MENG286 – Material Science

Eastern Mediterranean University
Faculty of Engineering

Department:
Mechanical Engineering

Program Name: Mechanical Engineering	**ProgramCode:** 23		
Course Code: MENG286	**Course Title:** Material Science	**Credits:** 3 Cr	**Year/Semester:** 2019-2020 Fall

- ☒ Engineering or Area Core
- ☐ Engineering Course offered by other programs
- ☐ Engineering or Area Elective
- ☐ Mathematics and Basic
- ☐ Sciences General Education

Prerequisite(s): CHEM101

Catalog Description:
Major classes of materials, atomic structure and bonding, crystallographic points, lines and planes, structure of crystalline solids. Point and line defects and imperfections in solids, diffusion in solids, mechanical properties of metals, stress-strain in metals, tensile test, hardness testing, dislocations and plastic deformation of metals, strengthening of metals, recovery and recrystallization. Fracture, fatigue and creep of metals, impact test. Phase diagrams of alloy systems, iron-iron carbide phase diagram, phase transformations, heat treatments applied to metallic materials and plain-carbon steels. Corrosion of metals, corrosion prevention, mechanical properties of ceramics, polymers and composites.

Instructor Name:	**Office No:**	**Office Tel:**
Senior Lecturer Emir Tascioglu	ME121	1455

Course Web Page: https://staff.emu.edu.tr/mohammedasmael/en

Textbook(s):
1) Materials Science and Engineering, W.D. Callister, Jr. and D.G. Rethwisch, 9th edition, John Wiley and Sons Inc. (2011).

Indicative Basic Reading List :

Topics Covered and Class Schedule:

Week 1-2	Materials science and engineering, classification of materials, atomic structure and bonding
Week 3-4	Crystal structures, unit cells, crystal systems, crystallographic directions and planes, metallic crystal structures, linear and planar densities.
Week 5-6	Imperfections in solids, point defects, line defects. Diffusion in solids, diffusion phenomena, mechanisms of diffusion, steady- state & non-steady state diffusion.
Week 7-8	Evaluation of mechanical properties of materials, tensile test, stress-strain diagrams, elastic and plastic deformation, ductility, resilience, toughness, hardness tests.
Week 9	**Midterm Examination Week**
Week 10-11	Dislocations, strengthening mechanisms in metals, recovery and recrystallization. Failure, ductile and brittle fracture, impact test, fatigue and creep of metals.
Week 12-13	Phase diagrams of alloy systems, binary eutectic systems, iron-iron carbide phase diagram, phase transformations, heat treatments applied to metallic materials and plain-carbon steels.
Week 14-15	Corrosion of metals, forms of corrosion, corrosion prevention. Ceramics, polymers and composite materials.
Week 16	**Final Examination Week**

Lecture and Tutorial Learning Outcome		Student Outcomes	Performed Assessments and Percentage
• Classify the solid materials, learning and understanding the atomic bonding in solids. Calculate the density of a material from the knowledge of the crystal structure understanding and drawing the cubic crystal structures, Unit cell, Face-centered cubic, body-centered cubic .Understanding and calculating the Miller indices of Crystallographic directions and planes. • Understanding and describing the imperfections and dislocations in the solids and calculating the grain size of a crystalline material. • Understanding the diffusion mechanisms and using the Fick's Laws to make calculations for the diffusion problems. • Understanding the mechanical properties of materials, the Hooke's law, the stress and strain relations, Poisson's ratio, ductility, hardness methods and conducting an experiment assign. • Understanding the phase diagrams for alloy systems, learning to make a correlation between microstructure and mechanical properties by carefully control of the heat treatment processes. • Understanding the importance of a heat treatment, and the effects on microstructure of the iron-carbon alloys. To understand how the desired microstructure will be produced by which heat treatment process. • To understand phase transformations and resulting microstructure obtained • Understanding of the mechanisms and causes of corrosion and degradation of metals and learning the prevention methods. Learning the basics about ceramics, polymers and composites. .		**a**	Midterm exam 25% Quizzes 15% Final exam 40% Assigment 5%
Lab. Experiment Title and Lab. Equipment Used	**Lab Learning Outcome**	**Student Outcomes**	**Performed Assessments and Percentage**
Lab 1: Tensile test Lab 2: Hardness test Lab 3: Impact test	Understanding and define the mechanisms and the techniques used to strengthening and harden the materials and the various failure modes such as, fracture, fatigue and creep.	**b**	Laboratory reports 15%

Contribution of Course to Criterion 5

Credit Hours for:
Mathematics & Basic Science: 0
Engineering Sciences and Design: 3
General Education: 0

Important Notes:

University rules and regulations are applied to this course.
Attendance is essential, minimum of 80% of attendance is required for regular students. Any attendance less than 50% will be treated as NG.