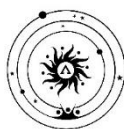


H.T.No:

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Course Code: 241PH002



ADITYA UNIVERSITY

B.Tech – I Semester End Examinations Supplementary – APR 2025

MODERN PHYSICS

(Common to EEE, ECE, IT & CSE(DS))

Time: 3 hours

Max. Marks: 50

Answer ONE question from each unit

All Questions Carry Equal Marks

All parts of the questions must be answered at one place only

UNIT-I

- 1 a Explain how Newton's Rings are formed in the reflected light. Derive an expression for diameters of dark and bright fringes. L2 CO1 [8M]
b In Newton's Rings experiment the diameters of 15th ring was found to be 0.59 cm and that of 5th ring is 0.336 cm. The radius of curvature of the lens is 100 cm. Find the wavelength of light? L3 CO1 [2M]

(OR)

- 2 a Explain the difference between Interference and Diffraction. L1 CO1 [3M]
b Give the theory of Fraunhofer diffraction due to a single slit and hence obtain the condition for primary and secondary maxima. L2 CO1 [7M]

UNIT-II

- 3 a Derive the relation between the probabilities of spontaneous emission and stimulated emission in terms of Einstein's coefficients. L2 CO2 [7M]
b A hypothetical atom has two atomic levels spaced by 3 eV in energy calculate the ratio in higher energy and lower energy population at 50 °C. Given Boltzmann constant $k_B = 1.38 \times 10^{-23} \text{ J/K}$. L3 CO2 [3M]

(OR)

- 4 a Optical fibres act as efficient mode of communication system. Classify the optical fibres based on the refractive index profile and modes of propagation. L2 CO2 [8M]
b Calculate the fractional index change for a given optical fibre if the refractive indices of the core and cladding are 1.56 and 1.54 respectively. L3 CO2 [2M]

UNIT-III

- 5 a What are the properties of matter waves? State and explain Heisenberg uncertainty principle. L2 CO3 [3M]
b Describe Davisson and Germer's experiment and explain how it enabled verification of the de-Broglie equation. L2 CO3 [7M]

(OR)

- 6 a An electron is trapped in one-dimensional potential box of width L, determine the discrete energy levels that the electron can occupy. L2 CO3 [8M]
b Estimate the energy of first excited state of an electron which is trapped in one-dimensional box of width 1 Å. (mass of the electron is $9.1 \times 10^{-31} \text{ kg}$). L3 CO3 [2M]

(P.T.O)

UNIT-IV

- 7 a Explain details in classical free electron theory with merits and demerits. L2 CO4 [4M]
b Derive the fermi distribution function and solve about electrical conductivity. L2 CO4 [6M]

(OR)

- 8 a Discuss the motion of an electron in a periodic potential. L2 CO4 [3M]
b Explain the classification of solids according to band theory of solids. L2 CO4 [7M]

UNIT-V

- 9 a Distinguish between intrinsic and extrinsic semiconductor. L1 CO5 [3M]
b Derive an expression for the carrier concentration of an intrinsic semiconductor. L2 CO5 [7M]

(OR)

- 10 a Write a short note on semiconductors. L1 CO5 [2M]
b Describe the drift and diffusion currents in a semi-conductor. Derive their expression. Deduce Einstein's equation. L2 CO5 [8M]
