

## 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