

## ESG 332 MATERIALS SCIENCE I: STRUCTURE & PROPERTIES OF MATERIALS (REQUIRED)

Credit: 3

### COURSE CATALOG DESCRIPTION:

This course develops a fundamental understanding of the relationships between the structure and properties of engineering materials and the principles by which materials' properties are controlled. In particular, the structure and structural imperfections in simple crystalline materials and the role that these factors play in defining mechanical and electrical properties of materials are considered. In addition to metallic and semiconducting materials, the molecular structure of polymers is discussed and related to their mechanical and electrical behavior as well. Advanced topics include foams, smart materials and microelectromechanical systems.

**PRE- OR CO-REQUISITE(S):** ESG 198 or CHE 131 or 141 and ESG 302

**TEXT(S) OR OTHER REQUIRED MATERIAL** W. D. Callister, Jr., Materials Science and Engineering – An Introduction, Sixth Edition, John Wiley and Sons, 2003

COURSE LEARNING OUTCOMES	SOS	ASSESSMENT TOOLS
Obtain familiarity with materials atomic-, crystalline- and micro-structure and defects	a,e,h,j,k	Written examinations
Understand the mechanistic origins of the elastic and plastic properties of materials	a,e,h,j,k	Written examinations
Understand the connections between the electronic structure and the electrical properties of materials		
Identify methods to engineer useful materials with desirable mechanical and electrical properties	a,c,e,h,i,j,k,f	Written examinations

### COURSE TOPICS:

- Week 1. Atomic Structure
- Week 2. Interatomic Bonding
- Week 3. Structure of Crystalline Solids
- Week 4. Imperfections in Solids, Diffusion
- Week 5. Mechanical Properties of Metals
- Week 6. Dislocation and Strength Mechanisms
- Week 7. Phase Diagrams
- Week 8. Phase Transformations in Metals
- Week 9. Thermal Processing of Metal Alloys
- Week 10. Structure and Properties of Ceramics, Applications and Properties of Ceramics
- Week 11. Polymer Structures, Characteristics of Polymers
- Week 12. Corrosion and Degradation of Metals
- Week 13. Electrical Properties
- Week 14. Materials for Integrated Circuit Package.

**CLASS/ LABORATORY SCHEDULE:**

ESG	332	Materials Sci I: Struct & Prop	LEC	1	TUTH	9:50 AM	11:10 AM
			REC	R01	RECF	9:35 AM	10:30 AM
			REC	R02	RETH	2:20 PM	3:15 PM
			REC	R03	RECF	10:40 AM	11:35 AM
			REC	R04	RECF	2:20 PM	3:15 PM

**CURRICULUM**

This course contributes 4 credit hours toward meeting the required 48 hours of engineering topics.

**STUDENT OUTCOMES (SCALE 1-3):**

A	B	C	D	E	F	G	H	I	J	K
3		2		3	2		3	2	3	3

**3 – Strongly supported****2 – Supported****1- Minimally supported****LEAD COORDINATOR(S) WHO PREPARED THIS DESCRIPTION AND DATE OF PREPARATION:**

Clive Clayton 05/17/10