

**Departmental Syllabus**

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**Prepared by the Department of Engineering Sciences and Applied Technology**

**Date of Departmental Approval:** August 28, 2017

**Date approved by Curriculum and Programs:** October 11, 2017

**Effective: Fall 2018**

1. **Course Number:** ENR207  
**Course Title:** Materials Science
  
2. **Description:** Materials science incorporates elements of physics, chemistry, and engineering and focuses on the structure, processing, and the characteristic limits of various materials. Study of materials science advances understanding of research areas such as nanotechnology, biomaterials, and metallurgy, forensic engineering and failure analysis. The course focuses on structure and characteristics of materials, material defects, testing and failure mechanisms of materials, applications of different materials, and the economic/environmental impact of various materials.
  
3. **Student Learning Outcomes** (instructional objectives, intellectual skills):  
Upon successful completion of this course, students are able to do the following.
  - Explain types of atomic bonds and the crystal structure of materials.
  - Demonstrate an understanding of material defects, dislocations, and diffusions.
  - Perform various material strength calculations.
  - Compare and contrast how material strength is tested and measured for various types of materials.
  - Explain elastic deformation and elastic modulus.
  - Demonstrate an understanding of basic material failure mechanisms.
  - Explain the impact of plastic deformation, material corrosion, and oxidation.
  - Demonstrate an understanding of the thermal properties of materials.
  - Compare the properties of polymers, ceramics, and composite materials.
  - Evaluate proper uses and applications of different materials.
  - Compare the economic and environmental impact of various materials.
  
4. **Credit(s):** 3 credits
  
5. **Satisfies General Education Requirement:** No
  
6. **Prerequisite(s):** CHM151 (General Chemistry I)
  
7. **Semester(s) Offered:** Varies
  
8. **Suggested General Guidelines for Evaluation:** The course grade is based on homework assignments; class work and participation; one-hour exam(s); and a final examination.
  
9. **General Topical Outline** (Optional):
  1. Structure of materials
  2. Defects, dislocations, and diffusion in materials
  3. Microstructure-property-processing relationships of metals and metal alloys
  4. Phase equilibrium diagrams
  5. Heat treatment
  6. Elastic deformation
  7. Elastic modulus
  8. Yield strength
  9. Poisson's ratio
  10. Plastic deformation
  11. Failure mechanisms
  12. Stress/strain and strain gages
  13. Mechanical testing
  14. Corrosion and oxidation
  15. Thermal properties
  16. Polymers, ceramics, and composites
  17. Uses/applications of different materials
  18. The economic/environmental impact of various materials.