Code No. : 12312

VASAVI COLLEGE OF ENGINEERING *(AUTONOMOUS)*, HYDERABAD

Accredited by NAAC with A++ Grade

B.E. II-Semester Main & Backlog Examinations, September-2022

Quantum Mechanics & Material Science

(Common to EEE & ECE)

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.	The line A of X-ray beam gives a first order reflection maximum at a glancing angle of 30º to the smooth face of a crystal. Line B of wave length of 0.92Aº gives a third order reflection maximum at an angle of 60º from the face of the same crystal. Find the wavelength of line A.	2	3	1	1,2
2.	How crystalline materials are different from amorphous materials.	2	2	1	1,12
3.	State the physical interpretation of the wave function Ψ	2	1	2	1,2
4.	What voltage must be applied to an electron microscope to produce electrons of wavelength of 0.40Aº.	2	3	2	1,2
5.	Distinguish conductors, insulators and semiconductors on the basis of band theory of solids.	2	3	3	1,12
6.	Draw the fermi level locations for intrinsic and extrinsic (p & n-type) semiconductors.	2	1	3	1,12
7.	State any four applications of Laser in the field of engineering and industry.	2	2	4	1,2,12
8.	Mention the factors responsible for attenuation in optical fibres.	2	2	4	1,12
9.	Give the important properties associated with dielectrics.	2	1	5	1,3,12
10.	The magnetic field intensity in a piece of ferric oxide is 10^6 amp/meter. If the susceptibility of the material is 1.5×10^{-3}, calculate the magnetization of the material and flux density.	2	3	5	1,2

Part-B (5 × 8 = 40 Marks)

11. a)	What is Schottky defect? Calculate the concentration of Schottky defects in the crystals.	5	2	1	1,2
b)	The density of copper is 8.96 gm/cm³ and Avogadro number is 6.02 x 10^{23} gm-molecule. The atomic weight of Cu is 63.5. Find the lattice constant for copper and the distance in Armstrong units between the two nearest Cu atoms in FCC lattice.	3	3	1	1,2

			M	L	CO	PO
12.	a)	Derive the expression for Schrodinger's time independent wave equation.	5	2	2	1,2
	b)	An electron is bound in one dimensional potential box of width 4×10^{-10}m. Find the energy values in the ground state and first two excited states.	3	3	2	1,2
13.	a)	What is intrinsic semiconductor? Derive the expression for density of electrons in conduction band of an intrinsic semiconductor.	5	2	3	1,2,12
	b)	Find the conductivity and resistance of intrinsic germanium rod which is 2cm long, 2mm wide and 1mm thick at 300K, For germanium $n_i = 2.5 \times 10^{19}/m^3$, $\mu_e = 0.39$ m^2/V-S and $\mu_h = 0.19$ m^2/V-S at 300K.	3	3	3	1,2
14.	a)	Describe the construction and working of He : Ne laser with energy level diagram.	5	1	4	1,2,12
	b)	In an optical fiber, the core has a refractive index equal to 1.5 and a cladding of refractive index is 1.4. (Assume the velocity of light in free space is 3×10^8m/s) i. What is the speed of the light inside the core? ii. What is the critical angle at the core-cladding interface?	3	3	4	1,2
15.	a)	List various types of polarizabilities in dielectric materials and obtain an expression for electronic polarizability in terms of the radius of the atom.	5	2	5	1,2
	b)	State Miessner effect and show that superconducting materials exhibit perfect diamagnetism	3	2	5	1,3
16.	a)	Show that in a cubic lattice the distance between successive planes of indices $(h\,k\,l)$ is given by $d = \dfrac{a}{\sqrt{h^2+k^2+l^2}}$	3	3	1	1,2
	b)	Show that the energy of electron confined to 1-D box of width L and infinite depth is quantized and obtain the wave function associated.	5	4	2	1,2,12
17.		Answer any *two* of the following:				
	a)	What is Fermi energy? Illustrate the effect of temperature on Fermi-Dirac distribution function.	4	2	3	1,2
	b)	With suitable diagrams briefly explain the propagation of light in single mode and multimode fibers.	4	1	4	1,2,12
	c)	Differentiate between soft and hard magnetic materials.	4	3	5	1,3,12

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

i)	Blooms Taxonomy Level – 1	20%
ii)	Blooms Taxonomy Level – 2	40%
iii)	Blooms Taxonomy Level – 3 & 4	40%

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