Course Specification

(Postgraduate Programs)

Course Title:	Magnetism and Superconductivity
Course Code:	PHYS642
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 the principles of magnetism and superconductivity. The first part gives a general overview of magnetism of materials. The second part discusses superconductivity, the Meissner effect, type I and II superconductors, and the superconducting transition. London equations, as well as the details of the BCS theory will be given. Unconventional high TC superconductivity and super fluidity phenomena and their gap symmetry are illustrated.				
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 basics of magnetism and superconductivity** • **Distinguish between Para magnetism, ant magnetism and ferromagnetism** • **Solve problems related to Spin orbit coupling, Para magnetism, diamagnetism, ferromagnetism, direct, indirect and super exchange,** • **Analyze the phase transitions that cause unusual physical phenomena.** • **Explain other unconventional phenomena of advanced materials.**				

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 theories and concepts for magnetism and superconductivity.	**PLO 1.1**	Lectures, blackboard and visualization, group and interactive guided discussion, Interactive discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.2	**Identify** materials, techniques, practices, convention and terminologies relevant to magnetism and superconductivity.	**PLO 1.1**	Lectures, blackboard and diagram illustration, group discussion, Interactive illustrations- Student contribution	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
1.3	**Discuss** the recent development in magnetism and superconductivity.	**PLO 1.2**	Lectures, blackboard and diagram illustration, group discussion, Interactive illustrations- Student contribution	**Direct** (formative and summative): 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** broad integrated underlaying theories and concepts in various contexts in magnetism and superconductivity.	**PLO 2.1**	Lectures and discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.2	**Solve** problems in various complex contexts in magnetism and superconductivity.	**PLO 2.1**	Lectures and discussion	**Direct** (formative and summative): 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**			

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
3.1	**Assess** own learning and performance autonomously and engage in independent life-long learning.	**PLO3.2**	Case study-interactive demonstration-guided discussion	Expository and Discovery, and Interactive Discussions
3.2	**Apply** ethical principles and commit to professional ethics, responsibilities, and norms of Physics practice.	**PLO3.3**	Interactive and Group discussion expository and discovery teaching	Expository and Discovery, and Interactive Discussions
...				

C. Course Content:

No	List of Topics	Contact Hours
1.	General introduction to magnetism: Magnetism of electrons in solids, Magnetic moments, Spin, and orbital moments.	7.5
2.	Spin orbit coupling, Para magnetism, Diamagnetism, Ferromagnetism, Direct, indirect and super exchange,	7.5
3	Magnetic structures: ferro-, antiferro-, ferromagnetic, Heisenberg model and magnetic excitations, Magnetic phase transitions.	7.5
4	Introduction to properties of superconductors: thermodynamics, and electrodynamics of superconductors, Meissner effect, type I and II superconductors	7.5
5	Flux lattice, Superconducting phase transitions, London equations, Isotope effect, Cooper pairs, BCS theory, High Tc superfluidity.	7.5
6	Applications of Superconductivity, Josephson and its Applications	7.5
Total		45

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	First mid-term exam	6	15
2.	Activities (home-works, tests, class activities)	Over the semester	20
3.	Second mid-term 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	L. P. Levy, Magnetism and superconductivity, (Springer Verlag,2000) (English Version).
Supportive References	Stephen Blundell, Magnetism in Condensed Matter (Oxford University Press 2001). W. Buckel, Reinhold Kleiner Superconductivity: Fundamentals and Applications, 2ndedition, by (Wiley-VCH 2004). Carsten Timm, Theory of Superconductivity, Winter semester 2011/2012 (Technische University at Dresden, Germany)
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
Technology equipment (Projector, smart board, software)	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
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)-Indirect peer evaluation
Effectiveness of students assessment	Students, Program assessment committee	Direct/Indirect
Quality of learning resources	Students, Faculty members	Indirect
The extent to which CLOs have been achieved	Instructor	Direct/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**