هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	**Crystal Structure**
Course Code:	**2034213-2**
Program:	**Bachelor in Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Taif University**
Version:	**2nd**
Last Revision Date:	**10/10/2023**

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2)					
2. Course type					
A.	☐University	☒ College	☐Department	☐Track	☐Others
B.	☐Required		☒ Elective		
3. Level/year at which this course is offered: (8th / 4th Year)					
4. Course general Description:					
The course extends the required "solid state physics 1" course to covers complementary important issues related to crystallography, including diffracted intensity calculation, analysis of diffraction patterns, lattice parameters calculation, indexing diffraction patterns, deducing crystalline structures, determining lattice type and associated microstructural parameters.					
5. Pre-requirements for this course (if any):					
None					
6. Co-requisites for this course (if any):					
None					
7. Course Main Objective(s):					
Generate X-rays spectra and patterns from diffraction by crystalline solids and carry out a complete crystallographic analysis of the diffracting sample.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30	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**	-
3.	**Field**	-
4.	**Tutorial**	-
5.	**Others (specify)**	-
Total		45

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

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Identify crystalline or amorphous phases in solids, and liquid-crystal phase pattern formation in liquid crystals or biological mineral liquid crystals.	K1	Lecture Discussion	Written exam
1.2	Recognize scattering from a crystal and relating the scattered pattern to the reciprocal lattice of the crystal.	K2	Lecture Discussion	Written exam
2.0	**Skills**			
2.1	Develop skills in a variety of X-ray diffraction methods	S1	Problem solving	Written exam
2.2	Analyze qualitatively and quantitatively the scattering intensity and calculate the diffraction parameters.	S4	Problem solving	Written exam
3.0	**Values, autonomy, and responsibility**			
3.1	Work effectively and responsibly within a team to perform class activities in	V2	Reports Activities	Evaluation of reports and activities

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	crystallography.			
3.2				

C. Course Content

No	List of Topics	Contact Hours
1.	**1- Solid and liquid crystals:** • The crystalline and amorphous state of solids • Bravais lattices and crystal systems • Crystal planes and directions and Miller indices • Types of crystal defects (point defects, F-center, line defects..) • History of Liquid crystals • Design of liquid crystalline materials and Liquid-crystal phases • Pattern formation in liquid crystals Theoretical treatment of liquid crystals	6
2.	**2- Diffraction of X-rays, neutrons and electrons in crystals:** • Generation and absorption of X-ray • Bragg's law • Scattering from a crystal • The reciprocal lattice • X-ray diffraction methods Diffraction pattern	6
3.	**Revision and Midterm exam**	2
4.	**3- Diffraction methods:** • Diffraction from a single crystal. • Diffraction from polycrystalline materials. • Construction and operation of a polycrystalline diffractometer • Monochromators and Soller slits Types of detectors.	6
5.	**4- Intensity calculation:** • Diffraction from electrons • Diffraction from an atom • Diffraction from a unit cell • Scale and Polarization factors Displacement and absorption factors.	6
6.	**5- Analyzing a diffraction pattern** • Indexing a polycrystalline pattern • Calculating the lattice constants • Deducing the crystallite size Deducing the microstrain	4

Total	30

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignments	Throughout Semester	20
2.	1st Periodic Exam	7	15
3.	2nd Periodic Exam	12	15
4.	Final Exam	16	50

*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	M. Ali Omar, Elementary Solid State Physics: Principles and Applications, Publisher: Addison-Wesley Publishing Company, ISBN-13: 978-8177583779, ISBN-10: 8177583778, (1993).
Supportive References	S.R. Cullity B.D. & Stock, Elements of X-ray Diffraction, 3rd Edition, Publisher: Pearson, ISBN-13: 978-0201610918, ISBN-10: 0201610914, (2014).
Electronic Materials	Interactive simulations for science and math: https://phet.colorado.edu/
Other Learning Materials	Lecture notes and PowerPoints presentations prepared by the lecturer.

2. Required Facilities and equipment

Items	Resources
facilities	A classroom with movable tables and chairs conducive to group discussion and teamwork.
Technology equipment	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

Assessment Areas/Issues	Assessor	Assessment Methods
Student Feedback on Effectiveness of Teaching	Students	Indirect
Evaluation of Teaching	Pear reviewer Program coordinator Departmental council Faculty council	Indirect
Improvement of Teaching	Program coordinator Relevant committee	Direct
Quality of learning resources	Students Instructor Faculty	Indirect
Extent of achievement of course learning outcomes,	Program coordinator Instructor	Direct
Course effectiveness and planning for improvement	Program coordinator Instructor	Indirect
Student Feedback on Effectiveness of Teaching	Students	Indirect

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	PHYSICS DEPARTMENT COUNCIL
REFERENCE NO.	NO. 4-45
DATE	27/09/2023 (12/03/1445)

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Physics Department
TU
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