

Time: 3Hours

Marks:80

N.B. 1) Question No.1 is Compulsory.

2) Attempt any Three questions from remaining questions.

3) Assume suitable data where required and clearly state the same.

4) Figures to the right indicate full marks.

Q.1 Attempt any Four

(20)

- a) What is difference between dynamic viscosity and kinematic viscosity? State their units of measurement.
- b) An oil of specific gravity 0.85 is contained in a vessel at a point the height of the oil is 37m. Find the corresponding height of water at the point.
- c) Explain equipotential lines and flow net.
- d) Explain the principle of venturimeter with a neat sketch.
- e) Explain Hydraulic coefficients.
- f) Derive an expression for Stagnation density and temperature.

Q.2.a) A vertical gap 24.5 mm wide of infinite extent contain a oil of specific gravity 0.96 and viscosity $2.45 \text{ N}_s/\text{m}^2$ A metal plate $1.5\text{m} \times 1.5\text{m}$. 1.5mm thickness Weighting 48 N is to be lifted through the gap at a Great constant speed of 0.1m/s Estimate the force required. (10)

b) A square surface $3\text{m} \times 3\text{m}$ lies in a vertical Plane Determine the position of the centre of pressure and the total pressure force on the Square when its Upper edge is a) in water b) 15m below the water surface. (10)

Q.3. a) Define the equation of continuity; obtain an expression for continuity equation for three-dimensional flow. (10)

b) If $\phi = 3xy$, find x and y components of velocity at (1,3) and (3,4) Determine the discharge passing between streamlines passing Through these points. (10)

Q.4.a) Derive the discharge through orifice meter. (10)

b) A horizontal venturimeter, with inlet and throat diameters of 300 mm and 100mm respectively is used to measure the rate of flow of water. The pressure intensity at inlet is 130 KN/m^2 while the vacuum pressure head at the throat is 35cm. of mercury. Assuming that 3%. of head is lost in between inlet and throat, find the coefficient of the discharge of the venturimeter and the rate of flow. (10)

- Q.5.a)** An external cylindrical mouth piece of diameter discharge 100mm is discharging water (10) under a constant head of gm. Determine the discharge and absolute pressure and head of water at vena-contracta take $C_d = 0.853$ and $C_c = 0.62$ for vena-contracta. Take atmospheric Pressure head = 10.3 m of water.
- b)** Suppressed rectangular water is used to measure rate of flow and a stream 2m wide. The (10) head of water above the weir is 25cm. The sill of the notch is 50cm above the stream bed. Assuming $C_d=0.62$ find the discharge consider velocity approach.
- Q.6.a)** Derive an equation for discharge over a triangular notch. (10)
- b)** find the mach number when an aero Plane is flying at 800 km/hr through still air having (10) a pressure of 9 N/cm^2 and temperature of 15°C . Take $K=1.4$ and $R = 287\text{J/kg k}$, calculate the Pressure, density and temperature of air at the Stagnation point on the nose of plane.
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