FLUID MECHANICS AND HYDRAULIC M/C

(Code—MET-404)

Full Marks : 70

Time : 3 hours

Answer any **five** questions

Figures in the right-hand margin indicate marks

1. (a) Define mass density and specific gravity.   2

    (b) A volume of 5 m³ of certain fluid weight 20 kN. Determine specific weight, mass density and specific gravity of the liquid.   5

    (c) Explain the working of Bourdon tube pressure gauge.   7

2. (a) Define uniform flow and Laminar flow.   2

    (b) State continuity equation and prove it for One dimensional flow.   5

(c) Water is flowing through a pipe having diameter 300 mm and 200 mm at bottom and upper end respectively. the intensity of pressure at bottom end is 24·525 N/cm² and the pressure at upper end is 9·81 N/cm². Determine the difference in datum head if the rate of flow through pipe is 40 lit/sec. 7

3. (a) State Archimedis Principle. 2

(b) Describe orifice co-efficient and write down the relationship among them. 5

(c) A rectangular plane surface is 4 m wide and 6m deep. It lies in vertical plane in water. Determine the total pressure and position of center of pressure on the plane surface when its upper edge is horizontal and
(i) coincides with water surface.
(ii) 2·5 m below water surface. 7

4. (a) What is surge tank. 2

(b) Write down the expression of loss of energy due to friction according to Darcy's formula and Chezy's formula with proper notation. 5

(c) Find the maximum speed at which a centrifugal pump will Start functioning against a head of 7·5 m , if the diameters of impeller at outlet and inlet are respectively 100cm and 50cm. 7

5. (a) What do you mean by impact of jet. 2

(b) Derive an expression of force exerted by a jet on stationary curved plate. 5

(c) A jet of water of diameter 7·5 cm strikes a curved plate at its centre with a velocity of 20m/sec. The curved plate is moving with a velocity of 8 m/sec in the direction of jet. The Jet is deflected through an angle of 165°. Assuming the plate is smooth and find
   (i) Force exerted on plate in the direction of jet.
   (ii) Power of Jet
   (iii) Efficiency of jet. 7

6. (a) Define Turbine ? 2

(b) Classify hydraulic turbine.

5

(c) A pelton wheel working under a head of 500 m, produces 13,000 kW at 430 rpm. If the efficiency of wheel is 50%.

Determine :

(i) discharge of the turbine
(ii) diameter of wheel
(iii) diameter of nozzle

Take $C_v = 0.98$.

7

7. (a) What is slip in pump ?

2

(b) Differentiate between Reciprocating pump and centrifugal pump ?

5

(c) The impeller of a centrifugal pump is 30 cm outside diameter. The impeller Vane angles are 30° and 25° at the inner and outer peripheries respectively and the speed is 1450 rpm. The velocity of flow through the impeller is constant. Find the work done by impeller per kg of water.

7

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