

The University of Jordan
Faculty of Engineering & Technology



Department	Course Name	Course Number	Semester
Mechanical Engineering	Materials Science for Mechanical Engineers	0904274	Spring 2022/2023

2019 Course Catalog Description

This course introduces the basic principles underlying the behavior of materials. Provide the scientific foundation for understanding of the relations among material properties, microstructure, macrostructure, and behavior of metals, polymers, and ceramics. Deals with atomic structure and bonding, the structure of crystalline solids, imperfection in solids, dislocations and strengthening mechanisms, phase diagrams and alloy formation, ferrous metals, and nonferrous metals and alloys.

Instructors

Name	E-mail	Sec	Office Hours	Lecture Time
Professor Salih Akour	akour@ju.edu.jo	01	Per announced	ONLINE: Mon, Wed

Text Books

	Textbook 1	Textbook 2
Title	Materials Science and Engineering: an introduction	Class Handouts
Author(s)	William D. Callister and David G. Rethwisch	
Publisher, Year, Edition	John Wiley & Sons, 2017, 10th edition	

References

Books	Foundations of Materials Science and Engineering, William F. Smith, McGraw-Hill Education, Sixth Edition
Journals	
Internet links	http://web.mst.edu/~mecmovie/

Prerequisites

Prerequisites by topic	-
Prerequisites by course	General Chemistry I (0303101)
Prerequisite for	Smart Structures (0914587), Rapid prototyping (0914530),

Topics Covered

Week	Topics	Chapter in Text
1	Introduction	Chapter 1
2,3	Atomic Structure and Bonding	Chapter 2
4,5	The Structure of Crystalline Solids	Chapter 3
6	Imperfections in Solids	Chapter 4
7	Diffusion	Chapter 5
8	Mechanical Properties of Metals	Chapter 6
9	Dislocations and Strengthening Mechanisms	Chapter 7
10	Failure	Chapter 8
11,12	Phase Diagrams	Chapter 9
13	Phase Transformations: Development of Microstructure and Alteration of Mechanical Properties	Chapter 10
14	Applications and Processing of Metal Alloys	Chapter 11
15	Structures and Properties of Ceramics	Chapter 12
16	Polymer Structures	Chapter 14

Mapping of Course Outcomes to ABET Student Outcomes

Course Outcomes	SOs
1. Discuss/explain the importance of materials structure at different levels of structure.	1
2. Understand the concepts of crystalline structure and its relations to physical and mechanical properties.	1
3. Understand the mechanical behaviour of metallic materials.	1
4. Understand and appreciate the difference between the different types of Binary Phase Diagrams and appreciate the diffusion phenomena and their application to solid materials.	1

Evaluation

Assessment Tools	Expected Due Date	Weight
Midterm Exam	TBA (as per Department's timetable)	25 %
Classwork (Project, HW, Quizzes, etc.)	Throughout the semester	25 %
Final Exam	TBA (as per Department's timetable)	50 %

Contribution of Course to Meet the Professional Components

The course contributes to building the fundamental basic concepts of design analysis of structures and basic machine components.

Relationship to Student Outcomes

SOs	1	2	3	4	5	6	7
Availability	X						

ABET Student Outcomes (SOs)

1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3	An ability to communicate effectively with a range of audiences
4	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Updated by ABET Committee, 2021

Prepared by: Dr. Moudar Zgoul, October 2021

Revised by: Prof. Naser Al-Huniti and Prof. Salih Akour