

NOTE: Figures to the right indicate full marks.
Non programmable calculators are allowed.
All questions are compulsory.

Q1) Answer the following.

- A) Explain the phenomenon of refraction through a thick lens and explain the formula for it. (20M)
(8M)
- OR
- A) Describe Newton's rings experiment to find the expression for the radius of the n^{th} ring (for both dark and bright). (8M)
- B) With the help of a neat ray diagram, explain the spherical aberration of lens. Explain any two way to reduce spherical aberration. (7M)
- OR
- B) Explain the construction of spectrometer with the help of neat diagram. (7M)
- C) Describe Schuster's method. (5M)
- OR
- C) Two thin lens of focal lengths 15cm and 20cm are placed coaxially parallel to each other at a distance 5 cm apart. Find the equivalent length and plot the cardinal points and planes. (5M)

2) Answer the following.

- A) Describe the construction and working of He-Ne laser with the help of energy level diagram (8M) •
(20M)
- OR
- A) What is numerical aperture (NA) of an optical fibre? Derive necessary expression for it. (8M)
- B) Explain the following properties of laser • (7M)
- Monochromaticity
 - Coherence
 - Intensity and power
 - Directionality
- OR
- B) Describe structure of a step-index optical fibre. Explain the propagation of light through it. (7M)
- C) Explain reconstruction of image in holography with neat and labelled diagram. (5M)
- OR
- C) Determine:
- The critical angle of reflection for core-cladding boundary and
 - The acceptance angle of the fibre
- Given: R.I. of core = $n_1 = 1.4$
R.I. of cladding = $n_2 = 1.3$ (5M)

Answer the following.

- A) What are the limitations of Vander waals equation. Find the equation of the curve passing through maxima and minima of vander waals isothermals. (8M)
- OR

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- A) Define molar specific heats of a gas and show that for a perfect gas, $C_p - C_v = R$ (8M)
- B) Derive the relations between Vander waals constants and critical constants. (7M)
- OR
- B) Derive an expression for the work done by a perfect gas in an adiabatic change. (7M)
- C) Explain Zeroth law of thermodynamics. (8M)

- OR
- C) Define critical coefficient. Show that its theoretical value is 2.667 (8M)

Q4) Answer the following. (15M)

- A) Write a note on graded index fibre with neat labelled diagram.
- B) Explain the term 'deviation' in case of lens. Hence prove that the deviation does not depend on the position of an object.
- C) The core and cladding of an optical fibre has refractive indices 1.5 and 1.47 respectively. Find the acceptance angle in air and the critical angle for core-cladding interface.
- D) Calculate the wavelength of light that incident on a wedge shaped film of glass of R.I. 1.47. The angle of wedge is 30 seconds of an arc and the fringe width is of the order 0.15 cm.
- E) The critical temperature and the critical pressure of a gas are 155°C and 77 atm respectively. Find the critical volume. Also calculate Vander waals constants. $R = 8.2 \text{ JK}^{-1} \text{ mol}^{-1}$, $1 \text{ atm} = 1.013 \times 10^5 \text{ Nm}^{-2}$
- F) State the concept of heat and define thermal interaction.