

Course E-Syllabus

1	Course title	Properties of Engineering Materials
2	Course number	906273
3	Credit hours	3 Hrs
	Contact hours (theory, practical)	Theory 5 hours per week
4	Prerequisites/ corequisites	Chem. 101 / 0303101
5	Program title	B.Sc. Industrial Engineering
6	Program code	
7	Awarding institution	The University of Jordan
8	School	Engineering
9	Department	Industrial Engineering
10	Level of course	Mandatory course 2 nd . year
11	Year of study and semester (s)	1 st . 2020 - 2021
12	Final Qualification	
13	Other department (s) involved in teaching the course	
14	Language of Instruction	English/Arabic
15	Teaching methodology	<input checked="" type="checkbox"/> Blended <input checked="" type="checkbox"/> Online
16	Electronic platform(s)	<input checked="" type="checkbox"/> Moodle <input checked="" type="checkbox"/> Microsoft Teams <input type="checkbox"/> Skype <input checked="" type="checkbox"/> Zoom <input type="checkbox"/> Others
17	Date of production/revision	10/10/2020

18 Course Coordinator:

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19 Other instructors:

Name:
Office number:
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Name:
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20 Course Description:

Introduction, Bonding forces and energies. Classification of engineering materials. Crystallography. X-ray diffraction. Imperfection in solids and strengthening mechanisms. Diffusion. Metallography. Mechanical properties of materials. Material testing evaluation and failure. Thermal equilibrium diagram. Corrosion of metals and their protection. Case studies in material selection. Relative cost of materials.

21 Course aims and outcomes:

Course Learning Outcome #	After successful completion of this course, the student will be able to	SO
CLO1	Be able to discuss/explain the importance of materials structure at different levels of structure.	1
CLO2	Understand the concepts of crystalline structure and its relations to physical and mechanical properties	1
CLO3	Understand the nature and importance of different types of lattice imperfections. Have a detailed idea about mechanical behavior of metallic materials.	1
CLO4	To be able to understand and appreciate the difference between the different types of Binary Phase Diagrams and appreciate the diffusion phenomena and its application to solid materials. & Selection of material processing method	2
CLO5	To be able to work within group as a team and submit a project that will enhance their knowledge in, at least one of the subjects of course, and improvement their soft skills	3

The B.Sc. in industrial Engineering program enables students to achieve, by the time of graduation the following program learning outcome (SOs)

1	<i>an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics</i>	6	<i>an ability to develop and conduct appropriate experimentation, analyze and interpret data and use engineering judgment to draw conclusions</i>
2	<i>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</i>	7	<i>an ability to acquire and apply new knowledge as needed, using appropriate learning strategies</i>
3	<i>an ability to communicate effectively with a range of audiences</i>		
4	<i>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</i>		
5	<i>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</i>		

Course Objective:

1. To understand the role of material sciences in the different engineering disciplines.
2. To introduce the different engineering materials, their basic properties, as well as the different material
3. To introduce the mechanical properties of the engineering materials.
4. To have a clear understanding of the relationship between microstructure and engineering properties. Material selection and compatibility.
5. To introduce the basics Fundamentals of Fracture and Mechanical Failures
6. Understanding of phase diagrams and it's important to the engineers related to the design and control of heat treating processes.
7. Introduction to the alloys, their types, and general applications.

22. Topic Outline and Schedule:

Week	Lecture	Topic	Teaching Methods*/platform	Evaluation Methods**	References
1	1.1	Chapter 1 -Introduction, Historical, Role of material science in the engineering disciplines,	Online / Microsoft teams	Homework, Quiz, Exam	Materials Science and Engineering, William Callister,
	1.2	Classification of materials		Homework, Quiz, Exam	Materials Science and Engineering, William Callister
	1.3	Interatomic Bonding:	Online / Microsoft teams	Homework, Quiz, Exam	Materials Science and Engineering, William Callister
	1.4	Atomic bonding in solids	Online /	Homework, Quiz, Exam	Materials Science and Engineering, William Callister
	1.5	Primary and secondary bonding.	Online / Microsoft teams	Homework, Quiz, Exam	Materials Science and Engineering, William Callister
2	2.1	The Structure of Crystalline Solids	Online / Microsoft teams	Homework, Quiz, Exam	Materials Science and Engineering,
	2.2	Crystal structure. Polymorphism and allotropy	Online / Microsoft teams	Homework, Quiz, Exam	Materials Science and Engineering, William Callister
	2.3	Crystal systems. Crystallographic directions and planes	Online / Microsoft teams	Short Quiz (Microsoft Forms)	Materials Science and Engineering, William Callister
	2.4	Single crystals. Polycrystalline materials.	Online / Microsoft teams	Homework, Quiz, Exam	Materials Science and Engineering, William Callister
	2.5	Anisotropy & X-RAYS-	Online / Microsoft teams	Homework, Quiz, Exam	Materials Science and Engineering, William Callister
3	3.1	Imperfections in Solids and Material Characterization:	Online / Zoom Microsoft teams	Homework, Quiz, Exam	Materials Science and Engineering, William Callister
	3.2	Point defects.	Online / Microsoft teams	Homework, Quiz, Exam	
	3.3	Line defects.	Online / Zoom Microsoft teams	Homework, Quiz, Exam	
	3.4	Plane defects. Bulk defects	Online / Zoom Microsoft teams	Homework, Quiz, Exam	
	3.5	X-ray Diffraction. Microscopic examination.	Online / Zoom Microsoft teams	Homework, Quiz, Exam	

4	4.1	Diffusion phenomena & mechanism	Online / Zoom Microsoft teams	Homework, Quiz, Exam	Materials Science and Engineering, William Callister
	4.2	Steady & Non Steady- State Diffusion	Online / Zoom	Midterm Exam	
	4.3	Mechanical Properties of Materials, Elastic & Plastic deformation. Yeild , UTS, Hardness, Toughness	Online / Zoom Microsoft teams	Homework, Quiz, Exam	
	4.4	Dislocations. Mechanisms of strengthening in metals.	Online / Zoom Microsoft teams	Homework, Quiz, Exam	
	4.5	Recovery, recrystallization and grain growth.	Online / Zoom Microsoft teams	Homework, Quiz, Exam	
5	5.1	Factors Affecting Stress- Strain Behavior	Online / Zoom Microsoft teams	Homework, Quiz, Exam	Materials Science and Engineering, William Callister
	5.2	Design (Safety) Factor	Online / Zoom Microsoft teams	Homework, Quiz, Exam	
	5.3	Fundamentals of Fracture and Mechanical Failures	Online / Zoom Microsoft teams	Homework, Quiz, Exam	
	5.4	Phase Diagrams, and Heat Treatment:	Online / Zoom Microsoft teams	Homework, Quiz, Exam	
	5.5	Basics. Equilibrium phase diagrams. .	Online / Zoom Microsoft teams	Short Quiz (Microsoft Forms)	
6	6.1	Strengthening by heat treatments.	Online / Zoom Microsoft teams	Homework, Quiz, Exam	Materials Science and Engineering, William Callister
	6.2	Iron carbon phase diagram	Online / Zoom Microsoft teams	Homework, Quiz, Exam	
	6.3	Basics of diffusion processes. Factors that influence diffusion	Online / Zoom	Homework, Quiz, Exam	
	6.4	Strengthening by heat treatments.	Online / Zoom Microsoft teams	Homework, Quiz, Exam	
	6.5	Metal Alloys, and Their Characteristics:	Online / Zoom Microsoft teams	Short Quiz (Microsoft Forms)	
7	7.1	Steel. Copper. Aluminum. Titanium. Structure and properties	Online / Zoom Microsoft teams	Homework, Quiz, Exam	Materials Science and Engineering, William Callister
	7.2	Material Selection and Design Considerations	Online / Zoom Microsoft teams	Homework, Quiz, Exam	
	7.3	Applications and processing of metals	Online / Zoom Microsoft teams	Homework, Quiz, Exam	

	7.4	Precipitation Hardening	Online / Zoom Microsoft teams	Homework, Quiz, Exam	
	7.5	Corrosion in metals and methods of protection	Online / Zoom Microsoft teams	Short Quiz (Microsoft Forms)	
8	8.1	Revision	Online / Zoom Microsoft teams		
	8.2	Revision	Online / Zoom Microsoft teams		
	8.3			Final exam	

- Teaching methods include: Synchronous lecturing/meeting; Asynchronous lecturing/meeting
- Evaluation methods include: Homework, Quiz, Exam, pre-lab quiz...etc

23 Evaluation Methods:

Opportunities to demonstrate achievement of the ILOs are provided through the following assessment methods and requirements:

Evaluation Activity	Mark	Topic(s)	Period (Week)	Platform
Homework, Quiz,	2	Interatomic Bonding:	2	Online / Zoom Microsoft teams
Homework, Quiz,	2	The Structure of Crystalline Solids	3	Online / Zoom Microsoft teams
Homework, Quiz,	2	Imperfections in Solids & Diffusion	4	Online / Zoom Microsoft teams
Homework, Quiz,	2	Mechanical Properties	5	Online / Zoom Microsoft teams
Homework, Quiz,	2	Phase Diagrams	6	Online / Zoom Microsoft teams
Project & Presentation skills	15		7	Online / Zoom Microsoft teams

24 Course Requirements (e.g: students should have a computer, internet connection, webcam, account on a specific software/platform...etc):

Student should have a computer and internet connection.

25 Course Policies:

A- Attendance policies: all students are expected to attend all one line meetings. Any student with more than 15% missing classes is subject to be failed in the class.

B- Absences from exams and submitting assignments on time: all students should submit the assigned quizzes, short late submission is permissible if the student had internet issues during the exam. Final exam is expected to be on campus and all absent student are subject to the university regulation for accepting their absence excuse through the office of the assistant dean for student affairs

C- Health and safety procedures: none

a. D- Honesty policy regarding cheating, plagiarism, misbehavior: Discuss the assignments among yourselves. This is helpful to the learning process. However, direct copying of others work will NOT be allowed or tolerated and will result in a reduction of grade.

E- Grading policy:

Home Works & Class + Quizzes	: 10%
Projects & Presentation skills	: 10%
Mid Exam	: 30%
Final Exam	: 50%
Total	: 100%

F- Available university services that support achievement in the course: school of engineering computer labs

26 References:

A- Required book(s), assigned reading and audio-visuals:

1. William D Callister, Materials Science and Engineering, 11th Edition, Wiley publishers. (Text Book)

References:

1. Donald R. Askeland, *The science and engineering of materials*, Boston, PWS Pub. 2010.
2. James F. Shackelford, *Introduction to materials science for engineers*, Upper Saddle River, N.J., Prentice Hall, 2012.

27 Additional information:

Name of Course Coordinator: **Yousef Al Abdallat** Signature: **Yousef Abdallat** Date:
10/10/2020

Head of Curriculum Committee/Department: **Prof. Mohammad Altahat** Signature: -----

Head of Department: **Prof. Mohammad Altahat** Signature: -----

Head of Curriculum Committee/Faculty: ----- Signature: -----
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Dean: ----- Signature: -----
