



**University of Tehran**  
**School of Electrical and Computer Engineering**

<b>Course:</b>	<b>8101497 – Course Name: Semiconductor Sensor Technology</b>									
<b>Course type:</b>										<b>Credit:</b> 3
		<b>EE*</b>					<b>CE*</b>			
		<b>Com</b>	<b>E</b>	<b>P</b>	<b>B</b>	<b>Con</b>	<b>D</b>	<b>SW</b>	<b>HW</b>	
	Required	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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<b>Level:</b>	Graduate									
<b>Co-requisite(s):</b>	None.									
<b>Prerequisite(s):</b>	None.									
<b>Prerequisite by topic:</b>	Familiarity with semiconductor devices.									
<b>Textbook(s):</b>	[1] S.M. Sze, “Semiconductor Sensor Technology”, J. Wiley, 1990. [2] Principles of Plasma Discharges and Material processing, M.A. Lieberman and A.J. Lichtenberg, John Wiley, 2005 [3] Introduction to Micro-Fabrications, by Sami Franssila, John Wiley, 2004.									
<b>Coordinator:</b>	S. Mohajerzadeh, Professor, School of ECE									
<b>Goals:</b>	Familiarity with integration circuit fabrications, Familiarity with various fabrication processes and especially MEMS technology, Grasp of plasma physics for processing, Familiarity with various sensors, including mechanical sensors, actuators, magnetic, optical, thermal, radiations/nuclear sensor, chemical and biological sensors.									
<b>Outcome:</b>	Upon successful completion of the course, students will be able <ol style="list-style-type: none"> <li>1. knowledge about complex fabrication processes,</li> <li>2. knowledge of various sensors and transducers</li> <li>3. knowledge of array structures,</li> <li>4. knowledge of cold plasma processes and physics</li> <li>5. knowledge about cold plasma formation</li> </ol>									
<b>Topics:</b>	<b>1- Semiconductor fabrication processes:</b> A survey on IC-fabrication steps. <b>2- Introduction to MEMS fabrication processes,</b> Deep investigation of micro-machining, reactive etching, various main and sacrificial layers etc.									

	<p><b>3- Plasma physics</b>, An elementary introduction to plasma physics starting with Boltzmann Transport Equation, Transport in plasma domain, Sheaths and plasma models.</p> <p><b>4- Mechanical sensors and actuators</b>, Membrane formation, piezo-electric effect, piezo-resistive structures, comb-like actuations, etc.</p> <p><b>5- Thermal sensors, flow meters</b>, interdigital structures on membranes, calorimetric devices, boundary layers and so on</p> <p><b>6- optical sensor, IR sensors, CCD's</b>: A review on CCD technology, detectors of infra red signals with Schottky barriers, Silicon-based color detectors, spreading resistance sensors,</p> <p><b>7- radiation sensors, nuclear sensors</b>, Silicon drift chamber, carrier domain structures, sensors for high energy irradiations, PIN structures,</p> <p><b>8- chemical sensors, gas sensors</b>: metal-oxide structures, Tin-oxide sensors, ZnO structures and sensors, humidity sensors, oxygen sensors, ISFET,</p> <p><b>9- biological issues, structures and sensors</b>; DNA/RNA structures, Enzyme encapsulation, biological sensors, Chain Replication</p>						
<b>Computer usage:</b>	Simulation of various fabrication processes,						
<b>Assignments:</b>	One or two homework is given to students to become familiar with topics.						
<b>Projects:</b>	One presentation is optional.						
<b>Grading:</b>	<table> <tr> <td>Assignments:</td> <td>10 %</td> </tr> <tr> <td>Midterm exams:</td> <td>30 %</td> </tr> <tr> <td>Final exam:</td> <td>60 %</td> </tr> </table>	Assignments:	10 %	Midterm exams:	30 %	Final exam:	60 %
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Final exam:	60 %						
<b>Further readings:</b>	[1] Physics of semiconductor devices [2] VLSI Fabrication technology						
<b>Prepared by:</b>	S. Mohajerzadeh, Professor, School of ECE						
<b>Date:</b>	September, 2017						

\*EE: Electrical Engineering CE: Computer Engineering IT: Information Technology