

1. Course Number and Name:

ENGT 3040 Applied Materials Science

2. Credits and Contact hours:

Credits: 4 hours, Contact: 3 lecture hours; 2 lab hours

3. Instructor's or course coordinator's name:

Gary L. Daugherty

4. Text book, title, author, and year:

Materials Science and Engineering, An Introduction, 8th Edition, W.D. Callister,

a. Other supplemental materials:

Minitab or other statistical analysis software

5. Specific Course Information:

a. Brief description of the content of the course (catalog description):

A 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.

b. Pre-requisites, or co-requisites:

CHEM 1230, ENGT 3010, and MET 2120

6. Specific goals for the course:

a. Specific outcomes of instruction:

1. Utilize a variety of analytical skills in the interpretation of material properties.
2. Collect laboratory data concerning material properties and analyze it using statistical methods.
3. Function as part of a laboratory team.
4. Communicate the results of laboratory experiments effectively.
5. Understand some of the social contexts in which materials are utilized.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:

- A. An understanding of the analytical skills associated with mechanical engineering technology, as evidenced by the ability to solve a variety of problems concerning the properties of metals, polymers, ceramics and composites.
- C. An ability to conduct, analyze, and interpret experiments, as evidenced by the data and data analyses associated with numerous laboratory reports.
- E. An ability to function as part of a team, as evidenced by attendance and participation in the conduct of laboratory experiments with laboratory partners.
- G. An ability to communicate effectively, as evidenced by numerous laboratory reports.

7. Brief list of topics to be covered:

1. Basic atomic structure.
2. Compositions based on either mass, volume, or atom fractions.
3. Metal crystal structures and theoretical densities.
4. Metallography / Microscopy.
5. Stress / strain behavior, including tensile strength, yield strength, elastic modulus, shear modulus, and ductility.
6. Rockwell, Brinell and superficial hardness.
7. Metal strengthening mechanisms.
8. Metal failure mechanisms, including fatigue and creep.
9. Binary equilibrium phase diagrams for metals.
10. The iron / carbon system and its relationship to steel and cast iron.
11. Phase transformations for steel and associated heat treating processes.
12. Families of alloys and their basic properties.
13. Basic ceramic structures and theoretical densities.
14. Densities and porosities of aggregates.
15. Viscosity.
16. Polymer structures and processes.
17. Types of composites and their mechanical properties.
18. Metal corrosion processes.
19. Electrical properties.