Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

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

B.E / B.Tech / B.Arch (Full Time)
II-Semester
PH3251 & Physics for Electrical Sciences
(Regulation2023)

Time:3hrs Max.Marks: 100

CO1	Knowledge of the electrical properties of materials
CO2	Acquire an adequate understanding of semiconductor physics and the functioning of semiconductor devices
CO3	Come to have firm knowledge of the dielectric and magnetic properties of materials and their applications
CO4	Understand the optical properties of materials and working principles of various optical devices
CO5	Appreciate the importance of nanotechnology, the physics of Nano devices, low dimensional structures and their applications

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

PART- A(10x2=20Marks)
(Answer all Questions)

Q.No.	Questions	Marks	CO	BL
1	Give any two postulates of classical free electron theory.	2	CO1	L1
2	Copper has electrical conductivity at 300 K as 6.40×10^7 m^{-1}. Calculate the thermal conductivity of copper.(Lorentz number is 2.44×10^{-8} W Ω k^{-2}).	2	CO1	L3
3	What are intrinsic semiconductors?	2	CO2	L1
4	What is ohmic contact?	2	CO2	L1
5	Define Electronic Polarization.	2	CO3	L1
6	Distinguish between Soft and Hard magnetic material.	2	CO3	L2
7	What is meant by luminescence?	2	CO4	L1
8	List out the materials responsible for the colour of emitted light in LED.	2	CO4	L2
9	Define quantum confinement.	2	CO5	L1
10	What are the advantages of single electron transistor?	2	CO5	L2

PART- B(5x 13=65Marks)
(Restrict to a maximum of 2 subdivisions)

Q.No.	Questions	Marks	CO	BL
11 (a) (i)	Define Fermi Energy? Write Fermi-Dirac distribution function. Explain how Fermi function varies with temperature.	10	CO1	L2
(ii)	Calculate the Fermi energy of copper at 0 K if the concentration of electron is 8.5×10^{28} m^{-3}.	3	CO1	L3
	OR			
11 (b)	With the help of Fermi-Dirac statistics, derive the expression for density of states and deduce Fermi energy.	13	CO1	L3

12 (a) (i)	Derive an expression for carrier concentration of density of holes in valence band in intrinsic semiconductor with neat diagram.	**10**	CO2	L4
(ii)	The intrinsic carrier density is 1.5×10^{16} / m^3. If the mobilities of electron and hole are 0.13 and 0.05 m^2 / V. s calculate the conductivity.	**3**	CO2	L3
	OR			
12 (b) (i)	What is Hall effect? Describe an experimental set-up for the measurement of Hall coefficient, and write its applications.	**10**	CO2	L2
(ii)	An electric field of 100 V/m is applied to sample of n-type semiconductor whose Hall coefficient is –0.0125 m^3 / C. Determine the current density in the sample, assuming $\mu_e = 0.36$ m^2 / V.s.	**3**	CO2	L3
13 (a) (i)	Derive an expression for electronic polarization in a dielectric material with neat diagram.	**10**	CO3	L2
(ii)	Calculate the electronic polarizability of neon. The radius of neon atoms is 0.158 nm. ($\varepsilon_0 = 8.854 \times 10^{-12}$ F/m).	**3**	CO3	L3
	OR			
13 (b)	Describe the ferromagnetic domain theory in detail and how will you account hysteresis of ferromagnetic material.	**13**	CO3	L2
14 (a)	Describe the principle and working white LED and Laser diode optical amplifier.	**13**	CO4	L2
	OR			
14 (b)	Describe the construction and working of semiconductor lasers.	**13**	CO4	L2
15 (a)	Derive an expression for density of states in quantum well, quantum wire and quantum dot structures.	**13**	CO5	L1
	OR			
15 (b)	Explain single electron phenomena and how the single electron transistor works based on this phenomenon.	**13**	CO5	L1

PART- C(1x 15=15Marks)

(Q.No.16 is compulsory)

Q.No.	Questions	Marks	CO	BL
16.	Describe the carrier concentration in N-type semiconductor and obtain an expression for density of electrons in conduction band with neat diagram.	**15**	CO2	L3