

EGR 221 - MATERIAL SCIENCE

Course Description

Introduction to the structure, processing, properties, and performance of engineering materials, including metals, polymers, glasses, ceramics, and composites. Presents case studies covering selection of materials, component design, and analysis of component failures. Group 2 course.

Credit Hours

3

Contact Hours

3

Lecture Hours

3

Required Prerequisites

MTH 141, ENG 111; CHM 150 may be taken concurrently.

General Education Outcomes supported by this course

Critical Thinking - Direct

Course Learning Outcomes

Knowledge:

- Identify different types of structure in all classes of inorganic materials.
- Describe why the design of structure in all classes of inorganic materials has a profound impact on observed properties.
- Will define crystal structures.
- Describe how different classes of inorganic materials are processed through basic diffusion.
- Define both quality and quantity of properties including mechanical, thermal, electrical, optical, magnetic, and chemical properties.
- Describe the structure of crystalline materials using the nomenclature of Bravais Lattices and Miller Indices.

Application:

- Predict basic physical properties of materials based on a knowledge of their atomic composition and chemical bonding.
- Explain the impacts of defects at the atomic and microstructures scales.
- Describe the compositions, phases and microstructures developed during heat treatments of binary solid systems using binary phase diagram.
- Interpret phase diagrams to predict the development of microstructures that impact phase transformations.

Integration:

- Solve problems involving kinetics of phase transformations in metal alloy systems by applying principles of nucleation theory and solid state diffusion.
- Solve engineering problems using the principles of solid state diffusion to determine the effects of heating on composition profiles.

Human Dimension:

- Develop interpersonal and team work skills.

Caring - Civic Learning:

- Discuss the importance of structure-property relations in engineering materials.
- Describe the challenges faced in the use of modern engineering materials.

Learning How to Learn:

- Utilize their core knowledge to analyze new information in their field.
- Utilize engineering skills and literacy to conduct research beyond this course.