

**School of Mechanical Engineering and Computer Science**  
**Mech 431: Semiconductor Devices**

<b>Catalog Data:</b>	<b>Mech 431 Semiconductor Devices</b> 3 credits Fundamentals of semiconductor device physics, including IC devices and MEMS devices. Use of TCAD for device simulation.
<b>Class Schedule:</b>	Three 50-minute lecture sessions per week, for one semester
<b>Laboratory Schedule:</b>	None
<b>Prerequisites by Course:</b>	Chem 106, Phys 202
<b>Prerequisites by Topic:</b>	Electromagnetics, D/C and A/C circuits, Crystal structure and bonds
<b>Required Texts:</b>	Streetman, Banerjee, "Solid State Electronic Devices" Fifth edition, Prentice Hall
<b>Course Coordinator:</b>	Dr. Daniel Chiang
<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>1. Understand semiconductor device physics.</li> <li>2. Learn how materials, device structure, and processes impact device performance.</li> <li>3. Learn how device parameters influence IC circuit performance.</li> <li>4. Learn how to use device simulation software to optimize device performance for particular applications.</li> <li>5. Describe recent trends in semiconductor device design, materials and process technology.</li> </ol>
<b>Topics Covered:</b>	<ol style="list-style-type: none"> <li>1. Semiconductor physics (energy band, carrier concentration, carrier transport)</li> <li>2. Semiconductor devices (p-n junction diode, MOSFET, high speed devices)</li> <li>3. Applications in IC systems (flash memory, RAM, ROM, CCD camera)</li> <li>4. TCAD device modeling and simulation</li> </ol>
<b>Course Outcomes:</b>	Students will be able to: A-1. Describe how energy band structure determines the electrical and photonic properties of semiconductor devices and construct mathematical models. A-3. Sketch cross-sections and describe semiconductor devices for: flash memory, RAM, ROM, CCD camera and basic digital circuit, flat panel display. A-4. Apply principles of carrier transport phenomena to mobility, effective mass, carrier concentration and other physical properties of semiconductors. A-7. Solve problems exploring the relationship between material properties and device dimensions to diode design. E-3. Use analytical and computational tools to explore design and process tradeoffs in deep submicron MOSFET device design. J-1. Describe emerging technologies including molecular devices, strained Si devices, silicon on insulator (SOI), flat panel displays and quantum effect devices.
<b>Required or Elective Course:</b>	Elective

<b><i>Contribution to Professional Component:</i></b>	Engineering Topics		
<b><i>Relationship of Course to Program:</i></b>	Meets: Educational Objectives <u>1, 2, 3, 4</u> Program Outcomes <u>A, E, J</u>		
<b><i>Prepared by:</i></b>	Dr. Daniel Chiang	Date:	November 1, 2006
<b><i>Approved by CAC:</i></b>			