Reg. No.															

Question Paper Code	13760

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025

Second Semester

Electronics and Instrumentation Engineering

(Common to Electronic Instrumentation and Control Engineering)

24BSPH206 - PHYSICS FOR INSTRUMENTATION ENGINEERING

Regulations - 2024

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	What happens to the free electrons when an electric field is applied? (a) They move randomly and collide with each other. (b) They move in the direction of the field. (c) They remain stable. (d) They move in the direction opposite to that of the field.	1	K1	CO1
2.	What is the level that acts as a reference which separates the vacant and filled states at 0 K? (a) Excited level (b) Ground level (c) Valance orbit (d) Fermi energy level	1	K1	CO1
3.	In a semiconductor, what is the ratio of the diffusion current to the drift current? (a) Directly proportional to the mobility (b) Directly proportional to the electric field (c) Inversely proportional to the mobility (d) Inversely proportional to the electric field	1	K1	CO2
4.	What is the diffusion coefficient proportional to? (a) Mobility (b) Electric field (c) Temperature (d) Both mobility and temperature	1	K1	CO2
5.	What is the area of the hysteresis loop proportional to? (a) The energy lost per cycle (b) The magnetic field strength. (c) The magnetization of the material (d) The permeability of the material.	1	K1	CO3
6.	What is the cause of hysteresis loss? (a) The reversal of magnetization (b) The alignment of magnetic domains (c) The random orientation of magnetic domains (d) The demagnetization of the material	1	K1	CO3
7.	What type of transition is involved in indirect band gap semiconductors? (a) Direct transition (b) Indirect transition (c) Both direct and indirect transitions (d) Neither direct nor indirect transition	1	K1	CO4
8.	What is the process of emission of photons due to the recombination of electrons and holes? (a) Absorption (b) Emission (c) Radiative recombination (d) Non-radiative recombination.	1	K1	CO4
9.	Why does the band gap increase in nano materials? (a) Due to the increase in the number of atoms (b) Due to the decrease in the number of atoms. (c) Due to quantum confinement effects. (d) Due to surface effects.	1	K1	CO5
10.	What is the effect of quantum confinement on the band structure of nano materials? (a) The bands become broader. (b) The bands become narrower. (c) The bands split into discrete energy levels. (d) The bands disappear.	1	K1	CO6

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11.	List the drawbacks of classical free electron theory.	2	K1	CO1
12.	Explain effective mass of electron.	2	K2	CO1

13.	Show the differences between direct and indirect band gap semiconductors.	*2*	*K1*	*CO2*
14.	What is a Schottky diode? Give its uses.	*2*	*K1*	*CO2*
15.	Define magnetic susceptibility.	*2*	*K2*	*CO3*
16.	Define coercivity.	*2*	*K2*	*CO3*
17.	Calculate the wavelength emitted by a semiconductor whose band gap energy is 1.44 ev.	*2*	*K3*	*CO4*
18.	Give the uses of solar cell.	*2*	*K1*	*CO4*
19.	Calculate the polarization produced in a dielectric medium of dielectric constant 6 and it is subjected to an electric field of 100 V/m. Given $\varepsilon_0 = 8.85 \times 10^{-12}$ F/m.	*2*	*K3*	*CO5*
20.	Define polarisation of a dielectric material.	*2*	*K2*	*CO5*
21.	Explain quantum confinement.	*2*	*K2*	*CO6*
22.	Distinguish between quantum computing over classical computing.	*2*	*K2*	*CO6*

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23.	a)	Apply the classical free electron model to derive an expression for the electrical and thermal conductivity of a metal.	*11*	*K3*	*CO1*
		OR			
	b)	Derive an expression for the density of states using quantum free electron theory of solids.	*11*	*K3*	*CO1*
24.	a)	Derive an expression for the density of electrons in the conduction band for an intrinsic semiconductor.	*11*	*K3*	*CO2*
		OR			
	b)	Apply the Hall effect principle to derive the Hall coefficient and Hall voltage in n-type semiconductor.	*11*	*K3*	*CO2*
25.	a)	Classify the magnetic materials (Ferromagnetic, Paramagnetic, Diamagnetic materials) and explain the fundamental differences between them.	*11*	*K2*	*CO3*
		OR			
	b)	Describe the magnetic hard disk based on a GMR sensor.	*11*	*K2*	*CO3*
26.	a)	Discuss about the theory of generation and recombination in charge carriers.	*11*	*K2*	*CO4*
		OR			
	b)	Explain the principle, construction, working of Laser Diode with neat sketch.	*11*	*K2*	*CO4*
27.	a)	Relate the term internal field in dielectric by using Lorentz method.	*11*	*K2*	*CO5*
		OR			
	b)	Explain Ferroelectric material and its energy converter application.	*11*	*K2*	*CO5*
28.	a)	Derive the expression for the density of states of a quantum well and quantum wire.	*11*	*K3*	*CO6*
		OR			
	b)	Explain the construction and working of Single Electron Transistor.	*11*	*K3*	*CO6*