Course Specification
(Bachelor)

Course Title:	Physics-3
Course Code:	319Phys-3
Program:	Bachelor's in Engineering
Department:	Physics
College:	Science
Institution:	King Khalid University
Version:	TP-153 2024
Last Revision Date:	28/10/2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3)					
3(2+1) hrs					
2. Course type					
A.	☒ University	☐ College	☐ Department	☐ Track	☒ Others
B.	☒ Required		☐ Elective		
3. Level/year at which this course is offered: (Level 7/ 3rd year)					
4. Course General Description:					
The purpose of this course is to integrate the fundamentals of the physics of solids. This course includes theoretical description of crystal and electronic structure, lattice dynamics, and physical properties of different materials (metals, semiconductors, dielectrics, magnetic materials) based on the classical and quantum physics principles.					
5. Pre-requirements for this course (if any)**:**					
219Phys-4					
6. Co-requisites for this course (if any)**:**					
Not Required					
7. Course Main Objective(s):					
The main objective of this course is to improve the ability to think logically about the problems of science and technology and obtain their solutions. This course is aimed to offer broad areas of physics which are required as an essential background to engineering students. The student should be able to know, understand, and use the mathematical concepts and physical laws related The objectives of this course are to teach the students fundamentals of Solid-state Physics. After completion of this course, students will have the knowledge and skills in the following topics: -Crystal structures and crystallography: Basic definitions of crystals, crystal structures, Types of unit cells, Braais lattices, Types of crystals, Miller indices, atomic packing factors, Diffraction from periodic structures ,Energy bands in solids, Free electron theory and electrical conductivity V- Dielectric properties of solids, Dielectric constant and polarizability (susceptibility); Dipolar polarizability, ionic and electronic polarizability; Piezoelectricity; pyro- and ferroelectricity. Magnetism Diamagnetism and Paramagnetism, Ferromagnetism and Antiferromagnetic.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	4 hour(2+2)/week	100%
2	E-learning	0	0 %
3	Hybrid • Traditional classroom • E-learning	0	0%
4	Distance learning	0	0 %

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	32
2.	Laboratory/Studio	32
3.	Field	
4.	Tutorial	0
5.	Others (specify)	
Total		64

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	Define basic knowledge about the crystal structures and physical properties of different solids	K1	Lectures and Discussion	Written examinations Home work Quizzes Oral Exam
1.2	Describe the concepts and principles theoretical description of crystal and electronic structure, lattice dynamics, and physical properties of different materials (metals, semiconductors, dielectrics, magnetic materials, and superconductors) based on the classical and quantum physics principles,	K2	Lectures and Discussion	Written examinations Home work Quizzes Oral Exam
1.3	Explain the operational principle, to solve different numerical problems	K3	Lectures and Discussion	Written examinations

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	and its application in physics problems			Home work Quizzes Oral Exam
2.0	**Skills**			
2.1	Show and solve various problems related to engineering physics.	S1	Lectures, Tutorials	Examinations, Assignments,
2.2	Prepare experiments and analyze the data by themselves.	S2	Lab demonstrations	Lab Report, Lab Activity, Lab Examinations
3.0	**Values, autonomy, and responsibility**			
3.1	Participate in commitment to professional and social responsibilities including ethical principles.	V1	Discussions Demonstrations	Faculty Observation, Group report
3.2	Practice communicating with others and cooperating with them.	V2	Discussions, Demonstration, Group work	

C. Course Content (Theoretical and tutorial part)

No	List of Topics	Contact Hours
1.	**Chapter 1 (Crystal Structures and Crystallography)** Basic definitions of crystals, crystal structures, Types of unit cells, Bravais lattices, Types of crystals, Miller indices, atomic packing factors	**6**
2.	**Chapter – 2 (Diffraction from periodic structures)** Diffraction of X-rays by crystals, Laue's experiment, Bragg law; Braggs spectrometer, Compton effect, Numerical problems	**6**
3.	**Chapter – 3 (Bonding in solids)** Types of Bands, Primary and secondary bonds, Ionic, Covalent, metallic, hydrogen and Vander Walls bond, Interatomic distance	**6**
4.	**Chapter – 4 (Free electron theory and electrical conductivity)** Classical free electron theory, drift velocity, Expression for electrical conductivity of metals, Temperature effect on resistivity, Distinction between conductors, insulators and semiconductors on the basis of band theory Conductivity of semiconductors and Numerical problems Concept of effective mass, Fermi Dirac Distribution function, Position of Fermi level in intrinsic and extrinsic semiconductors	**5**
5.	**Chapter – 5 (Dielectric properties of solids)** Dielectric constant and polarizability (susceptibility); Dipolar polarizability, ionic and electronic polarizability; Piezoelectricity; pyro- and ferroelectricity	**5**
6.	**Chapter – 6 (Magnetism)** Diamagnetism and Paramagnetism; Ferromagnetism and Antiferromagnetism	**4**
	Total	**32**

Lab Experiments:

No	List of Topics	Contact Hours
1	General definition of the laboratory (experiments - reports - graph - safety instructions)	**2**
2	Concept of errors in measurements and curve fitting (To draw best line)	**2**
3	Electron diffraction Experiment	**3**
4	P-N Junction diode characteristics	**3**
5	Solar Cell	**2**
6	Review of Lab reports	**2**
7	Hall effect	**2**
8	Hysteresis loop	**2**
9	Planck constant experiment (To find the Planck's constant)	**2**
10	Tutorial -1 (X-ray diffraction of simple cubic crystal)	**2**
11	Tutorial -2 (Hysteresis curve, magnetic properties)	**2**
12	Tutorial-3 (Hall effect)	**2**
13	A review of all laboratory experiments and lab reports with a general discussion	**2**
14	A review of all laboratory experiments and lab reports with a general discussion	**2**
Total		**32**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quiz and Assignments	5th& 12th	10%
2.	Mid Exam	10th	30%
3.	Practical Exam	End of Term	20%
4.	Final Exam	End of Term	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	CHARLES KITTEL, "Introduction to solid state physics", Eighth edition, 2005 John Wiley& Sons, Inc. A.J Dekker, Introduction to solid state physics 1- André Mo... Solid State Physics for Electronics, ISTE Ltd and John Wiley & Sons, Inc. 2007. 2- Harald Ibach and Hans Lüth, Solid-State Physics, An Introduction to Principles of Materials Science, Fourth Extensively Updated and Enlarged

	Edition, Springer-Verlag Berlin Heidelberg 1981, 1988, 1990, 1995, 1999, 2002, 2009. 3- Manijeh Razeghi, Fundamentals of Solid State Engineering, 3rd Edition Springer Science+Business Media, LLC 2009..
Supportive References	- Physics for Scientists and Engineers, Raymond A. Serway, Thomson Brooks, 2004; 9th Edition.
Electronic Materials	https://sites.google.com/a/elc.edu.sa/mwq-aljlaly-altlymy-fy-alfyzya/khzant-almlfat/mhadrat-fyzya-aljwamd-1 https://ar.wikipedia.org/wiki/%D9%81%D9%8A%D8%B2%D9%8A%D8%A7%D8%A1_%D8%A7%D9%84%D8%AC%D9%88%D8%A7%D9%85%D8%AF
Other Learning Materials	**NA**

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	One lecture room with 50 seats (Available)
Technology equipment (projector, smart board, software)	Data Show (Projectors) in lecture room (Portable projector Available)
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, Program Leaders	Direct
Effectiveness of Students assessment	Faculty, Peer Reviewer and Q &D Committee	Direct/Indirect
Quality of learning resources	Programs & Curricula Committee and Q &D Committee	Direct/Indirect
The extent to which CLOs have been achieved	Quality and Development Committee	Indirect
Other	Students, Program Leaders	Direct

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Physics Department Council
REFERENCE NO.	The meeting No. 6 for the academic year 1446, the recommendation No. 3.6.46
DATE	2/5/1446 H