

## Course Syllabus

1	Course title	MATERIALS CHEMISTRY	
2	Course number	0303453	
3	Credit hours	3	
	Contact hours (theory, practical)	3+0	
4	Prerequisites/corequisites	Physical Chemistry I	
5	Program title	Chemistry	
6	Program code	03	
7	Awarding institution	The University of Jordan	
8	School	Science	
9	Department	Chemistry	
10	Course level	4 <sup>th</sup> year	
11	Year of study and semester (s)	2 <sup>nd</sup> semester 2023-2024	
12	Other department (s) involved in teaching the course	none	
13	Main teaching language	English	
14	Delivery method	<input checked="" type="checkbox"/> Face to face learning <input type="checkbox"/> Blended <input type="checkbox"/> Fully online	
15	Online platforms(s)	<input type="checkbox"/> Moodle <input checked="" type="checkbox"/> Microsoft Teams <input type="checkbox"/> Skype <input type="checkbox"/> Zoom <input type="checkbox"/> Others.....	
16	Issuing/Revision Date		

### 17 Course Coordinator:

Name:	Imad Hamadneh	Contact hours:	Sun, Tus, Thu 12:00-1:00
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**18 Other instructors:**

Name:

Office number:

Phone number:

Email:

Contact hours:

Name:

Office number:

Phone number:

Email:

Contact hours:

**19 Course Description:**

This introductory course covers the history and definition of materials chemistry, crystalline and amorphous solids, which includes bonding in solids (ionic, covalent, metallic, molecular), electrical behavior and band theory, structural properties, and synthesis.



**20 Course aims and outcomes:**



#### A- Aims: Course Learning Outcomes (0303453) Materials Chemistry

Upon successful completion of this course, students will be able to:

- CLO-1. Problem-Solving: Graduates will be able to apply mathematical and scientific knowledge to calculate the crystalline volume, dimensions, densities, and directions. The calculations related to materials synthesis (ASO-1)
- CLO-2. Identify, formulate, and solve scientific problems in the area of Materials Chemistry. (ASO-1 & ASO-2)
- CLO-3. Design: Graduates will be able to use their understanding of materials synthesis and chemistry concepts to formulate and design ceramics with different techniques to meet the application's desires. (ASO-1 and ASO-2)

#### B- Students Learning Outcomes (SLOs):

- SO-1. Problem Solving: Graduates will be able to apply mathematical and scientific knowledge to identify, formulate, and solve technical or scientific problems relevant to the discipline of chemistry.
- SO-2. Design: Graduates will be able to use their understanding of chemistry concepts and principles to formulate and design systems, processes, procedures, or programs to meet desired goals and outcomes.
- SO-3. Experimental Skills: Graduates will be able to design, conduct, and analyze experiments or test hypotheses, utilizing appropriate chemical techniques and scientific judgment to draw meaningful conclusions.
- SO-4. Communication: Graduates will be able to communicate scientific information effectively and accurately to a range of audiences, including both technical and non-technical audiences.
- SO-5. Ethics and Global Context: Graduates will understand and apply ethical and professional responsibilities in the context of the impact of technical and scientific solutions on global, economic, environmental, and societal issues.
- SO-6. Teamwork: Graduates will be able to work effectively as part of a team, establishing goals, planning tasks, meeting deadlines, and analyzing risk and uncertainty in the context of chemistry-related projects and initiatives.
- SO-7. Handling Chemicals: An ability to apply the proper procedures for safe handling of chemicals.

SLOs SLOs of the course	SLO (1)	SLO (2)	SLO (3)	SLO (4)
CLO-1	✓			
CLO-2	✓	✓		
CLO-3	✓	✓		

## 21. Topic Outline and Schedule:

Week	Lecture	Topic	Student Learning Outcome	Learning Methods (Face to Face/Blended/ Fully Online)	Platform	Synchronous / Asynchronous Lecturing	Evaluation Methods	Resources
1	1.1	Introduction	CLO1 CLO 2	Face to Face	Classroom		1 <sup>st</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr
	1.2	Classification of materials	CLO1 CLO 2	Face to Face	Classroom		1 <sup>st</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr
	1.3	Bonding in solids	CLO1 CLO 2	Face to Face	Classroom		1 <sup>st</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr

2	2.1	crystal systems versus Amorphus	CLO1 CLO 2	Face to Face	Classroom	1 <sup>st</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr
	2.2	Unit cells, point coordinates,	CLO1 CLO 2	Face to Face	Classroom	1 <sup>st</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr
	2.3	crystallographic directions,	CLO1 CLO 2	Face to Face	Classroom	1 <sup>st</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr
3	3.1	crystal structures, crystal systems,	CLO1 CLO 2	Face to Face	Classroom	1 <sup>st</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr
	3.2	density calculations (bulk, linear)	CLO1 CLO 2	Face to Face	Classroom	1 <sup>st</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr
	3.3	density calculations (planar, and theoretical)	CLO1 CLO 2	Face to Face	Classroom	1 <sup>st</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr
4	4.1	single crystals & polycrystalline materials.	CLO1 CLO 2	Face to Face	Classroom	1 <sup>st</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr
	4.2	x-ray powder diffraction.	CLO1 CLO 2	Face to Face	Classroom	1 <sup>st</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr
	4.3	polymorphism and allotropy	CLO1 CLO 2	Face to Face	Classroom	1 <sup>st</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr
5	5.1	Ceramics, Structural determination.	CLO1 CLO 2	Face to Face	Classroom	2 <sup>nd</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr

	5.2	Super-lattice, AX, AX2.	CLO1 CLO 2	Face to Face	Classroom		1 <sup>st</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr
	5.3	ABX3, and silicate.	CLO1 CLO 2	Face to Face	Classroom		1 <sup>st</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr
6	6.1	Defects	CLO1 CLO 2	Face to Face	Classroom		1 <sup>st</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr
	6.2	Point Defects	CLO1 CLO 2	Face to Face	Classroom		1 <sup>st</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr
	6.3	Vacancies	CLO1 CLO 2	Face to Face	Classroom		1 <sup>st</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr
7	7.1	self-interstitial impurities in solids	CLO1 CLO 2	Face to Face	Classroom		1 <sup>st</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr
	7.2	Electrical behavior	CLO1 CLO 2	Face to Face	Classroom		1 <sup>st</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr
	7.3	Ohm's Law,	CLO1 CLO 2	Face to Face	Classroom		1 <sup>st</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr
8	8.1	the effect of temperature,	CLO1 CLO 2	Face to Face	Classroom		1 <sup>st</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr
	8.2	band theory,	CLO1 CLO 2	Face to Face	Classroom		1 <sup>st</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr
	8.3	microstructure, and scanning	CLO1 CLO 2	Face to Face	Classroom		1 <sup>st</sup> exam	Fundamentals of Materials Science and

		electron microscopy (SEM)						Engineering (10thEd) William D. Callister, Jr	
9	9.1	Ceramic synthesis	CLO1 CLO 2	Face to Face	Classroom		2 <sup>nd</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr	
	9.2	calculation of starting powders	CLO1 CLO 2	Face to Face	Classroom		2 <sup>nd</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr	
	9.3	solid-state route	CLO1 CLO 2	Face to Face	Classroom		2 <sup>nd</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr	
10	10.1	sol-gel	CLO1 CLO 2	Face to Face	Classroom		2 <sup>nd</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr	
	10.2	co-precipitation	CLO1 CLO 2	Face to Face	Classroom		2 <sup>nd</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr	
	10.3	spray pyrolysis	CLO1 CLO 2	Face to Face	Classroom		2 <sup>nd</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr	
11	11.1	self-ignition methods	CLO1 CLO 2	Face to Face	Classroom		2 <sup>nd</sup> exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr	
	11.2	Composite materials	CLO1 CLO 2	Face to Face	Classroom		Final exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr	
	11.3	Nanomaterials and Nanotechnology	CLO1 CLO 2	Face to Face	Classroom		Final exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr	
12	12.1	nanoscale materials	CLO1 CLO 2	Face to Face	Classroom		Final exam	Fundamentals of Materials Science and	

								Engineering (10thEd) William D. Callister, Jr	
	12.2	Quantum behaviour of nanomaterials	CLO1 CLO 2	Face to Face	Classroom		Final exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr	
	12.3	polymeric nanomaterials	CLO1 CLO 2	Face to Face	Classroom		Final exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr	
13	13.1	nanoscale building blocks	CLO1 CLO 2	Face to Face	Classroom		Final exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr	
	13.2	carbon nanotube	CLO1 CLO 2	Face to Face	Classroom		Final exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr	
	13.3	Materials Applications	CLO1 CLO 2	Face to Face	Classroom		Final exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr	
14	14.1	Biomaterial applications	CLO1 CLO 2	Face to Face	Classroom		Final exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr	
	14.2	polymers	CLO1 CLO 2	Face to Face	Classroom		Final exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr	
	14.3	geopolymers	CLO1 CLO 2	Face to Face	Classroom		Final exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr	
15	15.1	superconductors	CLO1 CLO 2	Face to Face	Classroom		Final exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr	
	15.2		CLO1 CLO 2	Face to Face	Classroom		Final exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr	

	15.3		CLO1 CLO 2	Face to Face	Classroom		Final exam	Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr
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## 22 Evaluation Methods:

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

Evaluation Activity	Mark	Topic(s)	SLOs	Period (Week)	Platform
1 <sup>st</sup> exam	30	-Introduction -Atomic Structure and Interatomic Bonding -The Crystalline State Ceramics -Imperfections in Solids	CLO1 CLO 2	5 <sup>th</sup> week	In the department
2 <sup>nd</sup> exam	20	- Physical properties of ceramics -Ceramic synthesis	CLO1 CLO 2	10 <sup>th</sup> week	In the department
Final	50	-Introduction -Atomic Structure and Interatomic Bonding -The Crystalline State Ceramics -Imperfections in Solids	CLO1 CLO 2	17 <sup>th</sup> week	In the department



		- Physical properties of ceramics -Ceramic synthesis			

### 23 Course Requirements

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

### 24 Course Policies:

- A- Attendance policies:
- B- Absences from exams and submitting assignments on time:
- C- Health and safety procedures:
- D- Honesty policy regarding cheating, plagiarism, misbehavior:
- E- Grading policy:
- F- Available university services that support achievement in the course:

### 25 References:

- A- Required book(s), assigned reading and audio-visuals:
  - 1- Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr.
- B- Recommended books, materials, and media:
  - 1-The Science and Engineering of Materials (6th Ed), Donald Askeland

### 26 Additional information:

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Name of Course Coordinator: ---Imad Hamadneh-----Signature: ----- Date: --9-6-2024---
Head of Curriculum Committee/Department: ----- Signature: ----- ---
Head of Department: ----- Signature: ----- -
Head of Curriculum Committee/Faculty: ----- Signature: ----- -
Dean: ----- Signature: -----