Code No. : 11216 S O

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS), HYDERABAD
Accredited by NAAC with A++ Grade
B.E. I-Semester Supplementary Examinations, August-2023
Semiconductor Physics and Optoelectronic Devices
(Common to 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
1.	Distinguish between Frenkel and Schottky defects in a crystalline solid.	2	1
2.	In a tetragonal lattice a=b=0.18 nm, c=0.25 nm, deduce the spacing between (111) planes.	2	2
3.	Mention the physical significance of wave function (ψ).	2	1
4.	Calculate the de Broglie wavelength of an electron accelerated through a potential difference of 100 V.	2	2
5.	What is Fermi energy level draw its variation with temperature.	2	2
6.	The conductivity of Germanium at 20°C is 2 Ω^{-1}-m^{-1}, what is its conductivity at 40°C? E_g=0.72 eV.	2	3
7.	Write the characteristics of a light emitting diode (LED).	2	2
8.	Write some medical applications of lasers.	2	2
9.	Mention the differences between single-mode and multi-mode optical fibers.	2	4
10.	What are the advantages of optical fibers over co-axial cables?	2	2

Part-B (5 × 8 = 40 Marks)

11. a)	Derive the expression for interplanar spacing (d_{hkl}) for a cubic crystal.	5	1
b)	A beam of X-rays incident on a NaCl crystal (lattice spacing 0.282 nm).The first order Bragg reflection is observed at a glancing angle of 8° 35'. What is the wavelength? At what angles would the second order Bragg's reflection occurs?	3	3
12. a)	Explain the formation of discrete energy levels in solids using Kronig-Penney model.	6	3
b)	Find the de-Broglie wavelength of a neutron having kinetic energy of 1 eV.	2	2
13. a)	Derive the expressions for electrons concentration in an intrinsic semiconductor.	5	2
b)	A current of 50 A is established in a Cu slab (0.2 cm thick X 2 cm wide). The slab is placed in a magnetic field B of 1.5 T along z-axis. The free electron concentration in Cu is 6.8 $\times 10^{28}$/m^3. What will the magnitude of Hall voltage across the width of the slab?	3	2

			M	L
14.	a)	What is Electroluminescence? Describe the construction and working of homo junction LED with band diagram.	6	2
	b)	Calculate optical power output from a LED with an electron current of 2 mA, efficiency 60% and wavelength 800 nm.	2	2
15.	a)	Explain various losses in optical fibers.	6	2
	b)	An optical fiber has NA of 0.2 and cladding refractive index of 1.59. Determine the acceptance angle for a fiber in water having refractive index of 1.33	2	1
16.	a)	Why visible light is not used to probe crystal structure of a solid? Differentiate between crystalline and amorphous solids.	4	1
	b)	What are matter waves? If the de Broglie wavelength of an electron is 0.05 nm then find the applied accelerating potential?	4	2
17.		Answer any *two* of the following:		
	a)	State Hall effect. Deduce the expression for Hall electric field (EH) and Hall coefficient (RH) of a n-type semiconductor.	4	2
	b)	What is Luminescence? List various types of luminescence depending upon type of excitations. Also, mention uses of each type of luminescence phenomenon.	4	2
	c)	Explain the optical fiber communication system using a neat block diagram.	4	4

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

i)	Blooms Taxonomy Level – 1	
ii)	Blooms Taxonomy Level – 2	
iii)	Blooms Taxonomy Level – 3 & 4	

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