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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

First Semester B.Tech Degree Regular Examination December 2024 (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	Define fermi energy. Give the significance of fermi level.	CO 1	(3)
2	Distinguish between intrinsic and extrinsic semiconductors.	CO 1	(3)
3	Write a short note on semiconductor laser.	CO 2	(3)
4	Explain stringing of solar cells.	CO 2	(3)
5	What are dielectric materials? Give 2 examples.	CO 3	(3)
6	Superconductors are perfect diamagnets. Justify.	CO 3	(3)
7	Distinguish between spontaneous emission and stimulated emission.	CO 4	(3)
8	Mention any 6 applications of optical fibres.	CO 4	(3)

PART B

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

Module -1

9	a)	Derive diode equation.	CO 1	6
	b)	At what temperature, the probability of a state to be occupied by an electron is 2 %. Given that the energy of the state is 0.1eV above the fermi level.	CO 1	3
10	a)	Derive an expression for density of holes in valence band of an intrinsic semiconductor.	CO 1	6
	b)	Calculate the intrinsic carrier concentration for silicon at 300 K with a band gap of 1.1 eV. Given $m_n^* = 0.12\ m_e$ and $m_p^* = 0.28\ m_e$	CO 1	3

Module -2

11	a)	Explain the working and VI characteristics of a tunnel diode.	CO 2	6
	b)	In a centre tap full wave rectifier each diode has an internal resistance of **10 Ω**. The transformer rms secondary voltage from centre tap to each end of secondary is **50 V** and load resistance is **980 Ω**. Find mean load current and rms value of load current.	CO 2	3

12	a)	Explain the working of a solar cell and draw its IV characteristics. Define fill factor and efficiency.	CO 2	6
	b)	Calculate the band gap energy of the semiconductor material used in an LED which emits light of wavelength **654 nm**.	CO 2	3

Module -3

13	a)	Derive Clausius- Mossotti relation.	CO 3	6
	b)	If the electric field strength inside two parallel plates of a capacitor is **10^4 V/m** due to a dielectric medium of dielectric constant **3**, find the polarisation vector. $\varepsilon_0 = 8.85 \times 10^{-12}\ C^2/Nm^2$	CO 3	3
14	a)	Define superconductivity, critical field and critical temperature. Write the relation connecting critical field and critical temperature.	CO 3	6
	b)	Explain any 3 applications of superconductors.	CO 3	3

Module -4

15	a)	Write short note on population inversion, pumping, metastable state and optical resonator in a laser system.	CO 4	6
	b)	Briefly explain any three applications of laser.	CO 4	3
16	a)	With the help of neat block diagram explain a typical fibre optic communication system.	CO 4	6
	b)	The refractive index of core and cladding for a step index fibre are **1.53** and **1.39** respectively. Find its numerical aperture and acceptance angle.	CO 4	3

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