WASHINGTON STATE UNIVERSITY
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School of Engineering and Computer Science

MECH 309: Introduction to Engineering Materials

Catalog Data:	**309 [M] Introduction of Engineering Materials** 3 (2-3) Course Prerequisite: MECH 215; CHEM 105 or concurrent enrollment; PHYSICS 201 or concurrent enrollment. Structure of materials, phase equilibrium, phase transformations, mechanical failure, and mechanical properties; materials testing laboratory. Typically offered Fall.
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:	MECH 215; CHEM 105 or concurrent enrollment; PHYSICS 201 or concurrent enrollment.
Prerequisites by Topic:	1. Periodic table, stoichiometry, structure, gases, liquids, solids, solutions, equilibrium, thermodynamics 2. Motion and dynamics of particles and rigid bodies
Textbook:	W. D. Callister, Jr., David G. Rethwisch, *Materials Science and Engineering: An Introduction*, 9th edition, Wiley, New York (2013)
Course Coordinator:	Dr. Dave Kim
Course Objectives:	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:	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. Ceramic materials for engineering applications 8. Polymers in engineering applications 9. Lab report writing
Lab Experiments and Activities:	1. X-ray diffraction measurement test 2. Microstructure test: optical microscopes, metallic and non-metallic samples. 3. Fourier transform infrared spectroscopy test 4. Knoop microhardness tester 5. Hardness test: Brinell hardness tester 6. Tensile test: compression/tensile tester with computer interface, metallic and polymer samples

Course Outcomes:	Students will be able to:	
	Assessed for Student Outcomes	3-a. Produce a variety of lab reports for technical audiences, using discipline-specific conventions including graph/tables, citations, etc. 6-a. Identify the constraints, assumptions, and appropriate models for the material characterization experiments. 6-b. Use appropriate materials testing equipment, standardized methods and apparatus for material property evaluations. 6-c. Conduct data analysis and interpretation from materials testing. 6-d. Draw useful conclusions through validating experimental results with respect to assumptions, constraints, and theory in materials science.
	Other	1-a. Describes fundamental scientific (chemistry, physics) and engineering principles (material science) in material properties and material systems. 1-d. Applies scientific (chemistry, physics) and engineering principles (material science) toward solving engineering problems.

Required or Elective Course:	Required		
Relationship of Course to Program:	Meets: Educational Objectives 1, 2, 4 Student Outcomes 1, 3, 6		
Prepared by:	Dr. Dave Kim	Date:	4/6/2018 (4.6.18 mb)
Approved by USC:	4/16/18		