H.T.No: | | | | | | | | | | | Course Code: **241PH002**

ADITYA UNIVERSITY

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

MODERN PHYSICS

(Common to EEE, ECE, IT & DS)

Time: 3 hours **Max. Marks: 100**

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	Draw a neat diagram showing the formation of Newton's rings, as well as the experimental set up. How are the ring diameters and film thickness related? Derive an expression for measurement of Refractive index in Newton's ring experiment.	L2	CO1	[14M]
	b	Explain colours of thin films.	L2	CO1	[6M]

(OR)

2	a	Distinguish between Fraunhofer and Fresnel's diffraction. Explain the Fraunhofer diffraction due to single slit with necessary theory.	L2	CO1	[12M]
	b	Explain the formation of the grating spectrum, including principal maxima, side maxima, and the role of groove spacing d in spectral resolution.	L2	CO1	[8M]

UNIT-II

3	a	Describe the characteristics of laser light and contrast them with ordinary light.	L2	CO2	[6M]
	b	Derive the relationships between Einstein's coefficients A_{21}, B_{21}, and B_{12} atomic system in thermal equilibrium.	L2	CO2	[14M]

(OR)

4	a	Explain the principle of total internal reflection as the basis for light propagation in optical fibers. Derive the expression for the numerical aperture of an optical fiber, including the angle of acceptance.	L2	CO2	[14M]
	b	Classify optical fibers based on refractive index profile and number of modes.	L2	CO2	[6M]

UNIT-III

5	a	Explain the derivation of the time-independent Schrödinger equation for a free particle and under a potential.	L2	CO3	[10M]
	b	Analyze experimental challenges in Davisson-Germer, including polycrystalline nickel oxidation and single crystal growth.	L2	CO3	[10M]

(OR)

6	a	For a particle in 1D infinite box, derive energy E_n and wave function $\psi_n(x)$.	L2	CO3	[12M]
	b	An electron is confined to 1D infinite box of length 2 A^0, calculate the energy in the first two excited states.	L3	CO3	[8M]

UNIT-IV

7	a	Explain the salient features of classical free electron theory. What are drawbacks of classical free electron theory of materials?	L2	CO4	[10M]
	b	Explain the terms 'Mean free path' 'Relaxation time' and 'Drift velocity' of an electron in a metal.	L2	CO4	[10M]

(P.T.O)

(OR)

8	a	Explain Fermi- Dirac distribution function in conductors.	L2	CO4	[12M]
	b	Discuss classification of materials briefly based on energy band gap.	L2	CO4	[8M]

UNIT-V

9	a	The following data are given for an intrinsic Ge at 300K. Calculate the conductivity and resistivity of the sample? (ni= 2.4 x$10^{19}$$m^{-3}$, μe = 0.39 m^2 -V^{-1} S^{-1}, μp = 0.19 m^2-V^{-1} S^{-1}).	L3	CO5	[4M]
	b	Explain the Hall effect principle, derive Hall voltage V_H and Hall coefficient R_H. Discuss its applications in determining carrier type, density, and mobility.	L2	CO5	[16M]

(OR)

10	a	Explain the formation of p-n junction. Explain effect of temperature on Fermi energy level of an extrinsic semiconductor.	L2	CO5	[10M]
	b	Explain PN junction diode formation and working under forward/reverse bias. Describe depletion region changes, V-I characteristics, and derive diode current equation.	L2	CO5	[10M]

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