Course Specification
(Bachelor)

Course Title:	Materials Science
Course Code:	ME2133
Program:	Mechanical Engineering
Department:	Department of Mechanical Engineering
College:	College of Engineering and Architecture
Institution:	Umm Al-Qura University
Version:	*Course Specification Version Number*
Last Revision Date:	*Pick Revision Date.*

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3)					
2. Course type					
A.	☐ University	☐ College	☒ Department	☐ Track	☐ Others
B.	☒ Required		☐ Elective		
3. Level/year at which this course is offered: (4th Level/2nd Year)					
4. Course General Description:					
Materials Engineering is a broad, multidisciplinary field devoted to understanding the role of materials in the design of engineering systems. This class focuses on the fundamental concepts of Materials Science as they apply in Engineering. The theoretical background in analyzing engineering materials behavior by emphasizing important relationships between internal structure and properties will also be reviewed. The course will also highlight how materials processing affects their properties and environmental behavior. The latest achievements in Materials Science and Engineering are also discussed.					
5. Pre-requirements for this course (if any):					
CHM1106 Chemistry for Engineering					
6. Co-requisites for this course (if any):					
7. Course Main Objective(s):					
1- Understand the concepts of atomic bonding, crystal structures, imperfections, diffusion, mechanical properties, electron energy, and dislocations related to engineering materials' processing and performance. 2- Understand the relationship between structure, properties, processing, and performance of materials that are essential for understanding the role of materials in the design of engineering parts, structures & systems. 3- Understand the microstructure characteristics, electronic properties, materials formation, and manipulation of microstructure for application in engineering design and materials processing.					

4- Understand the relations between the composition, temperature, and phase fractions applied to equilibrium phase diagrams for given material systems.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	75	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	45
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	
Total		75

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**Identify the fundamental principles and applications relevant to Materials Science and Engineering.**	**K1,I**	**Lectures.**	**In-class activities, homework assignments, quizzes, periodic exams 1 & 2, and**

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
				final exams.
1.2	Describe the concepts of materials science as related to the processing and performance of engineering materials.	K1,I	Lectures.	In-class activities, homework assignments, quizzes, periodic exams 1 & 2, and final exams.
1.3	Explain how structure and processing affect the properties and performance of materials.	K1,I	Lectures.	In-class activities, homework assignments, quizzes, periodic exams 1 & 2, and final exams.
1.4	Apply materials engineering knowledge of mathematics, science, and engineering with clear insight into the basis for the selected solution for properties and characteristics of the given material using materials property data.	K1,P	Lectures.	In-class activities, homework assignments, quizzes, periodic exams 1 & 2, and final exams.
1.5	Describe the effect of the Materials Science and Engineering solutions in economic,	K2,I	Lectures.	In-class activities, homework assignments,

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	environmental, and societal contexts.			**quizzes, and final exams.**
2.0	**Skills**			
2.1	Conduct mechanical engineering experiments and analyze, evaluate and present information, ideas, concepts and data, as well as considering uncertainties and draw valid conclusions	**S2**	**Lectures.**	**In-class activities, homework assignments, quizzes, and final exams.**
2.2				
...				
3.0	**Values, autonomy, and responsibility**			
3.1	Use basic skills in self-learning as a base for lifelong learning in topics related to metal alloys, phase diagram and phase transformation.	**V3**	**Lectures.**	**In-class activities, homework assignments, quizzes, and final exams.**
3.2				
...				

C. Course Content

No	List of Topics	Contact Hours
1.	**Introduction to Material Science**	**3**
2.	**Atomic Structure and Interatomic Bonding**	**10**
3.	**The Structure of Crystalline Solids**	**12**
4.	**Imperfections in Solids**	**6**
5.	**Diffusion**	**6**
6.	**Phase Diagrams**	**15**
7.	**Phase Transformations**	**10**
8.	**Heat Treatment**	**10**
9.	**Economic, Environmental, and Societal Issues in Materials Science and Engineering**	**3**
Total		**75**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework and quiz assignments # 1: Introduction to Material Science (descriptive and numerical type of questions)	2	2%
2.	Homework and quiz assignments # 2: Atomic Structure and Interatomic Bonding (descriptive and numerical type of questions)	3	2%
3.	Homework and quiz assignments # 3: The Structure of Crystalline Solids (descriptive and numerical type of questions)	5	2%
4.	Homework and quiz assignments # 4: Imperfections in Solids (descriptive and numerical type of questions)	6	2%
5.	Periodic exam 1 (written test and/or oral test)	7	20%
6.	Homework and quiz assignments # 5: Diffusion (descriptive and numerical type of questions)	9	2%
7.	Homework and quiz assignments # 6: Phase Diagrams (descriptive and numerical type of questions)	11	4%
8.	Homework and quiz assignments # 7: Phase Transformations (descriptive and numerical type of questions)	12	2%
9.	Homework and quiz assignments # 8: Heat Treatment (descriptive and numerical type of questions)	13	2%
10.	Periodic exam 2 (written test)	14	20%
11.	Homework and quiz assignments # 9: Economic, Environmental, and Societal Issues in Materials Science and Engineering (descriptive and numerical type of questions)	15	2%
12.	Final exam (written test)	16/17	40%
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*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	**Materials Science and Engineering: An Introduction, Authors (William D. Callister, Jr. and David G. Rethwisch): 10th edition, (ISBN 978-1-119-40549-8), Wiley (2018)**
Supportive References	
Electronic Materials	
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	**Classrooms**
Technology equipment (projector, smart board, software)	**Data show**
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect
Effectiveness of Students assessment	Peer Reviewers	Direct
Quality of learning resources	Faculty	Direct
The extent to which CLOs have been achieved	Faculty	Direct
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	