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

Seat No.	

[4857]-1014

S.E. (Mechanical/Automobile Engg.)
(First Semester) EXAMINATION, 2015
FLUID MECHANICS
(2012 PATTERN)

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

N.B. **:—** (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6** and Q. No. **7** *or* Q. No. **8**.
(*ii*) Neat diagrams must be drawn wherever necessary.
(*iii*) Figures to the right indicate full marks.
(*iv*) Use of calculator is allowed.
(*v*) Assume suitable data, if necessary.

1. (*a*) State and explain Newton's law of viscosity. Explain the importance of viscosity in fluid motion. [6]

(*b*) The velocity potential function is given by an expression : [6]

$$\phi = -\frac{xy^3}{3} - x^2 + \frac{x^3 y}{3} + y^2$$

(*i*) Find the velocity components in x and y directions.
(*ii*) Show that ϕ represents a possible case of flow.

Or

2. (*a*) Explain the following terms : [6]
(*i*) Path line
(*ii*) Streak line
(*iii*) Stream line and
(*iv*) Equipotential line.

(*b*) What is metacentre and metacentric height ? Explain their significance for floating and submerged bodies. [6]

P.T.O.

3. (*a*) Define HGL and TEL. Draw a neat diagram of venturimeter and show HGL and TEL for it. [6]

(*b*) An oil of viscosity 0.1 Ns/m^2 and relative density 0.9 is flowing through a circular pipe of diameter 50 mm and of length 300 m. The rate of flow of fluid through the pipe is 3.5 lit/sec. Find the pressure drop in a length of 300 m and also the shear stress at the pipe wall. [6]

Or

4. (*a*) The inlet and throat diameters of a horizontal venturimeter are 30 cm and 10 cm respectively. The liquid flowing through the meter is water. The pressure intensity at inlet is 13.734 N/cm^2 while the vacuum pressure head at the throat is 37 cm of mercury. Find the rate of flow. Assume that 4% of the differential heads is lost between the inlet and outlet. Find also the value of C_d for the venturimeter. [6]

(*b*) Prove that the maximum velocity in a circular pipe for viscous flow is equal to two times the average velocity of the flow. [6]

5. (*a*) Derive Darcy Weisbach equation to calculate loss of head due to friction in pipe. [6]

(*b*) The frictional torque T of a disc of diameter D rotating at a speed N in a fluid of viscosity μ and density ρ in a turbulent flow is given by : [7]

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

Prove this relation using Buckingham's π-theorem.

Or

6. (*a*) What do you mean by repeating variables ? How are the repeating variables selected for dimensional analysis ? [5]

(*b*) A pipeline of length 2 km is used for power transmission. If 110.3625 kW power is to be transmitted through the pipe in which water having a pressure of 490.5 N/cm^2 at inlet is flowing. Find the diameter of the pipe and efficiency of transmission if the pressure drop over the length of pipe is 98.1 N/cm^2. Take f = 0.0065. [8]

7. (*a*) Explain the following terms : [6]

(*i*) Laminar boundary layer

(*ii*) Laminar sub-layer and

(*iii*) Boundary layer thickness.

(*b*) A jet plane which weighs 29.43 kN and having awing area of 20 m^2 flies at a velocity of 950 km/hr, when the engine delivers 7357.5 kW power. 65% of the power is used to overcome the drag resistance of the wing. Calculate the coefficient of lift and drag for the wing. The density of the atmospheric air is 1.21 kg/m^3. [7]

Or

8. (*a*) What are the different methods of preventing the separation of boundary layers ? [4]

(*b*) Explain the terms : [4]

(*i*) Friction drag

(*ii*) Pressure drag.

(*c*) A kite 0.8 m × 0.8 m weighing 0.4 kgf assumes an angle of 12° to the horizontal. The string attached to the kite makes an angle of 45° to the horizontal. The pull on the string is 2.5 kgf when the wind is flowing at a speed of 30 km/hr. Find the corresponding coefficient of lift and drag. Density of air is 1.25 kg/m^3. [5]