

**OBJECTIVES/COMPETENCIES**

<b>Course Objectives</b>	<b>Competencies</b>
<ol style="list-style-type: none"> <li>1. Understand and identify the commonly used engineering materials types and classifications including UNS, AISI, ASTM</li> <li>2. Understand the different mechanical, physical and chemical properties of engineering materials</li> <li>3. Understand the relationship between force, stress, strain, elongation, stiffness, and other important mechanical properties and behavior of engineering materials</li> <li>4. Understand the basics of metallurgy including microstructure, phase diagrams and time-temperature-transformation diagrams used in the heat treatment of metals</li> <li>5. Understand common material testing methods including tensile testing, impact testing (Charpy &amp; Izod), fatigue testing (S-N curves), creep testing, Rockwell and Brinell hardness testing</li> <li>6. Understand the basic methods for materials property enhancement</li> <li>7. Understand principles of non-destructive testing of materials</li> </ol>	<ul style="list-style-type: none"> <li>• Define the four classifications of materials: Metals, Polymers, Ceramics, and Composites</li> <li>• Characterize and contrast the behavior of commonly used metals, polymers, ceramics and composites</li> <li>• Compare and contrast the mechanical, physical and chemical properties of the different classifications of materials</li> <li>• Define and visualize crystalline and amorphous structures of materials and their relation to mechanical properties</li> <li>• Define Anisotropic vs Isotropic behavior of materials</li> <li>• Calculate simple direct stress</li> <li>• Calculate axial strain</li> <li>• Generate a Stress-Strain Diagram from supplied Test Data</li> <li>• Conduct a Stress-Strain Test using the Tensile Testing Machine</li> <li>• Identify different points on the curve of the Stress-Strain diagram</li> <li>• Calculate Modulus of Elasticity, Elongation, reduction of area, .2% Offset Yield Point</li> <li>• Define ductile vs brittle behavior as depicted on stress-strain graphs</li> <li>• Explain the use of an Equilibrium Phase Diagram for a binary alloy system</li> <li>• Explain the various heat treatments used to enhance or change the behavior of metals including, Quench hardening, Annealing, Martensite formation, Normalizing, Tempering, Precipitation hardening, austempering, bainite formation</li> <li>• Use a metallurgical microscope for inspection of various microstructures</li> <li>• Use a material database to select suitable materials for mechanical components considering service requirements and material properties</li> </ul>