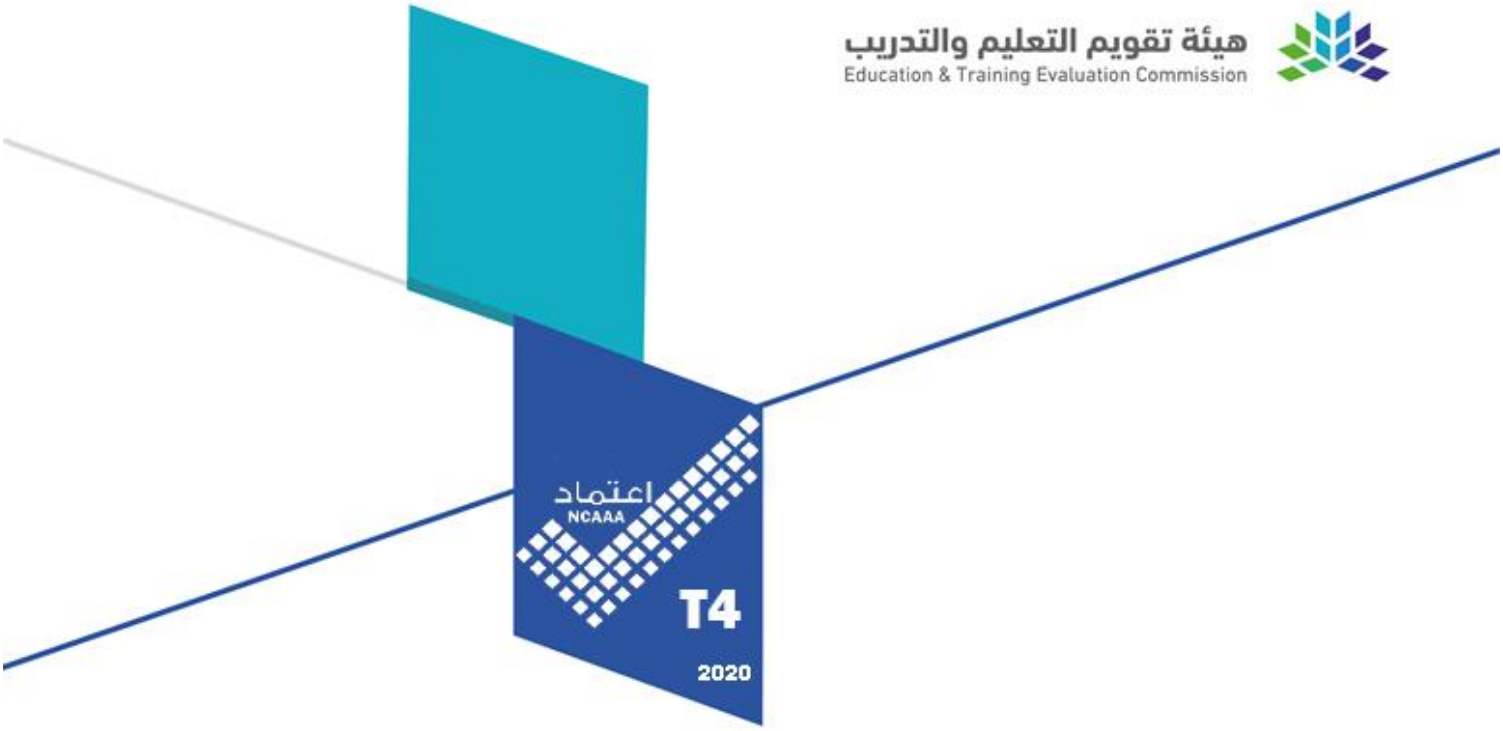
هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission



Course Specifications

Course Title:	**Solid State Physics 1**
Course Code:	**2033201 - 4**
Program:	**Bachelor in Physics**
Department:	**Physics Department**
College:	**College of Science**
Institution:	**Taif University**

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A. Course Identification

1. Credit hours: 4
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐
3. Level/year at which this course is offered: 9th Level/ 3rd Year
4. Pre-requisites for this course (if any)**: Modern Physics 2033105-4**
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**	**7**	**100 %**
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	50
2	**Laboratory/Studio**	20
3	**Tutorial**	
4	**Others** (specify)	
	Total	**70**

B. Course Objectives and Learning Outcomes

1. Course Description

The course introduces the basic solid state physics elements, including: Bravais lattices and crystal systems, miller indices for planes and directions, crystal defects, inter-atomic forces and bonds, X-ray diffraction methods, reciprocal lattice and Brillouin zones, lattice vibrations, Einstein and Debye models for heat capacity, thermal conductivity, free electron classic and quantum models, Fermi level and Fermi surfaces and the density of electronic states.

2. Course Main Objective

- Classify crystalline solids according to their crystalline structures.
- Introduce the x-ray diffraction techniques used to characterize the crystalline structure of solids.
- Explain the relation between lattice vibrations and thermal properties in solids.
- Introduce the free electron classic and quantum theories in solids.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Outline the different crystalline systems and the different X-ray diffraction methods used to analyze them.	K1
1.2	Recognize the main theories and laws of solid state physics relative to lattice dynamics and free electron phenomena.	K3
2	**Skills :**	
2.1	Develop skill versatility in solving problems related to solid state physics.	S2
2.2	Measure solid state quantities in laboratory and analyze qualitatively and quantitatively the associated experimental data.	S4
3	**Values:**	
3.1	Work efficiently within a group frame to perform class and laboratory activities in solid state physics.	V2
3.2	Act responsibly and be able to prepare a written scientific report.	V3

C. Course Content

No	List of Topics	Contact Hours
	Part 1 (Lectures)	
1	Unit1: **Crystal structure:** ▪ The crystalline state ▪ The fourteen Bravais lattices and the seven crystal systems ▪ Crystal directions and crystal planes ▪ Miller indices ▪ Examples of crystalline structures (sodium chloride, cesium chloride, diamond, mercury)	**12**
2	Unit2: **Crystal defects:** ▪ Point defects, ▪ Line defects. ▪ Surface defects ▪ Volume defects	**3**
3	Unit3: **Diffraction of X-rays in crystals:** ▪ Generation and absorption of X-ray ▪ Bragg's law ▪ Scattering from a crystal ▪ The reciprocal lattice and Brillouin zones ▪ X-ray diffraction methods	**10**
4	Unit4: **Lattice vibrations and thermal properties:** ▪ The Continuous Elastic Solid ▪ Vibration of monoatomic lattice in one dimension ▪ Specific heat (classical, Einstein and Debye models) ▪ Electronic specific heat (conduction electrons) ▪ Thermal expansion and Thermal conductivity.	**12**

5	Unit5: **Free electron model and introduction to band theory:** ▪ Classical theory of free electrons, Drude Model ▪ Ohm's law; Electrical conductivity, temperature dependence ▪ Quantum treatment of free electrons ▪ Density of state and Fermi level, Summerfield Model ▪ Introduction to band theory.	**10**
6	Revision	**3**
	Part 2 (Laboratory)	
1	Introduction	**2**
2	Models of the 14 Bravais lattices	**2**
3	Hall effect experiment for conductors (W, Ag)	**2**
4	Hall effect experiment for semiconductors (n-type Ge and p-type Ge)	**2**
5	Temperature dependence of electrical conductivity in conductors (W, Ag).	**2**
6	Temperature dependence of electrical conductivity in semiconductors (n-Ge, p-Ge).	**2**
7	Four-Probe experiment for sheet resistance	**2**
8	Dielectric constant experiment	**2**
9	Revision	**2**
10	Reports evaluation and practical exam	**2**
Total		**70**

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	Outline the different crystalline systems and the different X-ray diffraction methods used to analyze them.	Lectures Discussions	-Assignments -Written exams
1.2	Recognize the main theories and laws of solid state physics relative to lattice dynamics and free electron phenomena.	Lectures Discussions	-Assignments -Written exams
2.0	**Skills**		
2.1	Develop skill versatility in solving problems related to solid state physics.	Problem solving	-Assignments -Written exams
2.2	Measure solid state quantities in laboratory and analyze qualitatively and quantitatively the associated experimental data.	Lab work	Lab reports Lab exam
3.0	**Values**		
3.1	Work efficiently within a group frame to perform class and laboratory activities in solid state physics.	Lab work Essays	Lab reports Lab exam Essay evaluation

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.2	Act responsibly and ethically in conducting their work.	Lab work Discussions	Indirect evaluation

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm exam	6th	20%
2	Activities	Periodically	10%
3	Lab reports	Weekly/ 9th	20%
4	Final Lab Exam	10th	10%
5	Final exam	11th	40%

***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).
- Teaching staff are available for individual student consultations during office hours.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• Introduction to Solid State Physics, Charles Kittle, John Wiley & Sons, Inc, New York USA (1996). Solid State Physics, J. S. Blakemore, 2nd edition, Cambridge university press 1985.
Essential References Materials	• Solid State Sciences
Electronic Materials	http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html http://www.crystallography.net/cod/result.php https://en.wikipedia.org/wiki/Main_Page
Other Learning Materials	• Lecture notes and PowerPoint presentations

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• Classroom • Solid State laboratory
Technology Resources (AV, data show, Smart Board, software, etc.)	• Data show • Laptop • White board

Item	Resources
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 • Departmental council • Faculty council	Indirect
Improvement of Teaching	• Program coordinator • Program committee	Indirect
Quality of learning resources	• Faculty • Students	Indirect
Extent of achievement of course learning outcomes	• Faculty • Students	Indirect
Course effectiveness and planning for improvement	• Faculty • Students	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	
Reference No.	
Date	October 2, 2022