



Form: Course Syllabus	Form Number	EXC-01-02-02A
	Issue Number and Date	2/3/24/2022/2963 05/12/2022
	Number and Date of Revision or Modification	
	Deans Council Approval Decision Number	2/3/24/2023
	The Date of the Deans Council Approval Decision	23/01/2023
	Number of Pages	06

1.	Course Title	Materials Science
2.	Course Number	0333743
3.	Credit Hours (Theory, Practical)	(3,0)
	Contact Hours (Theory, Practical)	(3,0)
4.	Prerequisites/ Corequisites	none
5.	Program Title	Chemistry
6.	Program Code	03
7.	School/ Center	Science
8.	Department	Chemistry
9.	Course Level	Master
10.	Year of Study and Semester (s)	2024-2025
11.	Other Department(s) Involved in Teaching the Course	none
12.	Main Learning Language	English
13.	Learning Types	<input type="checkbox"/> Face to face learning <input checked="" type="checkbox"/> Blended <input type="checkbox"/> Fully online
14.	Online Platforms(s)	<input type="checkbox"/> Moodle <input checked="" type="checkbox"/> Microsoft Teams
15.	Issuing Date	20/11/2024
16.	Revision Date	20/11/2024

17. Course Coordinator:

Name: Imad Hamadneh	Contact hours: 4-5 Mon, Wed
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18. Other Instructors:

Name:
Office number:
Phone number:
Email:
Contact hours:

19. Course Description:

As stated in the approved study plan.

20. Program Student Outcomes (SO's): (To be used in designing the matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program).

- SO1. Develop chemistry expertise, focus on theory and practice, and contribute to advancing knowledge in a specific research field.
- SO2. Conduct original, high-quality research that advances knowledge in chemistry by developing complex projects using innovative methodologies.
- SO3. Mentor junior researchers and students and demonstrate leadership in the scientific community through collaboration, peer review, and knowledge exchange.
- SO4. Recognize the ethical implications and responsibly use chemistry solutions to tackle global challenges.
- SO5. Participate in ongoing professional development to stay up to date with the latest research and innovations.

21. Course Intended Learning Outcomes (CLO's): (Upon completion of the course, the student will be able to achieve the following intended learning outcomes)

1. To correlate the principles of chemistry in Materials Science and Chemistry.
2. **Problem solving:** to be able to apply mathematical and scientific knowledge to calculate the crystalline volume, dimensions, densities, and directions. The calculations related to materials synthesis, using proper software for the calculations (ASO-1 -5).
3. **Design:** the postgraduates will be able to use their understanding of materials synthesis and chemistry concepts to formulate and design nanoceramics with different techniques to meet the application's desires. (ASO-1,2,3 and ASO-5).



Course CLOs	The learning levels to be achieved					
	Remembering	Understanding	Applying	Analysing	evaluating	Creating
CLO-1	✓			✓		
CLO-2	✓	✓	✓	✓	✓	
CLO-3	✓	✓	✓		✓	

22. The matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program:

Program SO's	SO (1)	SO (2)	SO (3)	SO (4)	SO (5)
Course CLO's					
CLO-1	✓			✓	
CLO-2	✓	✓	✓	✓	✓
CLO-3	✓	✓	✓		✓

23. Topic Outline and Schedule:

Week	Lecture	Topic	CLO/s Linked to the Topic	Learning Types Face to Face (FF) Blended (BL) Fully Online (FO)	Platform Used	Synchronous (S)	Evaluation Methods	Learning Resources
1	1.1	Properties of solids - Bonding,	1&2	BL				
	1.2	Crystal structure, crystal energy, Madelung constant,	1&2	BL				
	1.3	The Born-Lande Equation	1&2	BL				
2	2.1	The Kapustinskii's Equation.	1&2	BL			Assignment	
	2.2	Packing Factor 14 Bravais Lattices	1&2	BL				
	2.3	Clusters of atoms and molecules	1,2 &3	BL				
3	3.1	Directions Planes	1,2 &3	BL				
	3.2	Linear Density	1,2 &3	BL				
	3.3	Planar Density	1&2	BL				
4	4.1	Theoretical Density	1&2	BL				
	4.2	Actual Density and Porosity	1&2	BL			Assignment	
	4.3	Electronic structure of solids - Free electron theory,	1,2 &3	BL			Mid Exam	
5	5.1	Band theory, Fermi energy levels.	1,2 &3	BL				



	5.2	Imperfections on Solids	1,2 &3	BL				
	5.3	Electrons and holes, atomic imperfection	1,2 &3	BL				
6	6.1	Non-stoichiometry	1,2 &3	BL			Assignment	
	6.2	Line defects	1,2 &3	BL				
	6.3	Plane defects	1,2 &3	BL				
7	7.1	Phonons, excitons	1&2	BL			Assignment	
	7.2	Polarity, eximers	1,2 &3	BL				
	7.3	Characteristics of semiconductors - Electric, dielectric,	1,2 &3	BL				
8	8.1	Absorption of light, photoconductivity,	1,2 &3	BL				
	8.2	Diffraction of light, photoconductivity,	1,2 &3	BL				
	8.3	Magnetic, thermal and mechanical properties	1,2 &3	BL				
9	9.1	Imperfection equilibrium - Chemical potential.	1,2 &3	BL				
	9.2	Ionization, imperfection of native atoms.	1,2 &3	BL				
	9.3	Equilibria that control disorder, external impurities	1,2 &3	BL				
10	10.1	Diffusion - Theory	1,2 &3	BL				
	10.2	Kirkendal Effect,	1,2 &3	BL				
	10.3	Ionic conductivity	1,2 &3	BL			Presentations	
11	11.1	Structural transformation Classification,	1,2 &3	BL				
	11.2	kinetics, reaction order,	2 &3	BL				
	11.3	recrystallization, movement of grain boundaries	2 &3	BL			Assignment	
12	12.1	precipitation, sintering	2 &3	BL				
	12.2	Chemical reactions	1&2	BL				
	12.3	Non-crystallinity, dissociation	1&2	BL				
13	13.1	nucleation law, reactivity	1&2	BL			Assignment	
	13.2	photographic process	1&2	BL				
	13.3	oxidation theory.	1&2	BL				
14	14.1	Aspects of Solid-State Synthesis. - Self-assembly,	1&2	BL				
	14.2	Property of Materials, Processing, & Performance	1&2	BL				
	14.3	constructing and studying the properties of ordered molecules on surfaces.	1&2	BL			Assignment	
15	15.1	adsorption and sorption.	1&2	BL			Presentations	
	15.2	Surface alloys, Lever rule	1&2	BL			Presentations	



	15.3	catalysts and their application in surface chemistry,	1&2	BL			Presentations	
16							Final Exam	

24. Evaluation Methods:

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

Evaluation Activity	Mark	Topic(s)	CLO/s Linked to the Evaluation activity	Period (Week)	Platform
Midterm Exam	25	Properties of solids Crystal structure Electronic structure of solids		Week 7	
Assignments	10	All topic		Weeks (2-13)	
Final Presentation	15	Property of Materials, Processing, & Performance		Week 14	
Final Exam	40	All topic		Week 16	

25. Course Requirements:

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



26. 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:

27. References:

- A- Required book(s), assigned reading and audio-visuuls:
 - 1- Fundamentals of Materials Science and Engineering (10thEd) William D. Callister, Jr.
- B- Recommended books, materials, and media:
 - 1. Solid State Chemistry, CRC, (4th ED) Lesley E. Smart., Elaine A. Moore,
 - 2. The Science and Engineering of Materials (6th Ed), Donald Askeland

28. Additional information:

Name of the Instructor or the Course Coordinator: Prof. Imad Hamadneh.	Signature:	Date:
The Head of Graduate Studies Committee/ Department Chemistry Dr. Murad AlDamen, Prof.	Signature:	Date:
The Head of Department of Chemistry Dr. Murad AlDamen, Prof.	Signature:	Date:
Vice Dean for Graduate Studies and Scientific Research / School of Science Dr. Kamal Sweidan, Prof.	Signature:	Date:
The Dean of School of Science Dr. Mahmoud I. Jaghoub, Prof.	Signature:	Date:



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