Module (Course Syllabus) Catalogue

2022-2023

College/ Institute	**Erbil Technical Engineering College**	
Department	**Technical Mechanical and Energy Engineering**	
Module Name	**Engineering Materials**	
Module Code	**ENM 404**	
Degree	**Technical Diploma** ☐ **Bachler** ■ **High Diploma** ☐ **Master** ☐ **PhD** ☐	
Semester	**5th**	
Qualification	**Ph.D. In Materials & Mechanical Engineering**	
Scientific Title	**Lecturer**	
ECTS (Credits)	**5**	
Module type	**Prerequisite** ☐ **Core** ■ **Assist.** ☐	
Weekly hours	Tuesday 08:30 am-10:30 am	Tuesday 10:30 am-12:30 pm
Weekly hours (Theory)	**(2)hr Class**	**(24)Total hrs Workload**
Weekly hours (Practical)	**(2)hr Class**	**(24)Total hrs Workload**
Number of Weeks	**12**	
Lecturer (Theory)	**Dr. Zhwan Dilshad**	
E-Mail & Mobile NO.	Zhwan.ibrahim@epu.edu.iq	
Lecturer (Practical)	**Mrs. Bayan Amin Mohammad**	
E-Mail & Mobile NO.		
Websites		

Course Book

<table>
<tr><td>Course Description</td><td>Description:

This required course is an introduction to the structure-property relationships of solid materials (metals, ceramics, polymers and composites). Topics covered include atomic structure and bonding, crystal structures, crystal structure imperfections, introduction to strength of materials and strengthening mechanisms, diffusion, introduction to phase diagrams, and the thermal, electrical, magnetic, and optical properties of materials.</td></tr>
<tr><td>Course objectives</td><td>1. Describe, discuss, and explain what the field of materials science includes.
2. Describe, discuss, and explain atomic structure, bonding, crystal structure and microstructure. And the significant relation between microstructure, property and performance</td></tr>
<tr><td>Student's obligation</td><td>• To be willing to learn.
• To treat everyone in the class (fellow students, instructors, teaching assistants, and visitors) with respect.
• To do work on time.
• To accept that previous academic preparation (e.g., mathematics, lower engineering courses) will affect your performance in this course.
• To realize that your perception of effort is not used as a basis for grade assignments.
• To not plagiarize.
• To come to office hours and talk to me if you have any problem with course material or related activities.</td></tr>
<tr><td>Required Learning Materials</td><td>Basic math and physics are required</td></tr>
<tr><td>Evaluation</td><td>
<table>
<tr><th colspan="2">Task</th><th>Weight (Marks)</th><th>Due Week</th><th>Relevant Learning Outcome</th></tr>
<tr><td colspan="2">Paper Review</td><td></td><td></td><td></td></tr>
<tr><td rowspan="6">Assignments</td><td>Homework</td><td>5</td><td>5 & 7</td><td></td></tr>
<tr><td>Class Activity</td><td>2</td><td>TBD</td><td></td></tr>
<tr><td>Report</td><td>10</td><td>9</td><td></td></tr>
<tr><td>Seminar</td><td>10</td><td>10</td><td></td></tr>
<tr><td>Essay</td><td>0</td><td></td><td></td></tr>
<tr><td>Project</td><td>0</td><td></td><td></td></tr>
<tr><td colspan="2">Quiz</td><td>8</td><td>6 & 8</td><td></td></tr>
<tr><td colspan="2">Lab.</td><td>15</td><td>TBD</td><td></td></tr>
<tr><td colspan="2">Midterm Exam</td><td>10 + 15</td><td>TBD</td><td></td></tr>
<tr><td colspan="2">Final Exam</td><td>15 + 20</td><td>TBD</td><td></td></tr>
<tr><td colspan="2">Total</td><td>100</td><td></td><td></td></tr>
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Specific learning outcome:	1. Explain material defects and their significance. 2. Use the isomorphous phase diagram to determine compositions and relative amounts of phases present. 3. Describe and explain solid state diffusion. 4. Relate **macroscopic physical and mechanical properties of solid materials** including thermal, electrical, magnetic, and optical properties, to **microscopic causes** (based on fundamental principles), including chemical bonding, crystal structure, and microstructure. 5. Describe and explain thermal, electrical, magnetic and optical properties in terms of microscopic causes. 6. Be able to describe the differences in macroscopic physical properties for: metals, polymers, ceramics, semiconductors, and composite materials in terms of microscopic causes.
Course References:	W. D. Callister, "Materials Science and Engineering: An Introduction," 9th Ed. John Wiley & Sons, Inc., NY, 2010 ***Additional Material:*** Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available online **Additional References:** 1. W. D. Callister, Fundamentals of Materials Science and Engineering, (all editions) 2. D. R. Askeland, Science and Engineering of Materials, (all editions) 3. J.F. Shackelford, Introduction to Materials Science for Engineers, (all editions)

Course topics (Theory)	**Week**	**Learning Outcome**
Course Introduction	1	
Atomic Structure	2	
Atomic Bonding	3-4	
Structure of Crystalline Solids	5	
Structure of Metals	6-7	
Structure of Ceramics	8	
Imperfections in Solids	9	
Mechanical Properties Metals	10-11	
Deformation and Strengthening	12	
Practical Topics	**Week**	**Learning Outcome**
Introduction to Microscopy	1-2	

Techniques for sample preparation	3-4	
Sample examination using all different available microscopes	5-7	
Different heat treatments and effects examination through microscopy	8-12	

Questions Example Design

Q: Calculate the atomic packing factor for FCC structure. A: 0.74

Q: What is the essential difference between optical and electron microscope:

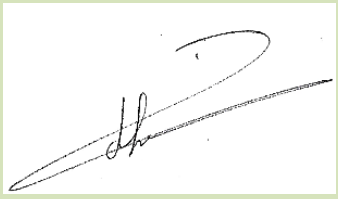
A: Optical microscopes use photons or light energy, while electron microscopes use electrons, which have shorter wavelengths that allows greater magnification. (electron microscopes deliver a more detailed image compared to optical microscopes)

Extra notes:

1. Read relevant text sections prior to the associated class so you will be familiar with the topic under discussion in advance, and have questions ready to ask during discussions. Be proactive.
2. Take notes during class.
3. Work in teams on homework problems beginning at least the weekend before they are due.

External Evaluator

I confirm that this coursebook is satisfy and covers all the requirement of the Materials Engineering Module.



Dr. Dlair O. Ramadan