Course Specification
(Bachelor)

Course Title:	SOLID STATE CHEMISTRY
Course Code:	CEM 455
Program:	CHEMISTRY
Department:	CHEMISTRY
College:	COLLEGE OF SCIENCE
Institution:	MAJMAAH UNIVERSITY
Version:	TP-153
Last Revision Date:	10/12/2024

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: (7th / 4th)					
4. Course General Description:					
This course introduces the general principles of crystal and molecular structures and structure-property relationship, investigation of structure, X-Ray diffraction, crystal structure, properties and types of solids.					
5. Pre-requirements for this course (if any)**:**					
CEM353					
6. Co-requisites for this course (if any)**:**					
None					
7. Course Main Objective(s):					
• Give a clear idea about the chemical and physical properties of the matter at its solid state. • Students will be able to differentiate between the main features of the crystalline and amorphous materials. • Taught the different crystal structures, their characterization, using the X-rays techniques and the identification of the structure defects. • Students will be familiarized with the solid solutions and their illustration by the phase diagram.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100
2	E-learning		

No	Mode of Instruction	Contact Hours	Percentage
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	45
2.	**Laboratory/Studio**	0
3.	**Field**	0
4.	**Tutorial**	0
5.	**Others (specify)**	0
Total		45

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	**Recognize the two main classes of solids (crystalline and amorphous) and tell their types and properties.**	**K1**	**- lectures (PowerPoint) and Video related to the topic. - Discussions - E-learning - Self-learning**	**- Midterms - Quizzes - Homework - Class participation - Encourage students to search the Internet for everything related to - Homework on the blackboard - Final exam - E-exam.**

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
2.0	**Skills**			
2.2	**Communicate effectively orally and written using appropriate presentation methods for different chemical issues like crystal systems, the fourteen Bravais's lattices, miller Indices of directions and plans and crystal system and their properties.**	**S2**	**- lectures (PowerPoint) and Video related to the topic. - Discussions - E-learning - Self-learning**	**- Midterms - Quizzes - Homework - Class participation - Encourage students to search the Internet for everything related to - Homework on the blackboard - Final exam - E-exam.**
2.4	**Applies the Miller semantics, calculates the size of the unit, determines the power of the grid, and identifies the unit building structure.**	**S4**		
3.0	**Values, autonomy, and responsibility**			
3.3	**Self-development, assess own learning and performance and autonomously make decisions regarding self-development and/or tasks based on convincing evidence.**	**V3**	**Assignments (individual or group) at regular intervals to solve and submit on time. • Participation of students in classroom discussion and problem solving sessions**	**- Observing student's participation in group activity. - Checklist of the tasks carried out by the student. Observing student's participation in group discussion. - Checklist of student's punctuality in**

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
			• Team work reports and presentations (data collection, internet search, data processing, analysis and reporting)	submitting work on time.

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to solid state chemistry.	6
2.	Crystal structures properties, crystal lattice, type of crystals (covalent - ionic)-cubic centered face-cubic centered body.	6
3.	Bravais lattices and study the symmetry operators, elements and axis of rotation, symmetry and point group of molecules and point group of unit cells-point groups and space groups.	6
4.	Calculate the volume of the unit cell, atomic radius, number of molecules, close and square packing, and the density.	6
5.	X- ray diffractions and Bragg's law, X-ray diffraction in the crystal structure-X-ray absorption- X-Ray spectrum experimental crystal study (Lewis Method-Rotatable crystal-powder diffraction) How to calculate Miller indices of directions and planes-calculate inter-planar d -spacing (dhkl)	6
6.	The crystal binding in solid Material, lattice energy and ionic charge.	6
7.	Defects in crystals.	3
8.	Amorphous materials.	3
9.	Solid solutions	3
Total		45

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework	Continues	5%
2.	Quizzes	End of topic	5%
3.	Presentation	One/semester	10%
4.	First midterm exam	6th	15%
5.	Second midterm exam	9th	15%
6.	E. exam	12th	10%
7.	Final written Exam	End of the semester	40%

*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	• Journal of Solid State Chemistry. • Solid State Science
Supportive References	•Anthony R. West, Solid State Chemistry and its Applications, 2nd ed., Wiley, 2014. •Amnon Aharony and Ora Entin-Wohlman "Introduction to Solid State Physics", World Scientific Publishing, 2018.
Electronic Materials	•http://www.mx.iucr.org/iucr-top/comm/cteach/pamphlets/13/node5.html •http://img.chem.ucl.ac.uk/sgp/mainmenu.htm •http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/intro3.htm •www.shef.ac.uk/.../solid-state-chemistry-applications-msc •www.simplybooks.in/solid-state-chemistry-its-anthony-r-book.. •www.infibeam.com/.../solid-state-chemistry-its-applications/9...
Other Learning Materials	•Isisdraw and Chemdraw and Chemoffice Software •http://scholle.oc.uni-kiel.de/herges/modeling/gliederung.html •http://chem-faculty.ucsd.edu/trogler/GroupTheory224/Grouptheory.html •http://phycomp.technion.ac.il/~ira/types.html

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	**Classrooms, E- learning, balckboard**
Technology equipment (projector, smart board, software)	**Data show, Smart Board**
Other equipment (depending on the nature of the specialty)	**None**

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	**students**	**students**
Effectiveness of Students assessment	**Program/Department Instructor**	**Program/Department Instructor**
Quality of learning resources	**Program/Department Instructor**	**Program/Department Instructor**
The extent to which CLOs have been achieved	**Peer review**	**Peer review**
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**CHEMISTRY DEPARTMENT COUNCIL**
REFERENCE NO.	**7**
DATE	**14-6-1446 H**