

University of Toledo

Mechanical Engineering Technology

Master Syllabus

Course Title: *Applied Material Science Laboratory* **Course Code & Number:** *MET 2320*

Credit Hour Total: *1*

Lecture Contact Hours: *1* **Lab Contact Hours:** *1*

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)

Laboratory based 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) Collect laboratory data concerning material properties
- 2) Analyze the collected data using statistical methods
- 3) Function as part of a laboratory team.
- 4) Communicate the results of laboratory experiments effectively
- 5) Understand the social context in which the materials are utilized

Course Outline:

- Basic atomic structure
- 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
- Iron / carbon phase diagrams
- Phase transformations for steel and associated heat treating processes
- Viscosity of glasses
- Electro-chemical reactions of materials

Major laboratory projects:

- Steel density and microstructure
- Tensile properties of steel, brass, and aluminum
- Rockwell hardness
- Toughness tests with an impact pendulum
- Iron carbon phase diagrams and their relationship to low, medium, and high carbon steels
- Annealing, normalizing and quenching
- Porous materials and aggregate mixtures
- Creep
- Polymer identification from density measurements
- Metal corrosion processes