

## **ENG EC574 Physics and Semiconductor Materials**

### **2007-2008 Catalog Data:**

Prereq: CAS PY 313. Study of the fundamentals of quantum mechanics necessary to understand the properties of semiconductor materials. Study of the electrical and optical properties of materials, including crystal structure and bonding, free electron theory, band theory of solids and semiconductors. Carrier transport properties, dielectric, ferroelectrics, and magnetic properties. Cannot be taken for credit in addition to CAS PY 543. 4 cr.

### **Class/Lab Schedule:**

Lecture: 4 hours/ week

### **Status in the Curriculum: Elective**

### **Textbooks and other required materials:**

B.H. Brandsen, and C.J. Joachain, Introduction to Quantum Mechanics , Longman Scientific and Technical, ISBN 0582444985

N.W. Ashcroft, and N.D. Mermin, Solid State Physics, Saunder College Publishing, ISBN 0030839939

### **Coordinator:**

Enrico Bellotti, Associate Professor, ECE

### **Goals:**

1. Master the formalism of quantum mechanics and apply it to problems relevant to solid state physics.
2. Learn the important concepts of solid state physics with particular emphasis on semiconductor materials.
3. Learn how to investigate and compute the basic electrical and optical properties of semiconductor material that are important for semiconductor device engineering.

### **Course Outcomes:**

1. Have a substantial understanding of quantum theory.
2. Have a working knowledge of the quantum mechanical formalism.
3. Being able to solve elementary quantum mechanical problems relevant to semiconductor materials and device structures
4. Have a substantial understanding of the physics of crystalline semiconductor materials.
5. Develop a basic knowledge of the numerical approached useful to solve quantum mechanical problems relevant to the calculation of the semiconductor material properties.
6. Gain insight on the potential impact of the semiconductor material properties on the semiconductor device design.

**Course Outcomes mapped to Program Outcomes:**

	A	B	C	D	E	F	G	H	I	J	K
<b>Program Outcomes</b>	<b>a</b>	<b>b</b>	<b>c</b>	<b>d</b>	<b>e</b>	<b>f</b>	<b>g</b>	<b>h</b>	<b>i</b>	<b>j</b>	<b>k</b>
<b>Course Outcomes</b>	<b>1,2,3,4,5</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>3,5</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>1</b>	<b>1,2</b>	<b>2,3,5</b>
<b>Emphasis (1-5)</b>	<b>5</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>4</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>4</b>

1=not at all; 5=a great deal;

**Contribution of Course to Meeting the Professional Component:**

Engineering topics: 40%

Math & Basic Science: 55%

General Education: 5%

**Prepared by:** E. Bellotti

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