VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS), HYDERABAD
Accredited by NAAC with A++ Grade
B.E. I-Semester Main & Backlog Examinations, Jan./Feb.-2024
Physics of Semiconductors and Optoelectronic Devices
(Common for CSE, AIML & IT)

Time: **3 hours**   Max. Marks: **60**

*Note: Answer all questions from **Part-A** and any FIVE from **Part-B***

Part-A (10 × 2 = 20 Marks)

Q. No.	Stem of the question	M	L	CO	PO
1.	Why X-rays are used for crystal diffraction studies?	2	2	1	1,2,12
2.	What are miller indices?	2	1	1	1,2,12
3.	Give the physical significance of wave function (Ψ).	2	2	2	1,2,12
4.	Calculate the wavelength associated with an electron accelerating through a potential of 1600V.	2	3	2	1,2,12
5.	Mention few applications of Hall effect.	2	1	3	1,2,12
6.	The intrinsic carrier density at room temperature in Ge is 2.4×10^{19}/m^3. If the electron and hole mobilities are 0.4 and 0.2 m^{2}V^{-1}S^{-1} respectively. Calculate the conductivity and resistivity.	2	3	3	1,2,12
7.	Write a short note on LED.	2	1	4	1,2,12
8.	What is the principle of solar cell?	2	2	4	1,2,12
9.	List out various pumping mechanisms used in Laser.	2	1	5	1,2,12
10.	What are the advantages of optical fibres over Co- axial cables?	2	1	5	1,2,12

Part-B (5 × 8 = 40 Marks)

		M	L	CO	PO
11. a)	What is Schottky defect? Evaluate the expression for concentration of Schottky defects at a temperature T of a crystal under equilibrium condition.	5	3	1	1,2,12
b)	X rays diffraction studies are conducted on a lead (FCC) sample. X rays of wavelength 1.54 A° are deflected by (220) plane at a Bragg angle of 32° in the first order. Determine the lattice parameter of lead and radius of the atom.	3	4	1	1,2,12
12. a)	Derive the Schrödinger time independent wave equation for a free particle.	5	3	2	1,2,12
b)	How quantum computer is different from classical computer? Bring out the differences between them.	3	1	2	1,2,12
13. a)	What is intrinsic semiconductor? Derive the expression for electrons concentration in conduction band of an intrinsic semiconductor.	5	3	3	1,2,12
b)	Write the differences between direct and indirect band gap semiconductors with suitable examples and diagrams.	3	1	3	1,2,12

			M	L	CO	PO
14.	a)	How PIN diode is different from Photo diode? Describe the construction and working of PIN diode?	5	2	4	1,2,12
	b)	The radiative and non-radiative recombination lifetimes of carriers of LED are 80ns and 120ns. Determine total recombination life time, internal quantum efficiency and optical power generated with operating wavelength 850nm and I= 25mA.	3	3	4	1,2,12
15.	a)	Describe the construction and working of He: Ne laser with its energy level diagram.	5	2	5	1,2,12
	b)	A multimode step index fibre having core refractive index of 1.458 and relative refractive difference of 0.01. Find the numerical aperture, refractive index of cladding and acceptance angle of fibre.	3	3	5	1,2,12
16.	a)	Describe Powder method (Debye-Scherrer method) of XRD to evaluate inter planar spacing of the crystal.	4	2	1	1,2,12
	b)	What are matter waves? Mention its properties and write an expression for the wavelength associated with matter waves.	4	3	2	1,2,12
17.		Answer any *two* of the following:				
	a)	Explain the formation of PN-junction diode with suitable band diagram.	4	2	3	1,2,12
	b)	Explain V-I characteristics of solar cell and define conversion efficiency, fill factor of solar cell.	4	2	4	1,2,12
	c)	With the help of block diagram explain the working of optical fibre communication system.	4	3	5	1,2,12

M : Marks;   L: Bloom's Taxonomy Level;   CO; Course Outcome;   PO: Programme Outcome

i)	Blooms Taxonomy Level – 1	20%
ii)	Blooms Taxonomy Level – 2	35%
iii)	Blooms Taxonomy Level – 3 & 4	45%

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