



- Notes :
1. All questions carry equal marks.
 2. Assume suitable data wherever necessary.
 3. Diagrams and Chemical equation should be given wherever necessary.
 4. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) Express the dimensions of dynamic and kinematic viscosities in terms of – force, length and time, and explain the effect of temperature on viscosity. **8**
- b) Explain Rheological diagram in details. **8**

OR

2. a) What are the various methods of dimensional analysis to obtain a functional relationship between various parameters influencing a physical phenomenon? Explain any one of them. **8**
- b) Resistance R due to wind on a tall vertical chimney is dependent upon the density ρ and viscosity σ of air, the wind velocity V , the diameter D and height H of the chimney. Develop an expression for resistance of the chimney in terms of these quantities. **8**
3. a) Define atmospheric, gauge, vacuum and absolute pressure and establish relationship between them with neat sketch. **8**
- b) A body weighing 320 N with a flat surface area of 0.065m^2 slides down a lubricated inclined plane making an angle 35° with the horizontal for the viscosity of 0.1 Pa-S and body speed of 2 m/sec. Determine the lubricant film thickness. **8**

OR

4. a) Prove that the total pressure exerted by a static liquid on an inclined plane submerged surface is same as the force exerted on a vertical plane surface as long as the depth of center of gravity of the surface is unaltered. **8**
- b) A circular plate of diameter 2 m is submerged in water vertically such that its top surface is 1 m below the free surface of the water. Determine the total pressure force on the plate and the position of the center of pressure. **8**
5. a) Define stream function and velocity potential. Show that equipotential and streamlines intersect each other orthogonally. **8**
- b) If $\psi = (x^3 - y^3)$, show that the flow is not a potential flow. **8**

OR

6. a) A venturi meter with 150 mm inlet diameter & 100 mm throat is used for measuring flow. of oil ($S = 0.9$). Differential gauge shows a reading of 30 cm. Assuming C_d of 0.98, calculate the discharge flowing through the venturi meter. **8**
- b) Starting from steady flow energy equation, show how Bernoulli's equation for an inviscid incompressible fluid can be obtained. **8**
7. a) Explain briefly. **8**
- 1) Laminar and Turbulent flow.
- 2) Reynold's number and critical velocity.
- b) What is meant by boundary layer thickness, displacement thickness and momentum thickness? **8**

OR

8. a) A smooth flat plate is exposed to wind velocity of 6 km / minute. If the laminar boundary layer exists upto a value of $Re = 2 \times 10^5$, find the maximum distance upto which laminar boundary layer exists and its maximum thickness. **8**
- b) An oil with density 9000 N/m^3 and viscosity 0.18 N-s/m^2 flows through a 10 cm diameter horizontal pipe. The pressure drop over a 10 m length of pipe is 10 kPa. Determine the average velocity and the rate of flow. **8**
9. a) a) Derive an expression for Darcy – Weisbach formula to determine the head loss due to friction. **8**
- b) Explain about Reynold's experiment.
- b) Three pipes 300 m of 30 cm diameter, 180 m of 20 cm dia and 400 m of 40 cm dia. are connected in series. Determine the discharge if the difference of elevation between entry of first pipe and exit of last pipe is 10 m. Consider friction factor 0.021. **8**

OR

10. a) A pipe network consists of two loops formed by five pipes AB, BC, CD, DA and BD. Pipe BD is common to both the loops. The inflow at A is $1.2 \text{ m}^3/\text{sec}$. and outflow at B, C and D are $0.34 \text{ m}^3/\text{sec}$, $0.42 \text{ m}^3/\text{sec}$ and $0.44 \text{ m}^3/\text{sec}$. resp. The value of 'K' for pipe AB is 50 and BC is 40, CD is 40; DA is 20 and BD is 25. Determine the flow in each pipe and the elevation of hydraulic grade line at C, if the elevation of hydraulic grade line at A is 100 m. **8**
- b) Explain Moody's diagram in details. **8**
