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 $(10 \times 2 = 20 \text{ Marks})$

2 2 1 1 1 2 2 2 1 1 1 2 2 2 1 1 1 2 2 2 1 1 1 2 2 2 1 1 1 1 1 2 2 2 2 1 1 1 1 1 1 2 2 2 2 2 1 1 1 1 1 1 1 2 2 2 2 2 1	Q. No.	Stem of the question	1	<u>/</u>	Y	00	
What is the importance of impurity defects relevant to electronics engineering? 3. Mention the physical significance of wave function (ψ). 4. Examine what is meant by Quantum tunneling. 5. Write the limitations of classical free electron theory. 6. Draw the Fermi level location for intrinsic and extrinsic semiconductors. 7. Summarize the three important requisites for laser action to takes place. 8. List any four important applications of optical fibres. 9. Differentiate between polar and non-polar dielectrics. 10. Discuss any four important properties of super conductors. Part-B (5 × 8 = 40 Marks) Examine the Schottky defect. Evaluate the expression for equilibrium concentration of Schottky defects at a temperature T. b) Lithium crystallizes in BCC structure. If the density of lithium is 530 kg/m³, calculate the lattice constant and nearest neighbouring distance of lithium. The atomic weight of lithium is 6.94. Write the properties of matter waves and derive the equation for de-Broglie wave length associated with matter waves. 6. A) Write the energy difference between the ground state and third excited state of an electron in I-D box of length 10-\(^{\text{\$}}\text{cm}\). 8. A) What is intrinsic semiconductor? Derive expression for electrons of the concentration of an intrinsic semiconductor.	1.	Compare primitive cell and non-primitive cell.	-			CO	PO
Mention the physical significance of wave function (ψ). Examine what is meant by Quantum tunneling. Draw the Fermi level location for intrinsic and extrinsic semiconductors. Summarize the three important requisites for laser action to takes place. List any four important applications of optical fibres. Differentiate between polar and non-polar dielectrics. Discuss any four important properties of super conductors. Part-B (5 × 8 = 40 Marks) Examine the Schottky defect. Evaluate the expression for equilibrium concentration of Schottky defects at a temperature T. Lithium crystallizes in BCC structure. If the density of lithium is 530 kg/m³, calculate the lattice constant and nearest neighbouring distance of lithium. The atomic weight of lithium is 6.94. Write the properties of matter waves and derive the equation for de-Broglie wave length associated with matter waves. Calculate the energy difference between the ground state and third excited state of an electron in I-D box of length 10-8 cm. Mat is intrinsic semiconductor? Derive expression for electrons Draw the Fermi level location for intrinsic semiconductor. 2 2 4 3 1.2 2 2 4 1.2 2 2 4 1.2 2 2 5 1.2, 2 2 5 1.2, 2 2 5 1.2, 2 2 5 1.2, 2 2 5 1.2, 2 2 5 1.2, 2 2 5 1.2, 2 2 5 1.2, 2 2 5 1.2, 2 2 5 1.2, 2 2 5 1.2, 2 2 5 1.2, 2 2 5 1.2, 2 2 5 1.2, 2 2 5 1.2, 3 2 2 1 1.2, 3 2 1 1.2, 3 2 1 1.2, 4 1.2, 4 1.2, 4 1.2, 4 1.2, 4 1.2, 4 1.2, 4 1.2, 4 1.2, 4 1.2, 4 1.2, 4 1.2, 4 1.2, 4 1.2, 4 1.2, 4 1.2, 4 1.2, 4 1.2, 4 1.2, 5 2 2 1.2, 6 1.2, 6 1.2, 7 2 1.2, 8 3 2 1.2, 8 3 2 1.2, 8 3 2 1.2, 8 3 3 1.2, 8 3 3 1.2, 8 3 1.2, 8 4 1.2, 8 5 1.2, 9 6 1.2, 9 7 2 1.2, 9 8 1.2, 9 8 1.2, 9 9 1.	2.	What is the importance of impurity defects relevant	2		2	1	1,2,1
Examine what is meant by Quantum tunneling. Examine what is meant by Quantum tunneling. Write the limitations of classical free electron theory. Draw the Fermi level location for intrinsic and extrinsic semiconductors. Summarize the three important requisites for laser action to takes place. List any four important applications of optical fibres. Differentiate between polar and non-polar dielectrics. Discuss any four important properties of super conductors. Part-B (5 × 8 = 40 Marks) Examine the Schottky defect. Evaluate the expression for equilibrium concentration of Schottky defects at a temperature T. Lithium crystallizes in BCC structure. If the density of lithium is 530 lithium. The atomic weight of lithium is 6.94. Write the properties of matter waves and derive the equation for de-Broglie wave length associated with matter waves. Write the energy difference between the ground state and third excited state of an electron in I-D box of length 10-8 cm. 2 2 2 4 1.2 2 2 4 1.2 2 4 5 1.2, 2 4 5 1.2, 2 1 1 1.2,1	3		es 2		1	1	1,2,1
Write the limitations of classical free electron theory. Draw the Fermi level location for intrinsic and extrinsic semiconductors. Summarize the three important requisites for laser action to takes place. List any four important applications of optical fibres. Differentiate between polar and non-polar dielectrics. Discuss any four important properties of super conductors. Part-B (5 × 8 = 40 Marks) Examine the Schottky defect. Evaluate the expression for equilibrium concentration of Schottky defects at a temperature T. Lithium crystallizes in BCC structure. If the density of lithium is 530 kg/m³, calculate the lattice constant and nearest neighbouring distance of lithium. The atomic weight of lithium is 6.94. Write the properties of matter waves and derive the equation for de-Broglie wave length associated with matter waves. Calculate the energy difference between the ground state and third excited state of an electron in I-D box of length 10-8 cm. What is intrinsic semiconductor? Derive expression for electrons concentration of an intrinsic semiconductor.		Mention the physical significance of wave function (ψ) .	2	2	2	2	1,2,12
Write the limitations of classical free electron theory. Draw the Fermi level location for intrinsic and extrinsic semiconductors. Summarize the three important requisites for laser action to takes place. List any four important applications of optical fibres. Differentiate between polar and non-polar dielectrics. Discuss any four important properties of super conductors. Part-B (5 × 8 = 40 Marks) Examine the Schottky defect. Evaluate the expression for equilibrium concentration of Schottky defects at a temperature T. Lithium crystallizes in BCC structure. If the density of lithium is 530 lithium. The atomic weight of lithium is 6.94. Write the properties of matter waves and derive the equation for de-Broglie wave length associated with matter waves. Write the energy difference between the ground state and third excited state of an electron in I-D box of length 10-8 cm. What is intrinsic semiconductor? Derive expression for electrons concentration of an intrinsic semiconductor.		Examine what is meant by Quantum tunneling.	1 2				1,2,1
Draw the Fermi level location for intrinsic and extrinsic semiconductors. Draw the Fermi level location for intrinsic and extrinsic semiconductors. Summarize the three important requisites for laser action to takes place. List any four important applications of optical fibres. Differentiate between polar and non-polar dielectrics. Discuss any four important properties of super conductors. Part-B (5 × 8 = 40 Marks) Examine the Schottky defect. Evaluate the expression for equilibrium concentration of Schottky defects at a temperature T. Lithium crystallizes in BCC structure. If the density of lithium is 530 kg/m³, calculate the lattice constant and nearest neighbouring distance of lithium. The atomic weight of lithium is 6.94. Write the properties of matter waves and derive the equation for deBroglie wave length associated with matter waves. Calculate the energy difference between the ground state and third excited state of an electron in I-D box of length 10-8 cm. What is intrinsic semiconductor? Derive expression for electrons concentration of an intrinsic semiconductor.	5.	Write the limitations of classical free electron theory.					1,2,12
8. List any four important applications of optical fibres. 9. Differentiate between polar and non-polar dielectrics. 10. Discuss any four important properties of super conductors. Part-B (5 × 8 = 40 Marks) 1. a) Examine the Schottky defect. Evaluate the expression for equilibrium concentration of Schottky defects at a temperature T. b) Lithium crystallizes in BCC structure. If the density of lithium is 530 lithium. The atomic weight of lithium is 6.94. B) Write the properties of matter waves and derive the equation for de-Broglie wave length associated with matter waves. b) Calculate the energy difference between the ground state and third excited state of an electron in I-D box of length 10-8 cm. a) What is intrinsic semiconductor? Derive expression for electrons 5 3 3 1,2,12	6.	Draw the Fermi level location for intrinsic and extrinsic semicand	2			3	1,2,12
Differentiate between polar and non-polar dielectrics. Discuss any four important properties of super conductors. Part-B (5 × 8 = 40 Marks) Examine the Schottky defect. Evaluate the expression for equilibrium concentration of Schottky defects at a temperature T. Lithium crystallizes in BCC structure. If the density of lithium is 530 kg/m³, calculate the lattice constant and nearest neighbouring distance of lithium. The atomic weight of lithium is 6.94. Write the properties of matter waves and derive the equation for deBroglie wave length associated with matter waves. Calculate the energy difference between the ground state and third excited state of an electron in I-D box of length 10 ⁻⁸ cm. What is intrinsic semiconductor? Derive expression for electrons concentration of an intrinsic semiconductor.	7.	Summarize the three important requisites for laser action to the		3		3	1,2,12
Differentiate between polar and non-polar dielectrics. Discuss any four important properties of super conductors. Part-B (5 × 8 = 40 Marks) Examine the Schottky defect. Evaluate the expression for equilibrium concentration of Schottky defects at a temperature T. Lithium crystallizes in BCC structure. If the density of lithium is 530 lithium. The atomic weight of lithium is 6.94. Write the properties of matter waves and derive the equation for deBroglie wave length associated with matter waves. Calculate the energy difference between the ground state and third excited state of an electron in I-D box of length 10-8 cm. What is intrinsic semiconductor? Derive expression for electrons concentration of an intrinsic semiconductor.	8.	List any four important applications of optical fibres		2		4	1,2,12
Discuss any four important properties of super conductors. Part-B (5 × 8 = 40 Marks) Examine the Schottky defect. Evaluate the expression for equilibrium concentration of Schottky defects at a temperature T. Lithium crystallizes in BCC structure. If the density of lithium is 530 lithium. The atomic weight of lithium is 6.94. Write the properties of matter waves and derive the equation for deBroglie wave length associated with matter waves. Calculate the energy difference between the ground state and third excited state of an electron in I-D box of length 10 ⁻⁸ cm. What is intrinsic semiconductor? Derive expression for electrons concentration of an intrinsic semiconductor.	9.	Differentiate between polar and non-polar dielectric	2	1		4	1,2,12
Part-B (5 × 8 = 40 Marks) 1. a) Examine the Schottky defect. Evaluate the expression for equilibrium concentration of Schottky defects at a temperature T. b) Lithium crystallizes in BCC structure. If the density of lithium is 530 lithium. The atomic weight of lithium is 6.94. 4. a) Write the properties of matter waves and derive the equation for deBroglie wave length associated with matter waves. b) Calculate the energy difference between the ground state and third excited state of an electron in I-D box of length 10-8 cm. a) What is intrinsic semiconductor? Derive expression for electrons 5 3 3 1,2,12	10.	Discuss any four important properties of	2	2		5	1,2,12
Examine the Schottky defect. Evaluate the expression for equilibrium concentration of Schottky defects at a temperature T. b) Lithium crystallizes in BCC structure. If the density of lithium is 530 kg/m³, calculate the lattice constant and nearest neighbouring distance of lithium. The atomic weight of lithium is 6.94. Write the properties of matter waves and derive the equation for deBroglie wave length associated with matter waves. b) Calculate the energy difference between the ground state and third excited state of an electron in I-D box of length 10-8 cm. a) What is intrinsic semiconductor? Derive expression for electrons concentration of an intrinsic semiconductor.			2	4	5	;	1,2,12
Lithium crystallizes in BCC structure. If the density of lithium is 530 kg/m³, calculate the lattice constant and nearest neighbouring distance of lithium. The atomic weight of lithium is 6.94. Write the properties of matter waves and derive the equation for de-Broglie wave length associated with matter waves. Calculate the energy difference between the ground state and third excited state of an electron in I-D box of length 10-8 cm. What is intrinsic semiconductor? Derive expression for electrons 5 3 1,2,12 concentration of an intrinsic semiconductor.	1 0)	$Tart-B (3 \times 8 = 40 Marks)$	1975				
b) Lithium crystallizes in BCC structure. If the density of lithium is 530 kg/m³, calculate the lattice constant and nearest neighbouring distance of lithium. The atomic weight of lithium is 6.94. Write the properties of matter waves and derive the equation for deBroglie wave length associated with matter waves. Calculate the energy difference between the ground state and third excited state of an electron in I-D box of length 10-8 cm. What is intrinsic semiconductor? Derive expression for electrons 5 3 3 1,2,12)	concentration of Schottky defects at a temperature T.	5	4	1	1	,2,12
Broglie wave length associated with matter waves. b) Calculate the energy difference between the ground state and third excited state of an electron in I-D box of length 10 ⁻⁸ cm. a) What is intrinsic semiconductor? Derive expression for electrons 5 3 3 1,2,12	b) I k I	Lithium crystallizes in BCC structure. If the density of lithium is 530 kg/m ³ , calculate the lattice constant and nearest neighbouring distance of ithium. The atomic weight of lithium is 6.94.	3	2	1		,2,12
a) What is intrinsic semiconductor? Derive expression for electrons 5 3 3 1,2,12	a) V B	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
a) What is intrinsic semiconductor? Derive expression for electrons 5 3 3 1,2,12	b) C st	alculate the energy difference between the ground state and third excited ate of an electron in I-D box of length 10 ⁻⁸ cm.	3	3	2	1,2	2,12
b) Interpret limitations of Kronig-Pennsy and I	a) W	That is intrinsic semiconductor? Derive expression for electrons oncentration of an intrinsic semiconductor.	5	3	3	1,2	2,12
3 2 3 1.2.12	b) Int	terpret limitations of Kronig-Penney model.					

Code No.: 12322 N

	Describe the construction and working of Ruby laser with its energy level	5	4	4	1,2,12
4. a) b)	Calculate the refractive index of core and cladding of an optical fibre. The	3	3	4	1,2,12
15. a)	cladding of the optical fibre are 0.22 and 0.012 respectively. What is electronic polarizability? Obtain the expression for electronic	5	1	5	1,2,12
b)	polarizability. Show that super conductors exhibit perfect diamagnetism (Meissner	3	2	5	1,2,12
16. a)	effect) Inspect Powder Method of XRD to evaluate inter planar spacing of the	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
7.	Answer any <i>two</i> of the following:				101
a)	What is Hall effect? Derive the Hall voltage and Hall coefficient for n-type semiconductor.	4	1	1	1,2,1
b)	Briefly explain various losses in optical fibres.	4	2	2	1,2,1
c)	and hard magnetic materials on the basis of		2	3	1,2,1

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

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