Ref. No. : EX/ME/T/212/2017(old)(S)

Bachelor of Mechanical Engineering 2nd Year 1st Semester Supplementary Examination, 2017(Old)

Subject: **Fluid Mechanics-I(Old)**

Time : Three hours **Full Marks: 100**

Answer any FOUR questions. Assume any relevant data if necessary with proper justification.

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1. (a) What is Newton's law of viscosity? Explain Newtonian and Non-Newtonian fluid with one example of each.

   (b) A plate having an area of 0.9 m^2 is sliding down the inclined plane at 35° to the horizontal with a velocity of 0.5 m/s. There is a cushion of fluid 1.2 mm thick between the plane and the plate. Find the viscosity of the fluid if the weight of the plate is 300 N.

   [15+10=25]

2. (a) Explain Metacentre and Metacentric height of a floating body.

   (b) A rectangular plane surface 2.5m long and 3.25m deep lies in water is such a way that its plane makes an angle of 30° with the free surface of water. Determine the resultant force and the centre of pressure on one surface of the plane if the upper edge is 2.5 m below the free surface.

   [15+10=25]

3. (a) Deduce Euler equation of motion for a flow along a streamline. Get the Bernoulli's equation from Euler equation. State the necessary assumptions and explain the different terms involved in Bernoulli's equation.

   (b) A 45^0 inclined smooth tapered pipe of 6.0 m in length have 600 *mm* diameter and 60 *kPa* pressure at Section 1. At another Section 2, the diameter is 300 *mm* the pressure is 30 *kPa* and velocity is 3.0 *m/s*. Determine the head loss between the sections.

   [15+10=25]

4. (a) Explain a V-notch weir. What is the co-efficient of discharge?

(b) The diameter of a pipe bend is 350 *mm* at inlet and 150 *mm* at outlet and the flow is turned through 145^0 in the vertical plane. The axis at inlet is horizontal and the center of the outlet section is 3.5 *m* below the center of the inlet section. The total volume of fluid contained in the bend is 0.08 m^3. Neglecting friction, calculate the magnitude and direction of the net force exerted on the bend by water flowing through at $0.35 m^3/s$ when the inlet gauge pressure is 160 *kPa*.

[15+10=25]

5. (a) Derive the Hagen-Poiseuille equation for a laminar fully developed flow through a circular cross-section pipe.

   (b) Oil of absolute viscosity 1.25 poise and specific gravity 0.85 is flowing through a 35 cm diameter pipe. If the head loss in 500 m length of the pipe is 3.0 m, estimate (a) the velocity; (b) Reynolds Number and (c) The friction factor.

[15+10=25]

6. (a) Derive Chezy's equation for an open channel flow. What is specific energy?

   (b) Explain the specific energy curve.

   (c) Defining hydraulic jump. Find the ratio of the heights before and after the jump.

[08+05+12=25]

7. Write short notes on any *five* of the following:

   (a) Laminar and Turbulent Flow (b) Static and Stagnation pressure (c) Venturi-meter (d)Pitot Tube (e) Stability of fully submerged bodies (f) Continuity equation (g) Stream line (h) Compressible and incompressible flow (i) Reynolds Number. **[5X5=25]**