Course Specification

(Postgraduate Programs)

Course Title:	Materials Science
Course Code:	PHYS641
Program:	Master of Science in Physics
Department:	Physical Sciences
College:	Sciences
Institution:	Jazan University
Version:	
Last Revision Date:	20/4/2024

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3 hours)				
2. Course type				
A.	☐University	☐College	☒ Department	☐Track
B.	☐ Required		☐ Elective	
3. Level/year at which this course is offered: (level 2 or 3 /year 1 or 2)				
4. Course general Description:				
This course covers basic knowledge about crystalline and amorphous materials, polymer, ceramics, metals and alloys, glasses, semiconductors, luminescent and optoelectronic materials. It also covers topics including synthesis, processing, characterization and properties of the different materials.				
5. Pre-requirements for this course (if any)**: Non**				
6. Co-requirements for this course (if any)**: Non**				
7. Course Main Objective(s):				
The main objectives of this course are focused on the following: • **Discuss the importance of materials physics in determining the properties of materials according to its structure, composition and performance.** • **Explore the different techniques used for materials characterization to deduce the suitable technique for each type of materials.** • **Correlate between structure, processing and properties for a given material.** • **Differentiate between different materials in terms of their microstructures, characteristics and properties.** • **Investigate the relations between composition, temperature and phase fractions applied to the equilibrium phase diagrams for a given material system.**				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%

No	Mode of Instruction	Contact Hours	Percentage
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**	45
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: **Upon completing the course students will be able to**			
1.1	**Describe** the crystalline structure and amorphous materials, polymer, ceramics, metals and alloys, glasses, semiconductors, luminescent and optoelectronic materials.	**PLO1.1**	Lectures, discussion	Direct: In class interactive questioning, quizzes, written exams Indirect: student survey
1.2	**Discuss** the basic concepts and methodologies of metallography and	**PLO1.2**	Lectures, discussion	Direct: In class interactive questioning, quizzes, written exams

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	crystallography, the defects in crystals and diffusion in solids			Direct: In class interactive questioning, quizzes, written exams Indirect: student survey
1.3	**Discuss** various synthesis, preparation and processing of materials, phase equilibrium diagrams, phase transition and diffusion in solids as well as the methods of Phase transformations and phase diagram.	**PLO1.2**	Lectures, discussion	Direct: In class interactive questioning, quizzes, written exams Indirect: student survey
2.0	Skills: **Upon completing the course students will be able to**			
2.1	**Apply** the techniques used to characterize the properties of solids, neutron and X-ray diffraction, SEM, TEM, XRF, XPS, UV, IR and Raman spectroscopy, DSC, TGA and DTA methods, electrical, thermal, mechanical, magnetic and materials optics	**PLO2.1**	Lectures, discussion	Direct: In class interactive questioning, quizzes, written exams Indirect: student survey
2.2	**Solve** problems related to crystalline structure and amorphous materials, polymer, ceramics, metals and alloys, glasses, semiconductors, luminescent and	**PLO2.1**	Lectures, discussion	Direct: In class interactive questioning, quizzes, written exams

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	optoelectronic materials.			Indirect: student survey
2.3	**Show** abilities of critical thinking in explaining various related aspects of material structures and synthesis	**PLO2.2**	Lectures, discussion	Direct: In class interactive questioning, quizzes, written exams Indirect: student survey
2.4	**Demonstrate** communication effectiveness in interactive discussion and presenting information of various materials and characterization methods	**PLO2.3**	Discussion-presentation	Direct: In class interactive questioning, quizzes, written exams Indirect: student survey
3.0	Values, autonomy, and responsibility: **Upon completing the course students will be able to**			
3.1	**Practice** work group activities and bear responsibility in leading and taking individual tasks	**PLO3.3**	Group activities	Group assignments, discussion Indirect: student survey
...				

C. Course Content:

No	List of Topics	Contact Hours
1.	**STRUCTURE OF MATERIALS:** **- Structure of Crystals**: Introduction to Lattices, Local Atomic Bonding Units and Crystal Structures **- Bonding in Solids:** Bonding in Elemental Solids, Bonding in Multielement Crystals, Some Atomic Properties and Parameters **- Order and Disorder in Solids:** Order and Disorder**,** Defects in Solids	3

2.	**PHYSICAL PROPERTIES OF MATERIALS** **- Phonons**: Excitations of the Lattice: Phonons, Lattice Specific Heat of Solids, Anharmonic Effects. **- Electrons in Solids**: Electrical and Thermal Properties, Classical Theory of Electrical Conduction, Free-Electron Gases, Transport Theory, Conduction in Insulators, Metal– Insulator Transition, Conductivity of Reduced-Dimensional Systems, **- Optical Properties of Materials:** AC Conductivity of Metals, Optical Properties of Semiconductors, Excitons - **Magnetic Properties of Materials**: Origins of Magnetism in Solids, Types of Magnetism and Magnetic Behavior in Materials, **- Mechanical Properties of Materials**: Stress, Strain, and Elastic Constants, Elastic Properties of Materials, Anelastic Properties of Materials	9
3	**CLASSES OF MATERIALS:** **- Semiconductors:** Properties of Semiconductors**,** Macroscopic Properties**,** Applications of Semiconductors, **-Metals and Alloys:** Three Classes of Metals, Examples and Applications of Metallic Alloys **- Polymers:** Structure of Polymers, Mechanical Properties, Thermal Properties, Applications **- Magnetic Materials:** Characteristic Properties of Magnetic Materials, Effects in Magnetic Materials, Applications of Magnetic Materials **- Optical Materials** : Propagation of Light, Generation of Light, Recording of Light.	9
4	**SURFACES, THIN FILMS, INTERFACES, AND MULTILAYERS** **- Surfaces:** Real Surfaces, Electronic Properties of Surfaces, Surface Modification. **- Thin Films, Interfaces, and Multilayers**: Thin Films, Interfaces, Multilayers	9
5	**SYNTHESIS AND PROCESSING OF MATERIALS** **- Synthesis and Processing of Materials:** Synthesis and Processing of Semiconductors, Metals, Ceramics, Glasses and Polymers.	7.5
6	**CHARACTERIZATION OF MATERIALS** **-**Diffraction Techniques, Optical Spectroscopy, Electron Microscopy, Transport Measurements, Magnetic Measurements, Resonance Techniques, Elementary Particles	7.5

Total	45

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignments, and Classroom Activities	3,5,7,13	10
2.	Report/Presentation	7,11	10
3.	Mid-term exams	6,12	20
4.	Quizzes	4,8	10
5.	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	1- Joell.Gersten, FrederickW.Smith,The Physics and Chemistry of Materials, John Wiley & Sons, Inc., 2000.
Supportive References	2- William D. Callister, Jr., Materials Science and Engineering Introduction, John Wiley & Sons, 2007
Electronic Materials	
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	A classroom for a group of students equipped with LCD projector, smart board and/or white board
Technology equipment (Projector, smart board, software)	Data show- Smart Board
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)-Indirect peer evaluation
Effectiveness of students assessment	Students, Program assessment committee	Direct/Indirect
The extent to which CLOs have been achieved	Instructor	Direct/Indirect
Quality of learning resources	Students, Faculty members	Indirect
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	**Department Council**
REFERENCE NO.	**Psci2415**
DATE	**1/10/2024**