Con. 9980–13. **GX–14781**

(3 Hours) **[Total Marks : 80**

N.B. : (1) Question No.**1** is **compulsory**.
(2) Attempt any **three** questions out of remaining **five** questions.
(3) Assume any additional **data** if **necessary** and state **cleary**.
(4) Illustrate answer with **neat** sketches wherever **necessary**.

1. Attempt any **five** :– **20**
   (a) Define specific weight, specific gravity, mass density and specific volume.
   (b) Define the term centre of Buoyance and metacentric height.
   (c) What is meant by path line, stream line, streak line and flow net ?
   (d) Write the practical applications of Bernoullis theorem.
   (e) Write the difference between small orifice and large orifice. Also write the meaning and significance of vena-contracta.
   (f) Describe Lagrangian method and Eulerian method.
   (g) Define the term source, sink and doublet.

2. (a) (i) State and prove Pascal's law. **5**
   (ii) An oil of specific gravity 0·85 is contained in a vessel. At a point the height of oil is 35 m. Find the corresponding height of water at the point. **5**
   (b) (i) Find the kinematic viscosity of an oil having density 850 kg/m^3. The shear stress at a point in oil is 0·2524 N/m^2 and the velocity gradient at that point is 0·2 per second. **5**
   (ii) Explain with neat diagram use of mechanical pressure gauge. **5**

3. (a) Derive an expression for the depth of centre of pressure from free liquid surface of liquid of an inclined plane surface submerged in the liquid. **10**
   (b) A solid of 300 mm diameter and 900 mm depth has 30 mm thick and of specific gravity 6. The remaining part of the cylinder is of specific gravity 0·6. Determine metacentric height and state whether it can float vertically in water. **10**

4. (a) An open tank 8 m long, 3·4 m deep and 4·6 m wide contains oil of specific gravity 0·85 to a depth of 2·0 m. If the tank is accelerated along its length on a horizontal track at a constant acceleration 4 m/s^2. Determine :– **12**
      (i) The new position of the oil surface
      (ii) Pressure at the bottom of the tank at the front and rear edges
      (iii) The amount of spill if the tank is given a horizontal acceleration of 5 m/s^2 instead of 4 m/s^2.
   (b) The velocity vector in a fluid is given by – **8**
      $V = 6x^3i - 12\ x^2yj + 4\ tk.$
      Find the velocity and acceleration of a fluid particle at (2, 1, 3) at time t = 1.

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5. (a) What is Euler's equation of motion ? Derive Bernoulli's equation from Eulers equation. **10**

   (b) (i) State Bernoulli's equation. Write assumptions made and limitations of Bernoulli's equation. **5**

   (ii) A horizontal venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of oil of specific gravity 0·9. The discharge of oil through venturimeter is 80 liter/sec. Find the reading of oil-mercury differential manometer. Take cd = 0·98. **5**

6. (a) (i) Describe the experimental method of determination of hydraulic coefficients of circular orifice. **5**

   (ii) A rectangular orifice of 3 m width and 1·2 m deep is fitted in one side of large tank. The water level on one side of the orifice is 3 m above the top edge of the orifice, while on the otherside of the orifice is 0·6 m below its top edge. Calculate the discharge through the orifice if cd = 0·64. **5**

   (b) (i) What is Cipoletti Weir or notch, find the expression for the discharge over Cipoletti Weir. **6**

   (ii) A 40 m long Weir is divided into 10 equal boys by vertical post, each of 0·6 m wide. Using Francis formula, calculate the discharge over the Weir under an effective head of 1·1 m. **4**

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