs website1]

One method of reporting an academic policy violation is to submit a narrative of the incident to the Office of Student Judicial Affairs, located in E.H. Hereford University Center, lower level, B160, Box 19355 or to the professor. This narrative can also be submitted via email at judicial@uta.edu or fax to (817) 272-5221.[[1]](#footnote-1)

**I have read and I understand the above statement. In addition, I understand that, in order to ensure fairness to all students, exams will be proctored and possibly videotaped.**

Student's signature: Date:

Student's name, printed:

Student’s ID number:

**The Disciplinary Process: Scholastic Dishonesty**

**FACULTY MEMBER SUSPECTS DISHONESTY**

**FACULTY MEMBER CONFERS WITH STUDENT**

The faculty member may decide no infraction occurred

OR The faculty member may decide that an infraction occurred and the student may choose not to dispute the facts and accept a sanction given by the faculty member (Form 1).

OR The student denies scholastic dishonesty, and the matter is referred to the Office of Student Judicial Affairs (Form 2).

**FACULTY DISPOSITION**

The information (Form 1) is forwarded to the Office of Student Judicial Affairs which sanctions the student for the infraction.

Within 14 days of accepting administrative disposition, the student may appeal the sanction to the president.

Otherwise, the decision is final.

**REFERRAL TO THE OFFICE OF SJA**

The judicial officer confers with student and faculty member about the allegation. The judicial officer may dismiss the case if evidence is insufficient.

OR The student may choose not to dispute the facts and accept an administrative disposition.

OR The student disputes the allegations and the Vice President of Students Affairs appoints a hearing officer to hear the allegations and determine an outcome.

**ADMINISTRATIVE DISPOSITION**

Within 14 days of accepting administrative disposition, the student may appeal the discipline sanction to the president.

Otherwise, the decision is final.

**UNIVERSITY HEARING**

After hearing the facts, the Hearing Officer may dismiss the case or find the student responsible and impose a sanction.

Within 14 days of the decision, the student may appeal the discipline sanction to the President.

**APPEAL TO THE PRESIDENT BASED ON FACTS AND/OR SANCTION**

The President may reverse the decision regarding the facts OR Uphold the decision regarding both the facts and sanction

OR Uphold the decision regarding the facts but increase or reduce the sanction.

1. http://www.uta.edu/studentaffairs/judicialaffairs/jdpstudresp.html [↑](#footnote-ref-1)