

University of Toledo

Mechanical Engineering Technology

Master Syllabus

Course Title: *Applied Material Science* **Course Code & Number:** *MET 2310*

Credit Hour Total: 3

Lecture Contact Hours: 3 **Lab Contact Hours:** 0

Prerequisite(s): *ENGT 3010, CHEM 1230, CHEM 1280*

Text: *Materials Science and Engineering, An Introduction, 8th Ed., W. D. Callister, Jr.*

Software: none

Course Description: (Approved Catalog Description)

Study of the relationships between structures and properties for common engineering materials, including metals, polymers, ceramics and composites. Mechanical behavior, temperature effects, heat treatment, corrosion and electrical properties are covered.

Related Program Outcomes:

Outcome a: ability to select and apply the knowledge, skills and modern tools to engineering design

Outcome f: Students will have ability to identify, analyze, and solve broadly defined ET problems

Outcome j: Knowledge of the impact of ET solutions in a societal and global context

Course Objectives:

Upon completion of this course, the students will be able to:

- 1) Describe engineering materials in terms of structural characteristics like crystal structure, organic composition and properties, atomic structure, etc.
- 2) Explain the materials mechanical properties in terms of hardness, modulus of elasticity, tensile strength, yield strength, shear strength
- 3) Describe how the steels are made, including but not limited to, melting, casting, rolling
- 4) Describe the heat treatment impact on the chemical composition of materials

5) Select the appropriate engineering materials based on their chemical and mechanical properties

Course Outline:

- Basic atomic structure
- Compositions based on either mass, volume, or atomic fractions
- Metal crystal structures and theoretical densities
- Metallography / Microscopy
- Stress, strain behavior, including tensile strength, yield strength, elastic modulus, shear modulus, and ductility
- Rockwell, Brinell and superficial hardness
- Metal strengthening mechanisms
- Metal failure mechanisms, including fatigue and creep
- Phase diagrams for metals
- The iron / carbon system and its relationship; to steel and cast iron
- Phase transformations for steel and associated heat treating processes
- Families of alloys and their basic properties
- Basic ceramic structures and theoretical densities
- Densities and porosities of aggregates
- Viscosity
- Polymer structures and processes
- Types of composites and their mechanical properties
- Metal corrosion processes
- Electrical properties