



College: Engineering

Department: Civil

Course Title: **Materials Science**

Course No: CE300

Credit Hours: 3 Hours

Semester: First

### About The Course

Course Title: **Materials Science**

Class:

Course No: CE300

Credit Hours: 3

Lecture Room:

Obligatory/ Optional: Obligatory

Text Book: Callister, Materials Science and Engineering, (6th Ed.)

McGraw-Hill Companies, Inc.

### The Instructor

Name: Eng. Alaa' Falaileh

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## Course Description

1. Introduction to materials science and engineering
2. Atomic structure and inter atomic bonding
3. Structure of crystalline solids
4. Imperfections in solids
5. Diffusion
6. Mechanical properties of metals
7. Dislocation and strengthening mechanism
8. Failure
9. Electrical properties
10. Thermal properties
11. Magnetic properties
12. Optical properties

1. مقدمة في علوم وهندسة المواد
2. التركيب الذري والترابط الذري
3. هيكل المواد الصلبة البلورية
4. عيوب في المواد الصلبة
5. الانتشار
6. الخواص الميكانيكية للمعادن
7. الازاحة والية المقاومة والتعزيز
8. الفشل
9. الخواص الكهربائية
10. الخصائص الحرارية
11. الخصائص المغناطيسية
12. الخصائص البصرية

## Course Objectives

1. Determine the indices of different crystal directions and planes in unit cell
2. Determine different point defects, dislocation, and interfacial defects in the material.
3. Compute the concentration in the steady state and non-steady state.
4. Determine the true stress, true strain, resilience, toughness, and ductility of different materials.
5. Determine the fatigue life, tertiary creep of different materials under different loads.
6. Determine the indices of different crystal directions and planes in unit cell
7. Determine different point defects, dislocation, and interfacial defects in the material.
8. Compute the concentration in the steady state and non-steady state.
9. Determine the true stress, true strain, resilience, toughness, and ductility of different materials.

## Learning Outcome

Making students aware of how language works to convey meaning as its basic function

## Course Outline and Time schedule

Week	Course Outline
First week	Introduction of Materials Science and Engineering
	Why Study Materials Science and Engineering
	Classification of Materials
	Advanced Materials
2 <sup>nd</sup> week	Introduction of Atomic structure and inter atomic bonding
	Fundamental Concepts of atomic structure
	Electrons in Atoms
	Atomic bonding in solids
3 <sup>rd</sup> week	Introduction of The Structure of Crystalline Solids
	Fundamental Concepts of structure of crystalline solids
	Unit Cells
	Metallic Crystal Structures
4 <sup>th</sup> week	Density Computations (Theory + Example)
	Crystallographic points and directions (Example)
5 <sup>th</sup> week	Introduction of Imperfections in Solids
	Point defects
	Vacancies and Self-Interstitials

6 <sup>th</sup> week	Impurities in Solids
	Specification of Composition
	Dislocations–Linear Defects 88
	Interfacial Defects
7 <sup>th</sup> week	<b>Review &amp; Exam I</b>
8 <sup>th</sup> week	Introduction of Diffusion
	Diffusion Mechanisms
9 <sup>th</sup> week	Steady-State Diffusion
	Factors That Influence Diffusion
	Introduction of Mechanical Properties of Metals
	Concepts of Stress and Strain
	Elastic deformation (Stress-Strain Behavior)
	An elasticity
	Elastic Properties of Materials
10 <sup>th</sup> week	PLASTIC DEFORMATION Tensile Properties
	True Stress and Strain
	Elastic Recovery after Plastic Deformation
	Compressive, Shear, and Torsional Deformation
	Hardness
11 <sup>th</sup> week	property variability and design/safety factors
	Introduction of Dislocations and Strengthening Mechanisms
	Basic Concepts
	Characteristics of Dislocations
	Slip Systems

	Strengthening by Grain Size Reduction
	Solid-Solution Strengthening
	Strain Hardening
	recovery, recrystallization, and grain growth

12 <sup>th</sup> week	<b>Review &amp; EXAM II</b>
13 <sup>th</sup> week	Introduction of Failure
	Fundamentals of Fracture
	Ductile Fracture & Brittle Fracture
	Principles of Fracture Mechanics
	Impact Fracture Testing
	Fatigue Cyclic Stresses ,The S–N Curve ,Crack Initiation and Propagation , Factors That Affect Fatigue Life, Environmental Effects
	Creep Generalized Creep Behavior, Stress and Temperature Effects
	Electrical Properties ( ohm ’s law, electrical conductivity)
14 <sup>th</sup> week	Semi conductivity
	Dielectric behavior
	Thermal Properties (Heat capacity, thermal conductivity, thermal expansion, thermal stresses)
15 <sup>th</sup> week	Magnetic Properties
	Optical properties (Electromagnetic Radiation, Light Interactions with Solids, Atomic and Electronic, Interactions, Refraction, Reflection, Absorption, Transmission, Color, Opacity and Translucency in Insulators)
15 <sup>th</sup> week	<b>FINAL EXAM</b>

### **Presentation methods and techniques**

Methods of teaching varied according to the type of text, student and situation. The following techniques are usually used:

- 1- Lecturing with active participations.

- 2- Problem solving.
- 3- Cooperative learning.
- 4- Discussion.
- 5- Learning by activities.
- 6- Connecting students with different sources of information

### Sources of information and Instructional Aids

For example: Computer ... power point ...etc.

- Transparencies
- Distance learning
- Library sources

### Assessment Strategy and its tools

The assigned syllabus is assessed and evaluated  
Through: feed back and the skills that are acquired by the students

The tools:

- 1- Diagnostic tests to identify the students level and areas of weakness
- 2- Formal (stage) evaluation
  - a) Class Participation
  - b) Ist Exam
  - c) 2nd Exam
  - d) Activity file

### Tool & Evaluation

Tests are permanent tools & assessment, in addition to the activity file which contains curricular and the co-curricular activities, research, report papers and the active participation of the student in the lecture.

The following table clarifies the organization of the assessment schedule:

<b>Test</b>	<b>Date</b>	<b>Grade</b>
First Exam		20
2 <sup>nd</sup> Exam		20
Activities & Participation	Students should be notified about their marks	20
Final Exam		40

### **Activities and Instructional Assignment**

- 1- Practical assignments to achieve the syllabus objectives.
- 2- .....

#### **Regulations to maintain the teaching-Learning Process in the Lecture:**

- 1- Regular attendance.
- 2- Respect of commencement and ending of the lecture time.
- 3- Positive relationship between student and teacher.
- 4- Commitment to present assignments on time.
- 5- High commitment during the lecture to avoid any kind of disturbance and distortion.
- 6- High sense of trust and sincerity when referring to any piece of information and to mention the source.
- 7- The student who absents himself should submit an accepted excuse.
- 8- University relevant regulations should be applied in case the students behavior is not accepted.



9- Allowed Absence percentages is ( %).

### Internet websites

1.....

2.....

3.....

### References :

1. Engineering Materials Technology by Jacobs and Kilduff

2.....

3.....

## Syllabus Classification

Objectives	<i>Learning outcome</i>	<i>Assessment tools</i>
1-		
2-		
3-		
4-		
5-		

