Course Code	Course Title	L	T	P	C
BPHY401L	Solid State Physics	3	0	0	3
Pre-requisite	NIL	Syllabus version			
		1.0			

Course Objectives

1. To provide an introduction to some basic concepts in solid state physics.
2. To understand crystal structure; lattice vibrations, electron interactions, Fermi surface and models of electron dynamics.
3. To understand electron transport in metals, semiconductors, insulator and superconductors.

Course Outcomes

1. Comprehend basic model of electron dynamics in metals.
2. Analyze higher and advanced quantum mechanical models of electron dynamics in metals.
3. Learn basic concepts of crystal structure and lattice arrangements.
4. Recall lattice dynamics electron and lattice interactions.
5. Explain basic electron mobility in a crystal structure.
6. Apply semi-classical picture of electrons in a crystal structure and its outcomes.
7. Analyze electron dynamics in semiconductors.
8. Demonstrate electron dynamics in superconductors.

Module: 1	Crystal Structure	5 hours

Bravais lattice - Symmetry operations - Real and reciprocal lattice - Lattice diffraction - Bragg and Laue (Qualitative) - Indexing crystal planes - Lattice constant and interplanar spacing - Brillouin zone

Module: 2	Free Electron Theory	6 hours

Wiedemann-Franz law - Drude's model - Electrical conductivity - Thermal conductivity - Specific heat - Hall effect - Lorentz number - Failure of the free electron theory

Module: 3	Sommerfeld Model	5 hours

Fermi Statistics and Fermi Surface - Quantum mechanical model of lattice - Electronic Heat Capacity (Qualitative) - Thermal conductivity (Qualitative) - Lorentz number - Failures of Sommerfeld model

Module: 4	Lattice Vibration	7 hours

Lattice as harmonic oscillator - Low temperature specific heat - Einstein and Debye models of specific heat (Qualitative) - Nearest neighbour string vibration model

Module:5	Electron in a Periodic Potential	8 hours

Concept of periodic potential - Nearly free electron model - Bloch's theorem - Kronig-Penny model - Band theory - Reduced band structure - Effective mass - Concept of hole - Classification of metal, insulator and semiconductor

Module:6	Electron Transport in Semiconductor Devices	5 hours

Energy Bandgap - Intrinsic and extrinsic semiconductors - Mobility and carrier concentration with temperature variation - P-N Junction

Module:7	Introduction to Dielectrics and Magnetism	7 hours

Introduction - Polarization mechanisms - Electronic, ionic, orientation - Clausius-Mosotti relation (Qualitative) - Origin of magnetization - Orbital magnetic moment -

Spin magnetic moment - Bohr magneton - Properties of dia, para, ferro, antiferro and ferrimagnetic materials - Domain theory of ferromagnetism		
Module:8	**Contemporary Issues**	**2 hours**
Guest lecture from industry and R & D organisations		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	C. Kittel, Introduction to Solid State Physics, 2005, 8th Edition, John Wiley & Sons.
2.	A. J. Dekker, Solid State Physics, 2008, 1st Edition, Prentice Hall of India.
Reference Books	
1.	Neil W. Ashcroft and N. David Mermin, Solid State Physics, 2021, Brookes & Cole Publishing.
2.	J.P. Srivastava, Elements of Solid State Physics, 2011, 3rd Edition, Prentice-Hall of India.
3.	M. Ali Omar, Elementary Solid State Physics, 2002, 3rd Edition, Pearson Education.
4.	M. A. Wahab, Solid State Physics, 2015, 3rd Edition, Narosa Publishing House, India.

Mode of Evaluation: CAT, Written Assignment, Quiz and FAT

Recommended by Board of Studies	20-06-2023		
Approved by Academic Council	No. 70	Date	24-06-2023