

PaperCode: BS-106	Paper: Applied Physics - II	L	T/P	C								
		3	-	3								
<b>Marking Scheme:</b>												
1. Teachers Continuous Evaluation: 25 marks												
2. Term end Theory Examinations: 75 marks												
<b>Instruction for paper setter:</b>												
1. There should be 9 questions in the term-end examinations question paper.												
2. The first unit will be compulsory and cover the entire syllabus. This question will have Five sub-parts, and the students will be required to answer any THREE parts of 5 marks each. This unit will have a total weightage of 15 marks.												
3. Apart from unit 1 which is compulsory, the rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain up to 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.												
4. The questions are to be framed keeping in view the learning outcomes of the course/paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.												
5. The requirement of (scientific) calculators / log-tables / data - tables may be specified if required.												
<b>Course Objectives:</b>												
1:	To learn about the quantum nature of reality.											
2:	To learn about quantum statistics and its significance.											
3:	To understand the structures of crystals.											
4:	To learn about the band theory of solids and properties and characteristics of diodes.											
<b>Course Outcomes (CO):</b>												
CO1	Understand and appreciate the quantum nature of reality.											
CO2	Understand quantum statistics and its significance.											
CO3	Understand Crystalline Structure.											
CO4	Understand the band theory of solids and properties and characteristics of diodes.											
<b>Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)</b>												
CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO1	2	2	3	3	2	-	-	-	1	1	-	1
CO2	2	2	3	3	2	-	-	-	1	1	-	1
CO3	2	2	3	3	2	-	-	-	1	1	-	1
CO4	2	2	3	3	2	-	-	-	1	1	-	1

**Unit I**

Quantum Mechanics: Introduction; Wave particle duality, de Broglie waves, the experiment of Davisson and Germer, electron diffraction, physical interpretation of the wave function, properties, the wave packet, group and phase velocity, the uncertainty principle. The Schrödinger wave equation (1D), Eigen values and Eigen functions, expectation values, simple Eigen value problems - solutions of the Schrödinger's equations for the free particle, the infinite well, the finite well, tunneling effect, the scanning electron microscope, the quantum simple harmonic oscillator (qualitative), zero point energy. [8Hrs][T1,T2]

**Unit II**

Quantum Statistics: The need for statistics, statistical distributions: Maxwell Boltzmann, Bose-Einstein and Fermi-Dirac statistics, their comparisons, Fermions and Bosons, Applications of quantum statistics: 1. Molecular speed and energies in an ideal gas; 2. The Black body spectrum, the failure of classical statistics to give the correct explanations - Bose-Einstein statistics applied to the Black Body radiation spectrum; Fermi-Dirac distribution, free electron theory, electronic specific heats, Fermi energy and average energy; Dying stars. [8Hrs][T1,T2]

Applicable from Batch Admitted in Academic Session 2021-22 Onwards

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**Unit III**

Crystal Structure: Types of solids, Unit cell, Types of crystals, Translation vectors, Lattice planes, Miller indices, Simple crystal structures, Interplaner spacing, Crystal structure analysis: Bragg's law, Laue method, Point defects: Schottky and Frankel defects. [8Hrs][T1,T2]

**Unit IV**

Band Theory of Solids: Origin of energy bands in solids, motion of electrons in a periodic potential - the Kronig-Penny model (Qualitative). Brillouin zones, effective mass, metals, semi-conductors and insulators and their energy band structures. Extrinsic and Intrinsic semiconductors, doping - Fermi energy for doped and undoped semiconductors, the p-n junction (energy band diagrams with Fermi energy), the unbiased diode, forward and reverse biased diodes - tunnel diodes, zener diode, photo diode its characteristics, LED [8Hrs][T1,T2]

**Textbooks:**

1. *Concepts of Modern Physics (SIE)* by Arthur Beiser, Shobhit Mahajan, and S. Rai Choudhury, McGraw - Hill, 2017.
2. *Modern Physics* by Kenneth S. Krane, Wiley, 2020.

**References:**

1. *Physics for Scientists and Engineers* by Raymond A. Serway and John W. Jewett, 9<sup>th</sup> Edition, Cengage, 2017
2. *Principles of Physics* by Robert Resnick, Jearl Walker and David Halliday, Wiley, 2015.
3. *Solid State Electronic Devices*, by Streetman and Ben G. Prentice Hall India Learning Private Limited; 2006