ROCHESTER INSTITUTE OF TECHNOLOGY
MICROELECTRONIC ENGINEERING

MCEE 770 MEMS Fabrication

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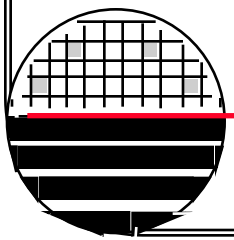

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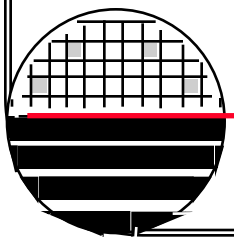
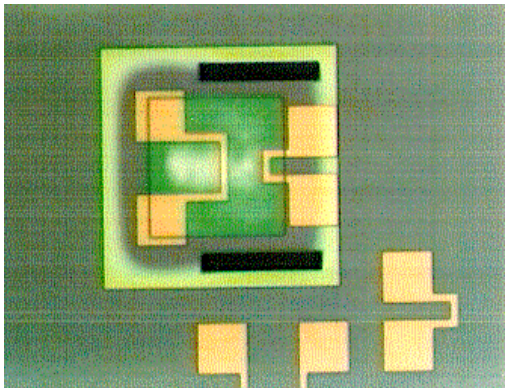


INTRODUCTION

MCEE 770 Microelectromechanical Systems Fabrication

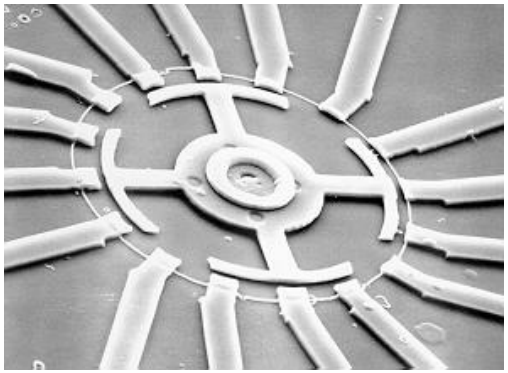
This course will provide an opportunity for the student to become familiar with the fabrication technology and applications of microelectromechanical systems. This is one of the fastest growing areas in the semiconductor business. Today's applications include accelerometers for air bag deployment, pressure sensors, flow sensors, optical systems, micromotors and more. Students will design, fabricate and test MEMS devices.

Piezoresistive Pressure Sensor



300 µm

Micromotor



100 µm

MCEE 770-01 COURSE DETAILS

MCEE 770 01 Microelectromechanical Systems Fabrication

Prerequisites: MCEE 601or Equivalent

Course Goals:
This course will provide an opportunity for the student to become familiar with the technology and applications of microelectromechanical systems. The main goal of this course is to design, fabricate and test MEMS devices.

Format: The lecture meets three times per week and the lab meets one time per week.

Laboratory: One 3 hour period per week, Plus 1 hour on Friday, other TBA

Meeting Days: We, Fr
Time: 8:00 am
Lecture Room: 09-3119

Grade:		
	Homework	25%
	Exams	25%
	Final Exam	25%
	Laboratory	25%

MCEE 770 LECTURE SCHEDULE

Rochester Institute of Technology
Microelectronic Engineering **August 14, 2014**
Dr. Lynn Fuller

MCEE 770 MEMS Fabrication

Also see History of MEMS at RIT

Lesson No.	Topic	Document	
1.	Orientation, Introduction to MEMs	Out_770.pdf History of MEMS	
2.	Mechanical Fundamentals	mem_mech.ppt	
	Lab - Surface MEMS Introduction		
3.	Mechanical Fundamentals	mem_mech.ppt	
4.	Electrical Fundamentals	mem_elec.pdf	
	Lab - MEMS CAD		
5.	Electrical Fundamentals	resistor_mems.pdf	
6.	Diode and Capacitor Sensors	Diode_Sensors.ppt Capacitor_Sensors.ppt	
	Lab - MEMs CAD	MEMS_CAD_BULK_20092.PPT	
7.	Gas Flow Sensors and Probes	RIT_Gas_Flow_Sensor.ppt Anemometer Gas Flow Sensor.ppt	
8.	Microbolometer		
	Process for Surface MEMS		
9.	Accelerometers	Accelerometers.pdf Cantilever Calculations.xls	
10.	Actuators and Switches	mem_app_switches.pp	
	Lab - Layout		
11.	Materials and Film Deposition for MEMs	mem_dep.ppt	
12.	Lithography for MEMs Ion Implant	mem_lith.ppt	
	Lab - Layout		

MCEE 770 LECTURE SCHEDULE

	Lab -Layout		
13.	Wet Etch for MEMs	mem_etch.ppt	
14.	Plasma Etch for MEMs	mem_etch.ppt	
	Lab - Fabrication	MEM_CMP.ppt	
15.	Process Integration	mem_proc.ppt	
16.	Maskmaking		
	Lab -Fabrication		
17.	Actuators, Legs and Wings	mem_app_leg.ppt	
18.	Measurement Techniques for MEMs	mem_meas.ppt	
	Lab -Fabrication		
19.	Signal Conditioning	mem_sigl.ppt	
20.	RIT Packaging	mem_probes.pdf	
	Lab - Fabrication		
21.	Fluid Channels	pressure_flow.ppt	
22.	Chemical Sensors	mem_chem.ppt Concentration_Calc.xls	
	Lab - Fabrication		
23.	Bio Sensors		
24.	Fluid Pumps, Valves, Flow	mem_App_Fluids.ppt RIT Fluid Channels.ppt	
	Lab - Packaging		
25.	Pressure Sensors		
26.	Microphones		
	Lab - Testing		
27.	Optical Fundamentals	mem_optic.ppt	
28.	Optical MEMS		
	Lab - Testing		
29.	Energy Harvesting		
30.	Energy		

TEXTBOOK/REFERENCES

Textbook:

1. None

References:

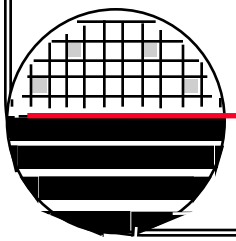
1. Fundamentals of Microfabrication, Marc Madou, CRC Press, 1997.
2. Micromechanics and MEMs, Edited by William S. Trimmer, IEEE Press, 1997.
3. Microsensors, Edited by Richard S. Muller, IEEE Press, 1991.
4. Handbook of Microlithography, Micromachining, and Microfabrication, Editor P. Rai-Choudhury, SPIE-The International Society for Optical Engineering, 1997.
5. "Journal of Microelectromechanical Systems", Joint IEEE/ASME Publication.
6. Micromachined Transducers, Kovacs, McGraw Hill
7. Microsystem Design, Stephen D. Senturia, Kluwer Academic Publishers, 2001

HOMEWORK FORMAT GUIDLINES

1. At the top of the front page include the following information:

Rochester Institute of Technology **Your Name**
Microelectronic Engineering **Date**
EMCR 201- Assignment Description

2. Name/date/page number on each page
3. Use 8.5”x11” paper with clean straight edges (no spiral notebook paper)
4. Leave room on the left margin for 3 hole punch.
5. Staple pages with one staple in top left at 45°.
6. Use black ink, avoid color because it will not copy well.
7. Type
8. Computer simulations must consist of a summary page followed by the hard copies of the data with key results underlined or boxed.
9. Covers and title pages should feed through the copier also.



LABORATORY NOTEBOOK GUIDELINES

The laboratory Notebook is an important tool. Each student will be required to have such a notebook.

Name, Date, Description on Cover
Notebook will be of the permanently bound type
Number each page
Sign and Date each page (witness signature)
Use a diary type format to take notes of what you do each day.
Include enough details so that a reader can follow what you did.
Tape printouts, data tapes, etc. correctly into the notebook.
Use ink.
Be neat.