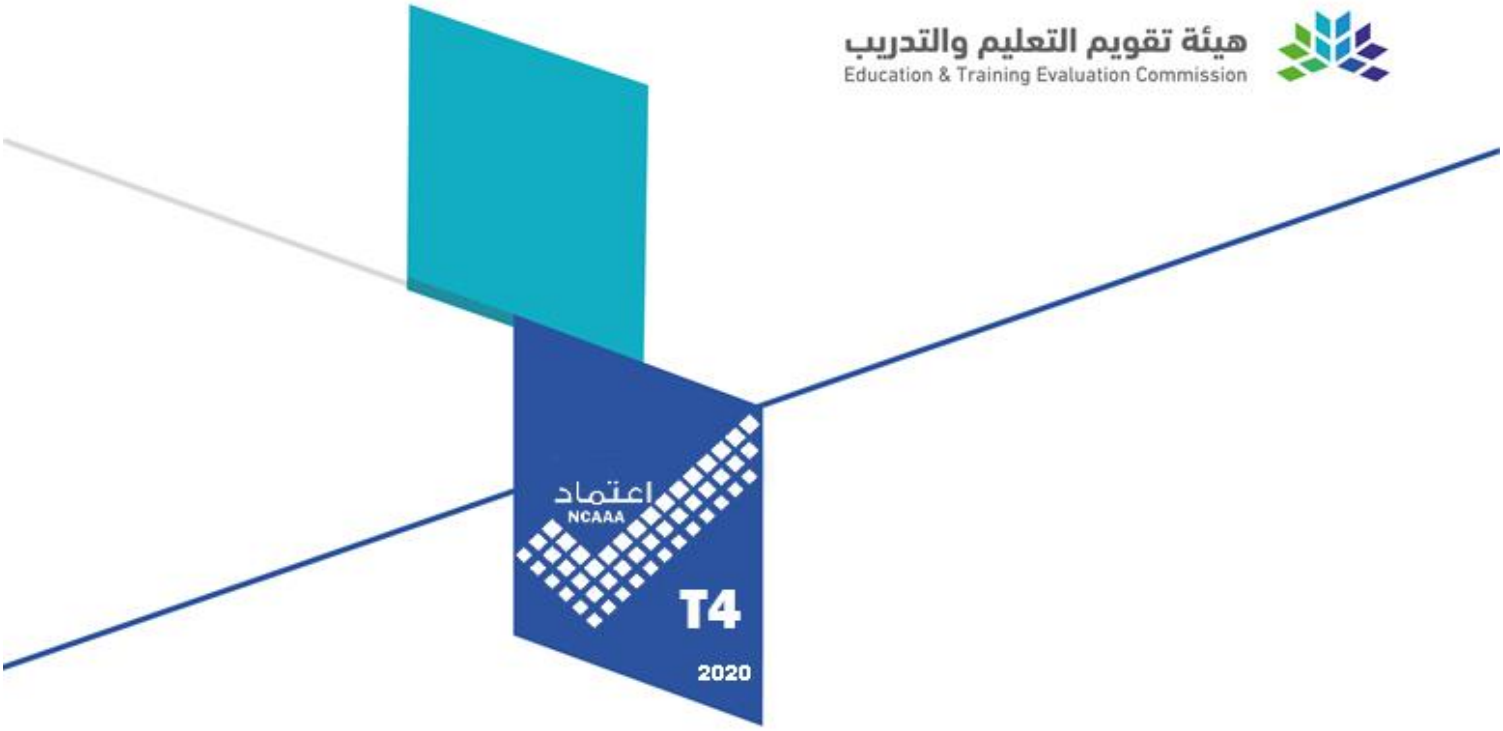
هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission



Course Specifications

Course Title:	**Crystal Structure**
Course Code:	**2034213-2**
Program:	**Bachelor in Physics**
Department:	**Physics Department**
College:	**College of Science**
Institution:	**Taif University**

Table of Contents

A. Course Identification

1. Credit hours: 2
2. Course type **a.** University ☐ College ☑ Department ☐ Others ☐ **b.** Required ☐ Elective ☑
3. Level/year at which this course is offered: 11th Level/ 4th Year
4. Pre-requisites for this course (if any)**: NONE**
5. Co-requisites for this course (if any)**: NONE**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	**3**	**100%**
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	30
2	**Laboratory/Studio**	
3	**Tutorial**	
4	**Others** (specify)	
	Total	30

B. Course Objectives and Learning Outcomes

1. Course 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

2. Course Main Objective

Generate X-rays spectra and patterns from diffraction by crystalline solids and carry out a complete crystallographic analysis of the diffracting sample.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Identify crystalline or amorphous phase in solids, and liquid-crystals	K1
1.2	Recognize scattering from a crystal and relating the diffraction pattern to the reciprocal lattice of the diffracting crystal.	K3
2	**Skills :**	
2.1	Develop skills in a variety of X-ray diffraction methods	S1
2.2	Analyze qualitatively and quantitatively the scattering intensity and calculate the diffraction parameters	S4
3	**Values:**	
3.1	Work effectively and responsibly within a team to perform class activities in crystallography.	V2

C. Course Content

No	List of Topics	Contact Hours
1-3	**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**
4-6	**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**
7	• **Revision and Midterm exam**	**2**
8-10	**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**
11-13	**4- Intensity calculation:** • Diffraction from electrons • Diffraction from an atom • Diffraction from a unit cell	**6**

	• Scale and Polarization factors • Displacement and absorption factors.	
14-15	**5- Analyzing a diffraction pattern** • Indexing a polycrystalline pattern • Calculating the lattice constants • Deducing the crystallite size • Deducing the microstrain	**4**
Total		30

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	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.	Lecture Discussion	Written exam
1.2	Recognize scattering from a crystal and relating the scattered pattern to the reciprocal lattice of the crystal.	Lecture Discussion	Written exam
2.0	**Skills**		
2.1	Develop skills in a variety of X-ray diffraction methods	Problem solving	Written exam
2.2	Analyze qualitatively and quantitatively the scattering intensity and calculate the diffraction parameters.	Problem solving	Written exam
3.0	**Values**		
3.1	Work effectively and responsibly within a team to perform class activities in crystallography.	Reports Activities	Evaluation of reports and activities

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm exam	6th	30%
2	Short exam	9th	10%
3	Activities	Periodically	10%
4	Final exam	12th	50%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student

consultations and academic advice : • **Each faculty member is assigned a group of students for continuous academic advice during six office hours weekly (6 hrs./week).** • **Also teaching staff are available for individual student consultations during office hours**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	S.R. Cullity B.D. & Stock, Elements of X-ray Diffraction, 3rd Edition, Publisher: Pearson, ISBN-13: 978-0201610918, ISBN-10: 0201610914, (2014).
Essential References Materials	M. Ali Omar, Elementary Solid State Physics: Principles and Applications, Publisher: Addison-Wesley Publishing Company, ISBN-13: 978-8177583779, ISBN-10: 8177583778, (1993).
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. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classrooms
Technology Resources (AV, data show, Smart Board, software, etc.)	• Data show • Laptop Smart board
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation 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

Evaluation Areas/Issues	Evaluators	Evaluation Methods
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

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Department Council / Committee of academic development
Reference No.	
Date	October 2, 2022