

**III/SEM/CIVIL/2015(W)**

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**FLUID MECHANICS AND HYDRAULIC MACHINES**

**Sub Code-CET-302**

*Full Marks : 70*

*Time : 3 hours*

**Answer any five questions**

*The figures in the right-hand margin indicate marks*

- 1. (a) Define Fluid Mechanics and Hydraulic Machine. 2
- (b) Calculate the specific weight, density and sp. gr. of 2.5 litre of a liquid which weighs 15 N. 5
- (c) Find the kinematic viscosity of an oil having density  $970 \text{ kg/m}^3$ . The shear stress at a point in oil is  $0.3245 \text{ N/m}^2$  and velocity gradient at the point is 0.35 per sec. 7
- 2. (a) Define Tranquil Flow and Torrential Flow. 2
- (b) Find the velocity of the flow of an oil through

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pipe, when the difference of mercury level in a differential U-tube manometer connected to two tapping pipes of a Pitot-tube is 175 mm. Take the co-efficient of Pitot-tube is 0.97 and sp. gr. of oil = 0.98. 5

(c) Find the discharge of water through the channel which is a combined shape of Rectangular (in upper portion) and half circular (in bottom portion). The depth of water in upper portion is 1.5 m and in bottom portion is 1.7 m. Take the value of Chezy's constant = 65 and bed slope is 1 in 2500. 7

3. (a) Find the surface tension in a soap bubble of 35.70 mm diameter when the inside pressure is  $2.75 \text{ N/m}^2$  above atmospheric pressure. 2

(b) Draw the sketches of centrifugal pump and reciprocating pump to show the main parts of the respective pumps. 5

(c) A double acting reciprocating pump, running at 65 r.p.m, is discharged  $2.5 \text{ m}^3$  of water per minute. The pump has stroke of 650 mm. The

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diameter of the piston is 35 cm. The delivery and suction head are 2800 cm and 565 cm respectively. Find the slip of the pump and power required to drive the pump. 7

4. (a) Write the Empirical Formulae for the value of Chezy's constant. 2

(b) Find the loss of head when a pipe diameter is 1200 mm is suddenly enlarged to 5350 mm. Take rate of flow of water through the pipe is 260 liters/sec. 5

(c) A circular plate of 3 m dia is under water with its plane making an angle of 30° with water surface. If the top edge of the plate is 1.5 m below the water surface, find the force on one side of the plate and its location. 7

5. (a) Differentiate centre of gravity and centre of buoyancy. http://www.sctevtonline.com 2

(b) The head of water over a rectangular notch is 970 mm. The discharge is 320 litres/s. Find the length of the notch, when  $C_d = 0.68$ . 5

(c) Derive the expression of rate of flow through venturi meter with neat sketch. 7

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6. (a) Write the assumptions made in the derivation of Bernoulli's equation. 2

(b) A 30 cm x 15 cm venturi meter is inserted in a vertical pipe carrying water, flowing in the upward direction. A differential mercury manometer connected to the inlet and throat gives a reading of 20 cm. Find the discharge. Take  $C_d = 0.98$ . 5

(c) A rectangular channel carries water at a rate of 300 litres/s, when bed slope is 1 in 2000. Find the most economical dimensions of the channel of  $C = 65$ . 7

7. (a) State the conditions of most economical rectangular channel. 2

(b) A weir 48 meters long divided into 16 equal bays by vertical post, each 500 mm wide. Determine the discharge over the weir if the head over the crest is 1.55 m and velocity of approach is 3 m/s. 5

(c) Determine the sp. gr. of a fluid having viscosity 0.09 poise and kinematic viscosity is 0.075 poise. 7

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