29/5/25 FN

Reg.No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, APR / MAY 2025

Artificial Intelligence and Data Science

Semester - II

PH23C09 - Semiconductor Devices and Quantum Technology
(Regulation2023)

Time:3 Hrs | Max. Marks: 100

CO1	Express knowledge on the electrical properties of materials
CO2	Have an insight into the semiconductor junction and display devices
CO3	Explore the magnetic and optical data storage devices
CO4	Implement the essential principles behind Nanodevices
CO5	Envisage the basics of quantum computing

BL – Bloom's Taxonomy Levels
(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A (10×2 = 20 Marks)

Q. No.	Questions	Marks	CO	BL
1	What is effective mass of electron?	2	1	L1
2	In a solid, consider energy level lying 0.05 eV above Fermi level. What is the probability of this level being occupied by an electron at 300 K. ($k = 1.38 \times 10^{-23} JK^{-1}$.)	2	1	L2
3	How to make degenerate semiconductor?	2	2	L2
4	What is Phosphors?	2	2	L2
5	Define magnetic flux density (B) and magnetic susceptibility (χ).	2	3	L1
6	How DVD differ from CD?	2	3	L2
7	What is quantum confinement?	2	4	L2
8	Write a note on resonant tunneling.	2	4	L1
9	How classical bits differ from qubits?	2	5	L2
10	Write the types of quantum computers.	2	5	L1

PART- B (5×13 = 65 Marks)

Q. No.	Questions	Marks	CO	BL
11 (a)	Derive an expression for density of states and carrier concentration of metal.	13	1	L3
	OR			
11 (b)	Explain intrinsic semiconductor with diagram and obtain expression for carrier concentration of electron.	13	1	L3
12 (a) (i)	Explain Hall effect Phenomena with neat diagram and derive expression for hall coefficient.	10	2	L4
(ii)	A silicon plate of thickness 1 mm and length 10 mm is placed in a magnetic field of 0.5 wb/m^2 acting perpendicular to its thickness. If 10^{-2} A current flows along its length, calculate the Hall voltage developed if the Hall coefficient is 3.66×10^{-4} m^3/coulomb.	3		
	OR			

12 (b) (i)	Explain the construction and working of LED with neat diagram	10	2	L4
(ii)	Calculate the wavelength and mention the colour of laser emission from GaAs semiconductor with bandgap 1.44 eV.	3		
13 (a) (i)	Explain giant magneto resistance (GMR) for multilayer structures with diagram.	10	3	L4
(ii)	In a magnetic material the field strength is found to be 106 A/m. if the magnetic susceptibility of the material is 0.5×10^{-5}, calculate the intensity of magnetization and flux density in the material.	3		
	OR			
13 (b) (i)	Describe the construction and reconstruction technique for hologram. Mention its advantages.	10	3	L4
(ii)	Calculate the diameter of the focal spot in CD when 10 mm focal length lens to focus the collimated output of a He-Ne laser (632.8 nm) that has a 1 mm diameter beam.	3		
14 (a)	Explain various quantum structures and bandgap of nanomaterials.	13	4	L3
	OR			
14 (b)	What is single electron phenomena? Explain single electron transistor with diagram.	13	4	L3
15 (a)	Explain one-QUBIT quantum gates and two-QUBIT gates (CNOT gate).	13	5	L4
	OR			
15 (b)	Explain Quantum cellular automata (QCA) with binary encoding.	13	5	L4

PART- C (1×15 = 15 Marks)

Q. No.	Questions	Marks	CO	BL
16.	Explain Peltier effect with neat diagram and application of this effect in coolers.	15	2	L5