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Bengaluru

Mid Term Examinations - October 2026

Date: 06/10/2026 **Time:** 09:30 AM - 11:00 AM

Course Code: PHY2501 **Course Name:** Optoelectronics and Quantum Physics

Semester: First Semester **Max. Marks:** 50 **Weightage:** 50%

CO - Levels	CO1	CO2	CO3	CO6
Marks	48	46	42	44

PART A: Answer Following Questions. 10 M

Q.N.	Questions	M	CO	BT
1	Phosphorus is doped to germanium, name the type of semiconductor formed. What will be the majority charge carrier in this type semiconductor?	2	CO1	BT2
2	Define Fermi level.	2	CO1	BT1
3	Mention two applications of p-n junction diode.	2	CO2	BT1
4	Explain the critical temperature for superconductors.	2	CO2	BT2
5	Calculate the de Broglie wavelength associated with an electron accelerated under a potential difference of 100 V.	2	CO6	BT3

PART B : Answer Any 1 Following Questions. 10 M

Q.N.	Questions	M	CO	BT
6	Define energy bandgap in solids. Discuss the classification of solids on the basis of energy bandgap with suitable diagram. With the help of graph, explain the variation of conductivity of intrinsic semiconductors as a function of temperature. Explain how bandgap of the semiconductor can be calculated from this graph.	10	CO1	BT3
7	Explain the position of the Fermi level in different types of semiconductors with suitable diagram. Write differences between intrinsic and extrinsic semiconductors.	10	CO1	BT3

PART C: Answer Any 1 Following Questions. 10 M

Q.N.	Questions	M	CO	BT
8	Explain Hall effect with suitable diagram. Write the significance of Hall coefficient. Mention two applications of Hall effect.	10	CO2	BT2
9	Explain principle and working of solar cell with suitable diagram. Draw and label I-V characteristics graph of solar cell, explain open ciruit voltage, short ciruit current.	10	CO2	BT2

PART D: Answer Any 1 Following Questions. 10 M

Q.N.	Questions	M	CO	BT

10	State de Broglie's hypothesis and derive the expression for de Broglie wavelength in terms of kinetic energy of particle. Why the de Broglie wavelength of a cricket ball having mass 0.15 kg moving with a speed of 30 m/s cannot be observed in daily life, whereas the de Broglie wavelength of an electron having mass 9.1×10^{-31} kg moving with a speed of 2.2×10^{6} m/s is significant and needs to be considered?	10	CO3	BT3
11	Mention the characteristics of matter waves. Write the significance of the wavefunction. Explain two important condions for a wavefunction.	10	CO3	BT3

PART E: Answer Any 1 Following Questions. 10 M				
Q.N.	**Questions**	**M**	**CO**	**BT**
12	The intrinsic carrier density of a semiconductor is1.5×10^{16} m^{-3}. If the mobility of electron and hole are 0.13 m^2 V^{-1} s^{-1} and 0.05 m^2 V^{-1} s^{-1}, Estimate the conductivity. A superconducting tin has a critical temperature of 3.7 K at zero magnetic field and a critical field of 0.0306 Tesla at 0 K. Find the critical field at 2 K.	10	CO6	BT3
13	Compare the energy of a photon with that of a neutron when both are associated with a de Broglie wavelength of 1 Å. Given mass of neutron is 1.674 x 10^{-27} kg. Planck's constant h = 6.625×10^{-34} Js, Speed of light c = 3×10^{8} m/s. Write the mathematical form of Heisenberg's uncertainty principle. Calculate the uncertainty in the momentum of an electron if uncertainty in its position is 1 Å.	10	CO6	BT3