H.T.No: | | | | | | | | | | | 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 expressionfor diameters of dark and bright fringes.	L2	CO1	[8M]
	b	In Newton's Rings experiment the diameters of 15^{th}ring was found to be 0.59 cm andthat of 5^{th}Ring is 0.336 cm. The radius of curvatureof the lens is 100 cm. Find thewavelength of light?	L3	CO1	[2M]

(OR)

2	a	Explain the difference between Interference and Diffraction.	L1	CO1	[3M]
	b	Give the theory of Fraunhoffer diffraction due to a single slit and hence obtain thecondition 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 particle hypothetical atom has two atomic levels spaced by 3 eV in energy calculate the ratio in higher energy and lower energy population at 50 ºC. Given Boltzmann constant $k_B = 1.38 \times 10^{-23}$ J/K .	L3	CO2	[3M]

(OR)

4	a	Optical fibres act as efficient mode of communication system. Classify the optical fibres basing 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	DescribeDavisson 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 9.1×10^{-31} 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]

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