

[Time: Three Hours]

[Marks:100]

- N. B.:** (1) All questions are **compulsory**.
 (2) **Figures** to the **right** indicate **full** marks.
 (3) Draw **neat** diagrams wherever **necessary**.
 (5) Symbols have usual meaning unless otherwise stated.
 (5) Use of **non-programmable** calculator is allowed.

- Q.1. A) Select the correct alternative** **12**
- (i) Impulse is product of _____
 a. Force & mass b. Mass & acceleration
 c. Force & time d. Force & displacement
- (ii) Poisson's ratio is a ratio of _____
 a. lateral strain and longitudinal strain b. Shear Stress and Shear Strain
 c. Volume Stress and Volume strain d. None of the above
- (iii) If the focal length of Huygen's Eyepiece is 18cm then focal length of field lens is _____.
 a. 12cm b. 24cm
 c. 36cm d. 72cm
- (iv) A ray of light reflected at the boundary of a rarer to denser medium undergoes a phase change of _____ degrees.
 a. 30 b. 180
 c. 90 d. 45
- (v) First law of thermodynamics is statement of _____?
 a. Conservation of momentum b. Conservation of energy
 c. Conservation of Angular Momentum d. Conservation of Mass
- (vi) Change in internal energy in a thermodynamic process depends _____
 a. Only on initial and final temperature b. Upon path taken
 c. Is always positive d. Is always negative
- B) Answer in one sentence** **3**
- (i) What is turbulent flow?
 (ii) State the two types of the defects in a lens.
 (iii) What is critical pressure?
- C) Fill in the blanks** **5**
- (i) In equation of continuity product of mass and velocity is _____
 (ii) Along the axis of the pipe velocity of the fluid is _____
 (iii) The radius of the n th dark ring is directly proportional to the _____ of the natural numbers in the reflected system.
 (iv) A single lens cannot form an image free from _____ aberration.

- (v) Isotherm is P-V diagram at constant _____

- Q. 2** **A)** **Attempt ANY ONE** **8**
- (i) Derive an expression for the moment of couple required to twist one end of the cylinder when other end is fixed for hollow cylinder
- (ii) For a homogeneous isotropic material find the relation between young's modulus Y bulk modulus K and Poisson's ratio σ .
- B)** **Attempt ANY ONE** **8**
- (i) Derive Poiseuille's equation for liquid flowing in narrow tube. State the assumptions made.
- (ii) a) As an application of Bernoulli's theorem, write a note on Venturimeter
b) On the basis of Bernoulli's theorem, explain the upward lift to aero plane
- C)** **Attempt ANY ONE** **4**
- (i) Young's modulus of a steel wire is $2.032 \times 10^{11} \text{ N/m}^2$ & its modulus of rigidity is $0.7 \times 10^{11} \text{ N/m}^2$ find its Poisson's ratio.
- (ii) In Atwood's machine, a string passing over frictionless, massless pulley has 10 kg block tied to one end and 12 kg block tied to the other. Find the acceleration and tension in the string.
- Q. 3** **A)** **Attempt ANY ONE** **8**
- (i) Derive the expression for optical path difference between two rays in the case of interference due to reflected light in the thin films.
- (ii) Describe Newton's rings experiment and explain with necessary theory the formation of Newton's rings.
- B)** **Attempt ANY ONE** **8**
- (i) Derive an expression for the equivalent focal length for a system having two thin lenses separated by a finite distance.
- (ii) What is chromatic aberration? Derive the expression for the axial chromatic aberration.
- C)** **Attempt ANY ONE** **4**
- (i) In the wedge shaped film of refractive index 1.57, fringe spacing is 1mm and wavelength of light used is 5893 \AA . Calculate the angle of wedge of film.
- (ii) Two convex lenses of focal lengths 10 cm and 20 cm are placed 5cm apart in air .Find the equivalent focal power of lens and its positions of principal points.
- Q. 4** **A)** **Attempt ANY ONE** **8**
- (i) With the corrections to pressure and volume, arrive at Van der Waals equation.
- (ii) Show that for adiabatic process, $PV^\gamma = \text{constant}$.
A gas occupies 1000 cc of volume at 4 atm pressure. It expands adiabatically to 1190 cc and the resulting pressure is 3 atm. Calculate γ .

- B) Attempt ANY ONE 8**
- (i) Show that for isothermal process work done, W is
- $$W = RT \times 2.303 \log_{10} \frac{P_1}{P_2}$$
- A perfect gas at room temperature having volume of 4 m^3 and initial pressure of 2 atm undergoes isothermal expansion to a volume of 5 m^3 . Calculate the work done by the gas.
- (ii) Show that for perfect gas, $C_P - C_V = R$
- C) Attempt ANY ONE 4**
- (i) A quantity of air at 30°C and at atmospheric pressure is suddenly compressed to half of its original volume. Find the final temperature and pressure of the gas. ($\gamma = 1.4$)
- (ii) An adiabatic container of volume V has an adiabatic partition making to compartments of volume V_1 and V_2 . These two compartments have an ideal gas of moles n_1 and n_2 at temperatures T_1 and T_2 , pressure P_1 and P_2 . If the partition is removed, what are the equilibrium temperature and pressure of the composite system?

- Q. 5 Attempt ANY FOUR 20**
- (i) Write short note on stream line flow and turbulent flow
- (ii) Write short note on limiting value of Poisson's ratio.
- (iii) Write a short note on Ramsden's eyepiece.
- (iv) State the various methods of reducing spherical aberration.
- (v) State and explain zeroth law of thermodynamics.
- (vi) Explain how the work done in a thermodynamic process is a path dependent function.
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