Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S1(S) Examinations May 2026 (2024 Scheme)

Course Code: GBPHT121

Course Name: PHYSICS FOR ELECTRICAL SCIENCE

Max. Marks: 60 Duration: 2 hours 30 minutes

PART A

(Answer all questions. Each question carries 3 marks)

			CO	Marks
1		Differentiate between diffusion and drift currents across a p-n junction.	(CO 1)	(3)
2		Explain the I-V characteristics of a p-n junction under forward bias.	(CO 1)	(3)
3		Explain negative resistance region in the I-V curve of a tunnel diode.	(CO 2)	(3)
4		List any three applications of Zener diode.	(CO 2)	(3)
5		Define critical magnetic field for a superconductor. Write the relation connecting critical magnetic field and critical temperature.	(CO 3)	(3)
6		Write the Clausius – Mossotti relation and explain the terms.	(CO 3)	(3)
7		Define the terms 'population inversion', 'pumping' and 'metastable state' in a lasing system.	(CO 4)	(3)
8		Explain the principle of propagation of light through an optical fibre.	(CO 4)	(3)

PART B

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

Module -1

9	a)	Derive an expression for density of electrons in the conduction band of an intrinsic semiconductor.	(CO 1)	(6)
	b)	Draw the energy band diagrams of n type and p type semiconductors marking the position of fermi level and respective impurity levels.	(CO 1)	(3)
10	a)	Derive the diode equation for an ideal diode.	(CO 1)	(6)
	b)	The reverse saturation current flowing through a Ge diode is 1.17×10^{-9}A. Calculate the current when a forward bias voltage of 0.4V is applied. Given the voltage equivalent of temperature is 25.2mV.	(CO 1)	(3)

Module -2

11	a)	Explain the process of 'rectification'? Explain the working of a centre tap full wave rectifier with the help of a neat circuit diagram and input-output	(CO 2)	(6)

		signals. Write any two advantages of a full wave rectifier over a half wave rectifier.		
	b)	A half wave rectifier with a peak input AC voltage of 240 V has a load resistance of 3.5kΩ. Calculate the efficiency of rectification if the diode resistance is 800Ω.	(CO 2)	(3)
12	a)	Explain the working principles of light emitting diode and solar cell. Draw their I-V characteristics and list any two applications for each device.	(CO 2)	(6)
	b)	A light emitting diode is made up of GaAsP having a bandgap of 1.9 eV. Determine the wavelength of the radiation emitted. ($h = 6.626 \times 10^{-34}$ Js, $e = 1.6 \times 10^{-19}$ C)	(CO 2)	(3)

Module -3

13	a)	Distinguish between type I and type II superconductors with necessary diagrams and examples.	(CO 3)	(6)
	b)	A lead wire has a critical magnetic field of 6.5×10^3 A/m at 0K. Its critical temperature is 7.18K. Calculate its critical magnetic field at 5.19K.	(CO 3)	(3)
14	a)	Explain the phenomenon of dielectric polarisation. Write short notes on electronic, ionic and orientation polarisation.	(CO 3)	(6)
	b)	Calculate the electronic polarizability of neon (Ne) gas if it contains 2.5×10^{25} atoms/m^3. The dielectric constant of Ne gas at room temperature is 1.000103. (Given: permittivity of free space is 8.85×10^{-12} F/m)	(CO 3)	(3)

Module -4

15	a)	Explain the construction and working of ruby laser with the help of necessary diagrams. List any two applications of laser.	(CO 4)	(6)
	b)	Explain the importance of optical resonator in a lasing system?	(CO 4)	(3)
16	a)	Derive an expression to determine the acceptance angle of a step index fibre.	(CO 4)	(6)
	b)	Calculate the acceptance angle and numerical aperture of an optical fibre with a core index of 1.55 and a cladding index of 1.50.	(CO 4)	(3)

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