

School of Mechanical Engineering and Computer Science
Mech 309: Introduction to Engineering Materials

Catalog Data:	Mech 309 Introduction to Engineering Materials; 3 credits (2-3) Structure of materials, phase equilibrium, phase transformations, mechanical failure, and mechanical properties. Materials testing laboratory.
Class Schedule:	Two 50-minute lecture sessions per week, for one semester.
Laboratory Schedule:	One three hour lab sessions per week, for one semester.
Prerequisites by Course:	Chem 106, Phys 201or c//
Prerequisites by Topic:	<ol style="list-style-type: none"> 1. Ionic, molecular, solubility, oxidation/reduction equilibria 2. Systemic chemistry of the elements 3. Motion and dynamics of particles and rigid bodies
Required Texts:	W. D. Callister, Jr., <i>Materials Science and Engineering: An Introduction</i> , sixth edition, Wiley, New York (2003)
Course Coordinator:	Dr. Dave (Dae-Wook) Kim
Course Objectives:	<ol style="list-style-type: none"> 1. Survey the whole of materials science: metals, ceramics, polymers, composites, and materials selection 2. Describe the relationships between material structure and properties 3. Understand the physical and mechanical properties of materials through the basic nature of their bonds 4. Identify phases and calculate amounts of each phase using phase diagrams 5. Predict microstructure and properties of heat treated metallic alloys 6. Plan and perform material characterization experiments and deliver through the written reports
Topics Covered:	<ol style="list-style-type: none"> 1. Characterizing metals, non-metals, and semiconductors 2. Primary and secondary bonding in materials 3. Defects in crystal systems and impact on materials properties 4. Phase diagram reactions and the kinetics of heat treatments 5. Testing and mechanical characterization of all materials 6. Ferrous and non-ferrous metals for engineering applications 7. Glass and ceramic materials for engineering applications 8. Polymers in engineering applications 9. Composites for engineering applications
Lab Experiments and Activities:	<ol style="list-style-type: none"> 1. Material classification 2. Microstructure test: optical microscopes, metallic and non-metallic samples. 3. FTIR test 4. Microhardness test: Vickers/Knoop microhardness tester. 5. Heat treatment test: heat treating furnaces, metallic materials. 6. Hardness test: Brinell hardness tester 7. Tensile test: compression/tensile tester with computer interface, metallic and polymer samples. 8. Materials Engineering project.

Course Outcomes:	Students will be able to:		
	Assessed for Program Outcomes	B-1. Identify the constraints, assumptions, and appropriate models for the experiment. B-2. Use appropriate materials testing equipment, standardized methods and apparatus for material property evaluations. B-3. Use appropriate tools and/or statistical tools to analyze data. B-4. Validate experimental results with respect to assumptions, constraints, and theory. G-1. Produce a variety of lab and/or project reports, using appropriate formats, grammar, and mechanics with discipline-specific conventions including citations.	
		Other	A-2. Describe fundamental scientific (chemistry, physics) and engineering principles (material science) in materials processes and material systems. A-3. Apply scientific (chemistry, physics) and engineering principles (material science) toward solving engineering problems. E-3. Use experimental methods to obtain solutions. K-1. Set-up and/or operate material property testing equipment such as hardness testers, tensile tester, and optical microscope for projects.
Required or Elective Course:	Required		
Contribution to Professional Component:	Engineering Topics		
Relationship of Course to Program:	Meets: Educational Objectives <u>1, 2, 4</u> Program Outcomes <u>A, B, E, G, K</u>		
Prepared by:	Dr. Dave (Dae-Wook) Kim	Date:	October 10, 2008
Approved by CAC:			