



- Notes :
1. All questions carry equal marks.
  2. Due credit will be given to neatness and adequate dimensions.
  3. Assume suitable data wherever necessary.
  4. Diagrams and Chemical equation should be given wherever necessary.
  5. Illustrate your answers wherever necessary with the help of neat sketches.
  6. Use of slide rule, Logarithmic tables, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.
  7. Solve Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q. 7 or Q. 8, Q. 9 or Q. 10.

1. a) Define & explain Newton's law of viscosity. Explain Newtonian and Non Newtonian fluids. **8**
- b) Enlist type of simple manometer. Explain U tube manometer with neat sketch. **8**

**OR**

2. a) 1m wide and 1.5m deep rectangular plane surface lies in water in such a way that its plane makes an angle of  $30^\circ$  with the free water surface. Determine the total pressure and position of centre of pressure when the upper edge is 0.75m below free water surface. **8**
- b) Define **8**
- i) Total pressure ii) Centre of pressure
- iii) Compressibility and bulk modulus iv) capillarity
3. a) A wooden block (Sp. Gr. 0.7) of width 15cm, depth 30cm & length 150cm floats horizontally on surface of sea water (Specific weight =  $10\text{kN}$ ). Calculate the volume of water displaced, depth of immersion & position of centre of buoyancy. Also find meta centric height. Comment on stability of block. **8**
- b) State and derive continuity equation in Cartesian coordinate form. **8**

**OR**

4. a) Explain **8**
- i) Velocity potential function ii) Stream function
- b) Water is flowing through the pipe having diameters 300 mm and 200 mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is  $24.525\text{ N/cm}^2$  and the pressure at the upper end is  $9.81\text{ N/cm}^2$ . Determine the difference in datum if the rate of flow through the pipe is 40 lit/sec. **8**

5. a) A horizontal Venturimeter with inlet diameter 20 cm & throat diameter 10cm is used to measure the flow of water. The pressure at inlet is  $17.658 \text{ N/cm}^2$  and the vacuum pressure at the throat is 30cm of mercury. Find the discharge of water through venturimeter. Take coefficient of discharge as 0.98. 8
- b) Enlist and explain the hydraulic coefficients. 8

**OR**

6. a) Explain: 8  
 i) Kinetic energy correction factor. ii) Momentum correction factor
- b) An oil of viscosity 10 poise flows between two parallel fixed plates which are kept at a distance of 50 mm apart. Find the rate of flow of oil between the plates if the drop of pressure in a length of 1.2m be  $0.3 \text{ N/cm}^2$ . The width of the plates is 200 mm. 8
7. a) In a pipe of 300 mm diameter and 800 m length an oil of specific gravity 0.8 is flowing at the rate of  $0.45 \text{ m}^3/\text{s}$ . Find : (i) Head lost due to friction, and (ii) Power required to maintain the flow. Take kinematic viscosity of oil as 0.3 stoke. 8
- b) Describe Prandtl mixing length theory for finding the shear stress in turbulent flow. 8

**OR**

8. a) Three pipes of diameters 300 mm, 200 mm and 400 mm and lengths 450 m, 255 m and 315 m respectively are connected in series. The difference in water surface levels in two tanks is 18 m. Determine the rate of flow of water if coefficients of friction are 0.0075, 0.0078 and 0.0072 respectively considering minor losses. 8
- b) Derive Darcy-Weisbach equation for head loss in pipes due to friction. 8
9. a) Discuss the following: 8  
 i) Boundary layer thickness ii) Displacement thickness  
 iii) Momentum thickness iv) Energy thickness
- b) A flat plate 2m x 2m moves at 60 km/hr in stationary air of density  $1.15 \text{ kg/m}^3$ . If the coefficient of drag and lift are 0.15 and 0.75 respectively. Determine 8  
 i) The lift force ii) The drag force  
 iii) Resultant force iv) Power required to keep the plate in motion

**OR**

10. a) Explain the importance of dimensional analysis. 8
- b) Define Buckingham's  $\pi$  theorem. Explain its significance in applications. 8

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