Total No. of Questions—**8**] [Total No. of Printed Pages—**4**

Seat No.	

[5668]-116

S.E. (Mech./Auto.) (Second Semester) EXAMINATION, 2019

FLUID MECHANICS

(2015 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. :— (*i*) Attempt question Nos. **1** *or* **2**, **3** *or* **4**, **5** *or* **6**, **7** *or* **8**.

    (*ii*) Figures to the right indicate full marks.

    (*iii*) Neat diagrams must be drawn wherever necessary.

    (*iv*) Assume suitable data, if necessary.

1. (*a*) Define the following terms. Also state its SI units : [6]

    (*i*) Specific weight

    (*ii*) Kinematic viscosity

    (*iii*) Surface tension.

  (*b*) The stream function for a two-dimensional flow is given by $\psi = 2xy$, calculate the velocity at point P (2, 3). Find the velocity potential function ϕ. [6]

Or

2. (*a*) Derive an expression for continuity equation. [6]

  (*b*) Determine the total pressure and centre of pressure on an isosceles triangular plate of base 4 m and altitude 4 m when

it is immersed vertically in an oil of specific gravity 0.9. The base of the plate coincides with the free surface of oil. [6]

3. (a) Explain the following : [6]

   (i) Hydraulic Gradient line

   (ii) Total Energy line

   (iii) Pitot tube.

   (b) A fluid of viscosity 0.7 Ns/m^2 and specific gravity 1.3 is flowing through a circular pipe of diameter 100 mm. The maximum shear stress at the pipe wall is 196.2 N/m^2.

   Find : [6]

   (i) Pressure gradient

   (ii) Average velocity

   (iii) Reynolds no. of the flow.

   Or

4. (a) Write short notes on : [6]

   (i) Hydro dynamically smooth and rough boundaries.

   (ii) Velocity profile of turbulent flow.

   (b) A horizontal Venturimeter with inlet and throat diameters 30 cm and 15 cm respectively is used to measure the flow of water. The readings of the differential manometer connected between the inlet and throat is 20 cm of mercury. Draw the neat sketch of Venturimeter for this situation and determine the discharge. Take coefficient of discharge equal to 0.98. [6]

5. (*a*) Derive an expression for Darcy-Weisbach equation. [6]

   (*b*) A syphon of 200 mm diameter connects two reservoirs having difference in elevation of 20 m. The length of syphon is 500 m and summit is 3 m above the water level in the upper reservoir. The length of pipe from upper reservoir to summit is 100 m. Determine the discharge through the syphon and also pressure at a summit. Take the coefficient of friction = 0.005. Neglect minor losses. [7]

Or

6. (*a*) Explain the following dimensionless numbers : [6]

   (*i*) Reynolds' Number

   (*ii*) Froude's Number

   (*iii*) Mach Number.

   (*b*) The efficiency of fan depends on density ρ, dynamic viscosity μ of the fluid, angular velocity ω, diameter of the rotor D and the discharge Q. Express efficiency η in terms of dimensionless parameters. [7]

7. (*a*) Find the displacement thickness, momentum thickness and energy thickness for the velocity distribution in the boundary layer given by $u/U = y/\delta$, where u is the velocity at a distance y from the plate and $u = U$ at $y = \delta$, where δ is the boundary layer thickness. [6]

(*b*) Write a short note on separation of boundary layer and its control. [7]

Or

8. (*a*) A body of length 2 m has a projected 1.5 m^2 normal to the direction of its motion. The body is moving through water, which is having viscosity = 0.01 poise. Find the drag on the body if it has a drag coefficient 0.5 for a Reynolds no. of 8×10^5. [4]

(*b*) Derive an expression for displacement, momentum and energy thicknesses. [9]