

Master Syllabus

MET 2151 - Material Science

Division: Science, Mathematics and Engineering

Department: Mechanical Engineering Technology

Credit Hour Total: 3.0

Lecture Hrs: 2.0 **Lab Hrs:** 2.0

Prerequisite(s): MET 1101 AND PHY 1131 OR PHY 1141 AND CHE 1111

Date Revised: June 2014

Course Description:

Terminology, designations of metals and the relationship among the properties of metals, the environment and heat treatment processes. Selecting and testing materials. Factors related to the selection of nonmetallic materials and the relationship between the nature of the materials and their properties. Thermoplastics, thermosetting, ceramics, composites and glasses are included. Two classroom, two lab hours per week.

General Education Outcomes:

- ▣ Written Communication
- ▣ Critical Thinking/Problem Solving
- ▣ Computer Literacy
- ▣ Information Literacy

Course Outcomes:

Properties of materials

Describe how the structures and properties of selected metallic materials are related to performance in terms of strength, stiffness, ductility, toughness, hardness, and density.

Assessment Method: Locally developed exams

Performance Criteria: 70% or better on all exams

Carbon steels

Perform experiments on various steels to determine the impact of different carbon levels and quenches on the properties.

Assessment Method: Performance appraisals

Performance Criteria: 70% or more of available points on lab activity and report

Environmental issues

Demonstrate an awareness of "cradle-to-grave" environmental issues.

Assessment Method: Locally developed exams

Performance Criteria: 70% or better on all exams

Common polymers

Identify common polymers and their applications.

Assessment Method: Locally developed exams

Performance Criteria: 70% or better on all exams

Properties of paper and polymers

Measure the mechanical properties of paper and polymers.

Assessment Method: Behavioral observations

Performance Criteria: 70% or more of available points on lab results

Engineering materials

Analyze and select engineering materials to highlight advantages and limitations that might limit the selection of each for the use with a given manufacturing process. Select metallic materials to meet customer requirements for a particular product. Use appropriate references to locate material properties.

Assessment Method: Locally developed exams

Performance Criteria: 70% or better on all exams

Non-metallic materials

Apply the following concepts in the selection of an appropriate non-metallic material (directionality, fatigue, strength to weight ratio, ductile to brittle transition, impact temperature and moisture resistance, resiliency, elongation, thermal conductivity, and electrical conductivity) given the operating environment.

Assessment Method: Locally developed exams

Performance Criteria: 70% or better on all exams

Outline:

Review of organic chemistry
Mechanical properties
Wood, paper, ceramics and abrasives
Food
Polymers, and elastomers and polymerization reactions
Packaging
Environmental issues
Material selection
Relationship among design, processes and inherent materials properties
Properties of metals and their measurement (hardness, tensile strength, and toughness)
Introduction to physical chemistry and phase diagrams
Crystalline structures and bonding
Strengthening mechanisms
Diffusion
Precipitation reactions
Heat treatment of steels and nonferrous light metals
Effect of use environment
Forms of corrosion