

Duration: 3 hours

Total marks: 80

NOTE:

QP-10068985

- Q1 is compulsory.
- Attempt any three from remaining five questions
- Assume suitable data wherever required

Q1 Answer any four from following:

- Explain the terms- specific volume, specific gravity, viscosity, surface tension and capillarity [5]
- Define Mach number and also explain subsonic, sonic and supersonic flows. [5]
- Explain different types of fluid flow [5]
- State Bernoulli's theorem for steady flow of an incompressible fluid and derive expression for Bernoulli's equation from first principle. [5]
- A stone weighs 400 N in air and when submerged in water, it weighs 225N. Calculate the volume of stone and its specific gravity [5]

Q2

- A square plate 1 m x 1m slides over an inclined plane making an angle of  $22^\circ$  with horizontal. The gap between the plate and the plane is 1mm and is filled with oil of viscosity 7.5 poise. Find the weight of the plate when it slides down the plane at constant velocity of 0.2 m/s. [10]
- Determine total pressure force and location of centre of pressure on an isosceles triangular plate of base 4m and altitude 4m when it is immersed in an oil of specific gravity 0.9 when
  - the base of the plate coincides with the free surface of the oil
  - the base of plate makes  $30^\circ$  with water surface [10]

Q3

- Sketch and explain working of Orificemeter and Pitot tube [10]
- A horizontal Venturimeter with inlet diameter 10 cm and throat 5 cm is used to measure rate of flow of oil of specific gravity 0.8. The discharge of oil through the venturimeter is 60 litres per sec. Find the reading of the oil- mercury differential manometer. Take  $C_d = 0.98$  [10]

Q4

- a) Differentiate between – Stream function and velocity potential function [5]
- b) Differentiate between – Lagrangian method and Eulerian method [5]
- c) If for a two-dimensional potential flow, the velocity potential function is given by  $\Phi = x(2y-1)$ , determine the velocity at the point (3,4). Determine also the value of stream function  $\psi$  at that point. [10]

Q5

- a) Differentiate between notches and weirs. Define velocity approach and explain how does it affect the discharge over a weir [10]
- b) Derive an expression for discharge through a rectangular notch. Also find the discharge of water flowing over a rectangular notch of 2m length when the constant head over the notch is 280 mm. Take  $C_d = 0.6$  [10]

Q6.

- a) What are the conditions of equilibrium of floating and submerged bodies [10]
- b) An aeroplane is flying at 1000 km/hr through still air having a pressure of 78.5 kN/m<sup>2</sup> (abs) and temperature -8° C. Calculate on stagnation point on the nose of plane a) stagnation pressure b) stagnation temperature c) stagnation density. Take  $R = 287$  J/kg° K and  $k = 1.4$  [10]

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