



SEMESTER END EXAMINATIONS – MAY 2023

Program	: B.E :- Common to CSE / ISE / CSE (CY) / AI & DS / BT / AI & ML / CSE (AI & ML)	Semester	: 1
Course Name	: Engineering Physics	Max. Marks	: 100
Course Code	: PYC12	Duration	: 3 Hrs

Instructions to the Candidates:

- Answer one full question from each unit.
- Physical constants: $h=6.625 \times 10^{-34}$ Js; $k=1.38 \times 10^{-23}$ JK⁻¹; $m_e=9.1 \times 10^{-31}$ kg; $\epsilon_0=8.852 \times 10^{-12}$ Fm⁻¹; $e=1.602 \times 10^{-19}$ C; $N_A=6.023 \times 10^{26}$ /k.mol; $c=3 \times 10^8$ ms⁻¹.

UNIT - I

- Explain the construction and working of He-Ne laser with relevant diagrams. CO1 (08)
 - Explain intermodal dispersion and how is it reduced in a Graded index multimode fibre. CO1 (07)
 - Calculate the number of modes supported for 82µm carrier wave by a multi-mode step index optical fiber of core diameter 50µm, core refractive index 1.53 and fractional index change 2.3×10^{-3} . CO1 (05)
- Explain interaction of radiation with matter and derive the expression for energy density at thermal equilibrium in terms of Einstein coefficients. Compare the expression with Planck's law. CO1 (08)
 - What is attenuation in an optical fiber? Explain any three mechanisms leading to attenuation in an optical fiber. CO1 (07)
 - For a light of frequency 1.5×10^{14} Hz used as an excitation source at a temperature of 300K find the ratio of stimulated to spontaneous emissions. CO1 (05)

UNIT - II

- Setup Schrodinger's time independent one dimensional wave equation. What are the characteristics of a wave function. CO2 (08)
 - Define phase velocity and group velocity. Derive the expression for group velocity from superposition principle. CO2 (07)
 - An electron has a speed of 4.8×10^5 m/s accurate to 0.017 %. With what accuracy can be located the position of electron? CO2 (05)
- Solve the Schrodinger wave equation for the Eigen energy values and Eigen functions in the case of a particle in an infinite potential well. CO2 (08)
 - State Heisenberg uncertainty principle. Prove that an electron does not exist within a nucleus. CO2 (07)
 - The ground state energy of electron in an infinite is 37.64 eV. What will be the ground state energy value if the width of the well is doubled? CO2 (05)

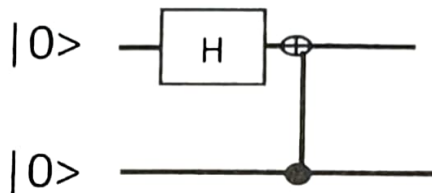
UNIT - III

- Obtain an expression for the density of energy states in a metal. CO3 (08)
 - Define Fermi factor. Explain the dependence of Fermi factor on temperature with the graph. CO3 (07)
 - The polarizability of an elemental solid dielectric material is 7×10^{-40} Fm². Assuming the internal field to be a Lorentz field, Calculate the material's dielectric constant if it has 2×10^{28} atoms/m³. CO3 (05)

6. a) Define the internal field. Derive an expression for internal field in a one-dimensional array of atoms in solids. CO3 (08)
- b) Define critical temperature. Explain the Meissner effect. CO3 (07)
- c) The Fermi energy of a metal is 5.5eV. Determine the value of energy for which the probability of occupation is 2 % at 350K. CO3 (05)

UNIT- IV

7. a) With suitable diagram, explain the production and detection of circularly polarized light and elliptically polarized light. CO4 (08)
- b) Explain single-particle quantum interference with a suitable example. CO4 (07)
- c) Consider two states $|\psi\rangle = |\phi_1\rangle + 3i|\phi_2\rangle - |\phi_3\rangle$ and $|\chi\rangle = |\phi_1\rangle - i|\phi_2\rangle + 5i|\phi_3\rangle$ where $|\phi_1\rangle, |\phi_2\rangle$ and $|\phi_3\rangle$ are orthonormal. Are $|\psi\rangle$ and $|\chi\rangle$ normalized? Justify your response. CO4 (05)
8. a) Explain the set up and theory of Stern-Gerlach experiment with suitable diagrams. CO4 (08)
- b) What is a qubit? Explain how a Bloch sphere is used for the representation of qubits. CO4 (07)
- c) Describe the action of a Hadamard gate and obtain the output of given quantum circuit. CO4 (05)



UNIT - V

9. a) Discuss Poisson's probability distribution. Explain the probability of number of particles emitted per second by a radioactive source using this method. CO5 (08)
- b) Explain as how physics of mechanics is involved in making a character jumping animation. CO5 (07)
- c) A jumping animation sequence consists of six frames with pulse height 0.5m and stop height 0.6m. Calculate the stop time if the animation is played at 30fps. CO5 (05)
10. a) Discuss normal distribution and bell curve. Explain Maxwell Boltzmann distribution law. CO5 (08)
- b) What is Monte-carlo simulation method? Discuss the steps involved in this method. CO5 (07)
- c) How many frames exist in a sequence of animation which covers a total distance of 0.2m with base distance of 0.05m. CO5 (05)
