Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

UG/PG DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL/MAY 2026

Second Semester

Mechanical Engineering

PH3251 / UPHT24205 – MATERIALS SCIENCE

Regulations – 2021 & 2024

Duration : 3 Hrs *Maximum : 100 Marks*

*PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)*

Q.No	*Questions*	*BLT*	*CO*	*Marks*
1.	Calculate the coordination number of BCC and FCC structures.	L2	1	2
2.	Define Burger's vector.	L1	1	2
3.	List any four postulates of classical free electron theory of metals.	L2	2	2
4.	Write the applications of ferromagnetic materials.	L1	2	2
5.	Draw the energy band diagram of conductors, semiconductors, and insulators.	L2	3	2
6.	Enlighten the term mobility of electrons.	L1	3	2
7.	Compare the terms charge hole pair generation and recombination process.	L2	4	2
8.	Calculate the wavelength of GaAs semiconductor with band gap value of 1.54 eV.	L2	4	2
9.	Recall quantum confinement and name the quantum structures based on the same.	L1	5	2
10.	Differentiate active and passive optoelectronic devices with example.	L2	5	2

*PART – B (ANSWER ALL QUESTIONS) (Marks 5*16 = 80)*

Q.No			*Questions*	*BLT*	*CO*	*Marks*
11.	a	i	Calculate the number of atoms per unit cell and atomic radius of the BCC crystal structure.	L3	1	4
		ii	Prove that atomic packing factor for the crystal structures FCC and HCP are same.	L3	1	12
			Or			
	b	i	Explain the concepts of nucleation and growth.	L3	1	4
		ii	With necessary diagram, describe the homogeneous and heterogeneous process of nucleation.	L3	1	12
12.	a	i	Using the classical free electron theory, derive the mathematical expressions for the electrical conductivity and thermal conductivity of metals.	L2	2	12
		ii	Deduce Widemann-Franz law and Lorentz number.	L2	2	4
			Or			

	b	i	Apply the spin moment concept and classify dia, para and ferromagnetic materials with its properties.	L2	2	12
		ii	Calculate the magnetization and flex density of the given material, if magnetic field intensity and susceptibility at room temperature is 10^4 A/m and $4.2x10^{-3}$ respectively.	L2	2	4
13.	a		Derive an expression for electron concentration in conduction band and hole concentration in valance band of an intrinsic semiconductor.	L2	3	16
			Or			
	b	i	Define Hall Effect. Derive an expression for n-type and p-type semiconductor.	L2	3	10
		ii	Describe the experimental setup for the measurement of Hall coefficient and list the applications.	L2	3	6
14.	a		Elucidate absorption and emission of light in metals, semiconductors, and insulators with necessary sketches.	L2	4	16
			Or			
	b	i	Describe the principle, construction and working of Light Emitting Diode (LED) with energy band diagram.	L2	4	12
		ii	List the advantages and disadvantages of solar cell.	L2	4	4
15.	a	i	Sketch the density of states of quantum well, quantum wire and quantum dot structures.	L2	5	4
		ii	Demonstrate the principle, construction and working of single electron transistor with characteristics.	L2	5	12
			Or			
	b		Explain the types, properties, and applications of carbon nanotubes in detail with necessary diagrams.	L2	5	16

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