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

Seat No.	

[5352]-516

S.E. (Mechanical/Auto.) (Second Semester)

EXAMINATION, 2018

FLUID MECHANICS

(2015 PATTERN)

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

N.B. :— (*i*) Neat diagram must be drawn wherever necessary.

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

(*iii*) Use of logarithmic tables, slide rule, Mollier charts, Electronic pocket calculator, Steam tables and p–h chart is allowed.

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

1. (*a*) Explain types of fluid using stress strain diagram. [6]

(*b*) Find the acceleration and vorticity components at a point (1,1,1) for the following flow field : [6]

$$u = 2x^2 + 3y,\ v = -2xy + 3y^2 + 3cy,\ w = -3/2z^2 + 2xz - 9y^2z$$

Or

2. (*a*) Define various types of flows with mathematical expressions. [6]

P.T.O.

(*b*) A 400 mm diameter shaft is rotating at 200 RPM in a bearing of length 120 mm. If the thickness of oil film is 1.5 mm and the dynamic viscosity of the oil is 0.7 N.s/m^2, determine : [6]

(*i*) Torque required to overcome friction in bearing

(*ii*) Power utilized in overcoming viscous resistance.

3. (*a*) Discuss various arrangements of Pitot tube used in pipes. [6]

(*b*) A 0.2 m diameter pipe carries liquid in laminar region. A pitot tube placed in the flow at a radial distance of 15 mm from the axis of the pipe indicates velocity of 0.5 m/s. Calculate : [6]

(*i*) the maximum velocity

(*ii*) the mean velocity

(*iii*) the discharge in the pipe.

Or

4. (*a*) Derive an expression of velocity and shear stress distribution for laminar flow through pipe. [6]

(*b*) A 300 mm × 150 mm venturimeter is provided in a vertical pipeline carrying oil of specific gravity 0.9, flow being upward. The difference in elevation of the throat section and entrance section of the venturimeter is 300 mm. The differntial U-tube mercury manometer shows a gauge deflection of 250 mm. Calculate : [6]

(*i*) The discharge of oil, and

(*ii*) The pressure difference between the entrance section and the throat section.

Take C_d = 0.98 and specific gravity of mercury as 13.6.

5. (*a*) A 3000 m long pipeline is used for transmission of power. 130 kW power is to be transmitted through the pipe in which water having a pressure of 40 bar at inlet is flowing. If the pressure drop over the length of pipe is 800 kN/m^2 and *f* = 0.024, find : [6]

(*i*) Diameter of the pipe

(*ii*) Efficiency of transmission.

(*b*) Explain : [6]

(*i*) Reynolds Number

(*ii*) Weber Number

(*iii*) Euler Number.

Or

6. (*a*) Torque T of propeller depends on density of iquid ρ, viscosity of liquid μ, speed of shaft N rpm, linear velocity V, diameter of the propeller shaft D. Using Buckingham π-theorem, show that : [7]

$$T = \rho N^2 D^5 \phi \left[\frac{ND}{\theta}, \frac{\rho ND^2}{\mu} \right]$$

(*b*) A siphon of dia 200 mm connects two reservoirs having a difference of elevation of 15 m. The total length of siphon is 400 m and the summit is 3 m above the water level in the upper reservoir. The length of siphon from upper reservoir to summit is 120 m. Take friction factor = 0.02,

Determine : [6]

(*i*) Discharge through the siphon, and

(*ii*) Pressure at the summit. Neglect minor losses.

7. (*a*) Write a short note on "Separation of Boundary Layer its Control." [7]

(*b*) For the following velocity profiles in the boundary layer. Show that whether the boundary is attached, datached or on the verge of separation : [6]

(*i*) $u/U = 2\eta - \eta^2 + 3\eta^3$

(*ii*) $u/U = -2\eta + \eta^3 + 2\eta^4$

(*iii*) $u/U = 2\eta^2 + 5\eta^3 + 2\eta^4$

where $\eta = y/\delta$.

Or

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

(*b*) A plate length 450 mm and width 150 mm has been placed longitudinally in a stream of crude oil (specific gravity 0.925 and kinematic viscosity of 0.9 stokes) which flows with velocity of 6 m/s. Calculate the friction drag on the plate. [4]