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Code No. : 12322 N

**VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS), HYDERABAD**  
*Accredited by NAAC with A++ Grade*

**B.E. II-Semester Main Examinations, August-2023**

**Quantum Mechanics and Materials 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.	Compare primitive cell and non-primitive cell.	2	2	1	1,2,12
2.	What is the importance of impurity defects relevant to electronics engineering?	2	1	1	1,2,12
3.	Mention the physical significance of wave function ( $\psi$ ).	2	2	2	1,2,12
4.	Examine what is meant by Quantum tunneling.	2	3	2	1,2,12
5.	Write the limitations of classical free electron theory.	2	4	3	1,2,12
6.	Draw the Fermi level location for intrinsic and extrinsic semiconductors.	2	3	3	1,2,12
7.	Summarize the three important requisites for laser action to takes place.	2	2	4	1,2,12
8.	List any four important applications of optical fibres.	2	1	4	1,2,12
9.	Differentiate between polar and non-polar dielectrics.	2	2	5	1,2,12
10.	Discuss any four important properties of super conductors.	2	4	5	1,2,12
<b>Part-B (5 × 8 = 40 Marks)</b>					
11. a)	Examine the Schottky defect. Evaluate the expression for equilibrium concentration of Schottky defects at a temperature T.	5	4	1	1,2,12
b)	Lithium crystallizes in BCC structure. If the density of lithium is 530 kg/m <sup>3</sup> , calculate the lattice constant and nearest neighbouring distance of lithium. The atomic weight of lithium is 6.94.	3	2	1	1,2,12
12. a)	Write the properties of matter waves and derive the equation for de-Broglie wave length associated with matter waves.	5	2	2	1,2,12
b)	Calculate the energy difference between the ground state and third excited state of an electron in I-D box of length 10 <sup>-8</sup> cm.	3	3	2	1,2,12
13. a)	What is intrinsic semiconductor? Derive expression for electrons concentration of an intrinsic semiconductor.	5	3	3	1,2,12
b)	Interpret limitations of Kronig-Penney model.	3	2	3	1,2,12

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14. a)	Describe the construction and working of Ruby laser with its energy level diagram.	5	4	4	1,2,12
b)	Calculate the refractive index of core and cladding of an optical fibre. The NA and fractional difference between the refractive indices of core and cladding of the optical fibre are 0.22 and 0.012 respectively.	3	3	4	1,2,12
15. a)	What is electronic polarizability? Obtain the expression for electronic polarizability.	5	1	5	1,2,12
b)	Show that super conductors exhibit perfect diamagnetism (Meissner effect)	3	2	5	1,2,12
16. a)	Inspect Powder Method of XRD to evaluate inter planar spacing of the crystal.	4	4	1	1,2,12
b)	Arrive at the Schrödinger time independent wave equation for a free particle.	4	1	2	1,2,12
17.	Answer any <i>two</i> of the following:				
a)	What is Hall effect? Derive the Hall voltage and Hall coefficient for n-type semiconductor.	4	1	1	1,2,12
b)	Briefly explain various losses in optical fibres.	4	2	2	1,2,12
c)	Distinguish between soft and hard magnetic materials on the basis of Weiss molecular field theory of ferromagnetism.	4	2	3	1,2,12

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

i)	Blooms Taxonomy Level - 1	21.25%
ii)	Blooms Taxonomy Level - 2	37.5%
iii)	Blooms Taxonomy Level - 3 & 4	41.25%

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