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B.Tech. (AE) (2012 to 2017) (Sem.–4)

FLUID MECHANICS AND MACHINERY

Subject Code : BTAE-403

M.Code : 54124

Time : 3 Hrs. Max. Marks : 60

INSTRUCTION TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. Answer briefly :

a. What is capillary effect? Write an expression for capillary rise of a liquid.

b. What is streamline and what are the characteristics of stream lines?'

c. How is the stability of floating and submerged bodies determined?

d. Define vorticity and circulation.

e. What is kinetic energy correction factor and what is its significance'?

f. Explain the variation of friction factor for laminar and turbulent flows.

g. What are distorted and undistorted models? What is the use of distorted models?

h. Using Darcy and Hagen-Poiseuille equations, derive expression for friction factor.

i. What is the hydraulics of flow through parallel pipes?

j. What is a mouthpiece and how are mouthpieces classified?

SECTION-B

2. A thin plate of very large area is placed in a gap of height h with oils of dynamic viscosity μ_1 and μ_2 on the two sides of the plate. The plate is pulled at a constant velocity V. Calculate position of the plate for

   a. equal drag on the plate

   b. drag on the piate is minimum.

3. A cube of side 100 mm and weight 5 N is immersed in a liquid of relative density 0.80 contained in a rectangular tank of plan area 150 mm × 150 mm. If tank contained liquid to a height of 80 mm before the immersion of cube, determine the levels of bottom of cube and the liquid surface.

4. Derive Darcy's Equation for the determination of loss of head due to friction in pipeline.

5. Water with a viscosity of 1.12×10^{-3} Ns/m^2 flows slowly along a glass tube of diameter 40 mm at a flow velocity of 150 mm/sec. Would the flow be laminar or turbulent?

6. Water flows over a rectangular notch 1 m wide at a depth of 150 mm and afterwards passes through a triangular right-angled notch. The coefficient of discharges for rectangular and triangular notches may be taken as 0.62 and 0.59 respectively. Find depth of water over the triangular notch.

SECTION-C

7. A lawn sprinkler has two identical nozzles of diameter 12 mm each, provided at the ends of a rotating arm of a sprinkler. Both the nozzles are discharging water in the same directions and in the same horizontal plane. The left nozzle is located at a radial distance of 200 mm from the center of rotor while the other nozzle is located at a radial distance of 150 mm from the center of rotor. The velocity of flow from each nozzle is 10 m/s. Determine

   a. torque required to hold the rotating arm stationary

   b. constant speed of rotation of the arm, if it is free to rotate.

8. A single acting reciprocating pump running at 50 *rpm*, delivers 0.01 m^3/s of water. The diameter of the piston is 200 mm and stroke length 400 mm Determine the theoretical discharge of the pump, coefficient of discharge and slip and the percentage slip of the pump.

9. Using Buckingham's π- theorem, show that the velocity through a circular orifice in a pipe is given by $v = \sqrt{(2gH)}\ f\ \{d/H,\ \mu/\rho vH\ |$ where v is the velocity through orifice of diameter d and H is the head causing the flow and ρ and μ are the density and dynamic viscosity of the fluid passing through the orifice and g is acceleration due to gravity.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.