Semester: I	Department of Physics	AY: 2026-27
Course Code: 1BPHYS202	Course Name: QUANTUM PHYSICS AND APPLICATIONS	

Question Bank

Q.	Module-01	M	L	C
1.	Set up one dimensional time -independent Schrodinger's wave equation.	8	L2	CO1
2.	Write a brief note on - Physical significance of wave function, Principle of complementarily, Expectation value& Quantum tunneling.	8	L2	CO1
3.	Derive a normalized wave function for a particle inside one dimensional infinite potential well.	8	L2	CO1
4.	Discuss Heisenberg's uncertainty principle and state the three relationships. Use the energy-time uncertainty to explain the broadening of spectral lines.	9	L2	CO1
5.	State and explain de Broglie's hypothesis. Derive the expression for wavelength of matter waves.	8	L2	CO1
6.	Find the Eigen values and Eigen function for a particle in one dimensional infinite potential well for first 3 cases	7	L2	CO1
7.	Show that $\lambda = \frac{12.27}{\sqrt{V}}\ \dot{A}$, for an electron accelerated under a potential difference of V volts.	8	L2	CO1
8.	Calculate the change in the de Broglie wavelength of an electron decelerated through a potential difference of 1 kV from 5 kV to 4 kV.	4	L3	CO1
9.	Calculate the de Broglie wavelength of an electron having kinetic energy 100eV.	4	L3	CO1
10.	Explain the physical significance of a wave function and its square modulus	8	L2	CO1
	Module-02			
1	Derive the expression for energy density of radiation using Einstein's coefficients.	**9**	L2	CO4
2	Describe the construction and working of Semiconductor laser with the help of energy band diagram.	8	L2	CO4
3	Explain the process of spontaneous and stimulated emission. OR Explain about the interaction of radiation with matter.	**8**	L2	CO4
4	Discuss about population inversion, meta-stable state and pumping mechanism.	**7**	L2	CO4
5	Define Acceptance Angle, Numerical aperture and Fractional index change Δ? Obtain an expression for numerical aperture of an optical fibre with suitable diagram.	**9**	L3	CO4
6	What are electro-optic modulators? Explain Pockel's effect and Kerr effect	8	L2	CO4
7.	What is Optical fiber? Explain the principle behind propagation of signals through optical fiber.	8	L2	CO4
8	Define Attenuation. Explain the different attenuation mechanism.	6	L2	CO4

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10.	Explain the principle and working of a Single Photon Avalanche Diode (SPAD) with I_V Characteristics graph.	7	L2	CO4
11.	Explain the principle and working of Superconducting Nanowire Single Photon Detector.	7	L2	CO4
12.	Explain the construction and working of Mach-Zehnder Interferometer.	8	L2	CO4
	Module-03			
1.	Define Fermi energy and Fermi factor. Discuss the variation of Fermi factor with temperature and energy.	9	L2	CO3
2.	Write the assumptions of quantum free electron theory. Discuss about the success (merits) of quantum free electron theory. (OR) Describe how quantum free electron theory has been successful in overcoming the failures of classical free electron theory.	8	L2	CO3
3.	Explain the Failure of Classical free electron theory of metals and the Assumptions of Quantum free electron theory.	9	L2	CO3
4.	Prove that the Fermi energy in an intrinsic semiconductor at finite temperature differs from its value at T =0 K by a value proportional to the temperature.	9	L3	CO3
5.	Calculate the probability of an electron occupying an energy level 0.02eV below the Fermi level at 400K	4	L3	CO3

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