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Reg No.:_______________ Name:__________________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S2 (R) Exam May 2025 (2024 Scheme)

Course Code: GAPHT121

Course Name: PHYSICS FOR INFORMATION SCIENCE

Max. Marks: 60 Duration: 2 hours 30 minutes

PART A

(Answer all questions. Each question carries 3 marks)

			CO	Marks
1		Draw labelled energy band diagram of conductors, semiconductors and insulators.	CO1	(3)
2		Explain critical temperature and critical field. How are they related?	CO1	(3)
3		Explain with a numerical example that wave nature of matter is not apparent in our daily observations of large particles.	CO2	(3)
4		Explain the barrier tunnelling of particles on the basis of quantum mechanics. Give practical examples.	CO2	(3)
5		Draw the V-I characteristics of a p-n junction diode and explain the features.	CO3	(3)
6		Explain the formation of p-type extrinsic semiconductor.	CO3	(3)
7		Explain the working of a tunnel diode.	CO4	(3)
8		Explain the working of LED.	CO4	(3)

PART B

(Answer any one full question from each module, each question carries 9 marks)

Module -1

9	a)	What are the basic assumptions of classical free electron theory? Obtain the expressions for drift velocity and electrical conductivity based on this theory.	CO1	(6)
	b)	Find the mobility of electrons in copper, if there are 9×10^{28} valence electrons per m^3 and conductivity of copper is 6×10^7 mho/m. Charge of the electron is 1.6×10^{-19} C.	CO1	(3)
10	a)	Explain BCS theory of superconductivity. Give four applications of superconductors.	CO1	(6)
	b)	The transition temperature for Pb is 7.26K. The maximum critical field for Pb is 8×10^5A/m. If it has to be used as a superconductor subjected to a magnetic field of 4×10^4A/m, what should be the temperature of Pb.	CO1	(3)

Module -2

11	a)	State and explain uncertainty principle. Use this principle to show the non-existence of electrons inside the nucleus.	CO2	(6)
	b)	An electron is trapped in a one-dimensional box of length 0.1nm. Calculate the energy required to excite the electron from its ground state to the second excited energy state.	CO2	(3)
12	a)	Obtain the time independent Schrodinger equation from time dependent Schrodinger equation.	CO2	(6)
	b)	An electron is confined to a potential well of width 10nm. Calculate the minimum uncertainty in its velocity. Mass of electron is 9.1×10^{-31} kg.	CO2	(3)

Module -3

13	a)	Derive the expression for density of holes in the valence band of an intrinsic semiconductor.	CO3	(6)
	b)	A germanium diode at room temperature has a forward current of 2 mA when the forward voltage across it is 0.3V. Assuming the ideal diode equation and kT = 0.026eV, calculate the reverse saturation current of the diode.	CO3	(3)
14	a)	Explain Fermi level in intrinsic and extrinsic semiconductors. How does it vary with temperature?	CO3	(6)
	b)	A silicon diode at room temperature with a reverse saturation current of 10nA is subjected to a forward voltage of 0.4V. Calculate the forward current assuming an ideal diode and kT=0.026eV.	CO3	(3)

Module -4

15	a)	Explain the construction, working and V-I characteristics of a solar cell. Write down an expression for the efficiency and fill factor of the solar cell.	CO4	(6)
	b)	A silicon diode having internal resistance 30Ω is used for half wave rectification. The input a.c. voltage is $V_i = 6 \sin\omega t$ volts and load resistance is 500Ω. Find a) d.c. output voltage b) a.c. input power and c) efficiency of the rectifier.	CO4	(3)
16	a)	Explain the working of a half wave rectifier. Derive the expression for efficiency of a half wave rectifier.	CO4	(6)
	b)	In a full wave rectifier using centre tapped transformer, internal resistance of the diode is 20Ω. The rms value of the secondary voltage from centre tap to each anode is 300V. If the load resistance is 980Ω, evaluate the mean load current, rms load current and d.c. output power.	CO4	(3)

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