

MSE 201: Materials Science

- Course description:* Structure of materials, phase equilibrium, phase transformations, and mechanical properties
- Number of credits:* 3. This course is required.
- Course Coordinator:* Scott Beckman
- Prerequisites by course:* Chem 105; Physics 201 or concurrent enrollment
- Prerequisites by topic:*
1. Basic knowledge of thermodynamics, organic and inorganic chemical structures
 2. Electron configuration and structures leading to valence in atoms
- Postrequisites:*
- ME 310: Manufacturing Processes
MSE 316: Thermodynamics and Kinetics of Materials
MSE 320: Materials Structure – Properties Laboratory
MSE 321: Materials Characterization
MSE 401: Metallic Materials
MSE 402: Polymeric Materials
MSE 403: Ceramic Materials
MSE 413: Mechanics of Solids
- Textbooks/other required materials:*
1. Callister, W. *Materials Science & Engineering: An Introduction*. Wiley, 2019
- Course objectives:*
1. Survey of different types of materials and materials science: metals, ceramics, polymers, composites, and materials selection.
 2. Develop a structure-properties perspective.
 3. Understand the physical and mechanical properties of materials through the basic nature of their bonds.
- Topics covered:*
1. Characterizing the periodic table from a materials perspective: metals, non-metals, and semiconductors.
 2. Primary and secondary bonding in materials.
 3. Metallic/ceramic crystal systems.
 4. Defects in crystal systems and impact on materials properties.
 5. Diffusion and diffusion mechanisms.
 6. Phase diagram reactions and the kinetics of heat treatments.
 7. Testing and mechanical characterization of all materials.
 8. Ferrous and non-ferrous metals for engineering applications.
 9. Glass and ceramic materials for engineering applications.
 10. Polymers in engineering applications.
 11. Composites for engineering applications.
 12. Basic concepts in corrosion.

Expected learning outcomes:

1. Be able to relate the mechanical qualities of any material to the type of primary or secondary bonding present.
2. Understand the basic concepts of stiffness, hardness, toughness, ductility, fatigue, resiliency, and how these qualities are measured for all materials.
3. Effects of structure and defects on mechanical properties of solids.
4. Kinetic processes in materials.
5. Fabrication and processing of engineering materials.
6. Be able to interpret a phase diagram and apply the Lever Law.
7. Develop a basic understanding of polymer matrix, metal matrix and ceramic matrix composite systems.

Class schedule:

Three 50-minute lecture sessions per week, for one semester

Laboratory schedule:

None

Contribution to meeting the professional component:

Engineering Topics

Relationship of course to student outcomes:

3 strongly supported; 2 supported; 1 minimally supported

Student Outcomes Pre-Fall 2018
(ABET EC2000)

Student Outcomes Fall 2018 forward
(ABET EC2019)

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	1	2	3	4	5	6	7	8	9	10	11
3											3				3						3	3	3		

Prepared by: Andrea Butcherite and Dr. Scott Beckman

Date: May 30, 2018