Code No. : 12034 (B)

VASAVI COLLEGE OF ENGINEERING (Autonomous), HYDERABAD
B.E. (CBCS) II-Semester Main Examinations, January-2021
Quantum Mechanics and Material Sciences
(Common to EEE & ECE)

Time: **2** hours

Max. Marks: **60**

Note: Answer any NINE questions from Part-A and any THREE from Part-B

Part-A (9 × 2 = 18 Marks)

Q. No.	Stem of the question	M	L	CO	PO
1.	Differentiate crystalline solids and amorphous solids.	2	3	1	1,2,12
2.	Determine the interplanar spacing for (220) in FCC structure. The lattice constant is 1.246A°.	2	3	1	1,2,12
3.	Outline the drawbacks of classical mechanics.	2	4	2	1,2,12
4.	Write a short note on tunnel effect in Quantum Mechanics.	2	2	2	1,2,12
5.	Define density of states and write its expression for bulk material.	2	2	3	1,2,12
6.	What is Fermi Energy?	2	1	3	1,2,12
7.	Compare spontaneous emission and stimulated emission.	2	1	4	1,2,12
8.	Write any *four* applications of optical fibers.	2	4	4	1,2,12
9.	Write a short note on Meissner effect.	2	2	5	1,2,12
10.	List out any *four* applications of ferrites.	2	2	5	1,2,12
11.	The spacing between the principal planes of NaCl crystal is 2.82A°.It is found that the first order Bragg reflection occurs at 10°.What is the wavelength of X-rays.	2	3	1	1,2,12
12.	Write down physical significance of wave function.	2	2	2	1,2,12

Part-B (3 × 14 = 42 Marks)

13. a)	Explain in detail the powder method X-ray diffraction for crystal structure analysis.	7	3	1	1,2,12
b)	Derive an expression for density of Frenkel defects in an ionic crystal at a temperature T.	7	3	1	1,2,12
14. a)	What are Matter waves? Describe how Davisson and Germer experiment confirms the de-Broglie hypothesis.	10	2	2	1,2,12
b)	Find the energy of neutron in eV whose de-Broglie wave length is 1 A°. (mass of neutron m=1.674×10^{-27}kg)	4	3	2	1,2,12

15.	a)	Explain the formation of discrete energy levels in solids using Kronig-Penney model.	10	2	3	1,2,12
	b)	Discuss the effect of temperature on Fermi energy level of n & p-type semiconductors.	4	2	3	1,2,12
16.	a)	Explain the construction and working of He-Ne laser with the help of a neat energy level diagram.	10	2	4	1,2,12
	b)	A step index fiber has a core refractive index of 1.44 and the cladding refractive index of 1.41. Find numerical aperture, the relative refractive index difference and the acceptance angle.	4	3	4	1,2,12
17.	a)	Explain ionic polarizability and derive an expression for ionic polarizability.	7	1	5	1,2,12
	b)	Distinguish between type I and type II superconductors with appropriate sketches.	7	3	5	1,2,12
18.	a)	Discuss briefly the seven systems of crystals.	7	2	1	1,2,12
	b)	Derive Schrodinger time independent wave equation.	7	4	2	1,2,12
19.		Answer any *two* of the following:				
	a)	Distinguish between conductors, semiconductors and insulators on the basis of band theory of solids.	7	3	3	1,2,12
	b)	State the necessary conditions for stimulated emission and explain the Einstein's A and B coefficients.	7	2	4	1,2,12
	c)	Discuss B-H (Hysteresis) curve of ferromagnetism.	7	2	5	1,2,12

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

S. No.	Criteria for questions	Percentage
1	Fundamental knowledge (Level-1 & 2)	60.47
2	Knowledge on application and analysis (Level-3 & 4)	39.53
3	*Critical thinking and ability to design (Level-5 & 6) (*wherever applicable)	--

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