Total No. of Questions—**8**] [Total No. of Printed Pages—**5**

Seat No.	

[5152]-115

S.E. (Mechanical/Automobile Engg.) (I Sem.) EXAMINATION, 2017

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**, Q. No. **7** *or* Q. No. **8**.

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

(*iii*) Figures to the right side indicate full marks.

(*iv*) Use of calculator is allowed.

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

1. (*a*) Distinguish between : [6]

(*i*) Newtonian and non-Newtonian fluids

(*ii*) Adhesion and Cohesion

(*iii*) Dynamic and Kinematic Viscosity.

(*b*) An equilateral triangular plate of 2 m side is immersed vertically in water with one of its axis of symmetry parallel to water surface and at a depth of 2 m below water surface. Determine total pressure and position of center of pressure. Neglect thickness of plate. [6]

P.T.O.

Or

2. (*a*) A metal disc of 500 mm diameter slides down an inclined plane covered with a thin film of oil of thickness 0.5 mm. The plane is inclined at 30° with horizontal. Viscosity of oil is 2.5 poise. If the speed of the disc is 0.5 m/s, determine its weight. [6]

(*b*) If velocity potential function is

$$\phi = c(x^2 - y^2),$$

where c is a numerical constant :

(*i*) Obtain corresponding stream function ψ

(*ii*) Show that flow is possible and irrotational

(*iii*) Sketch the streamlines. [6]

3. (*a*) State the governing principle of venturimeter and derive the equation for discharge through it. [6]

(*b*) Crude oil is pumped through a smooth horizontal pipe 1000 m long, 200 mm diameter. Kinematic viscosity of oil is 20 stokes. Flow rate of oil through pipe is 5300 N/min. The pipeline is laid at an upgrade of 1 : 100. The specific weight of oil is 8833 N/m^3. Assuming the flow of oil to be laminar, find the power required to pump the oil. [6]

Or

4. (*a*) Show that the velocity distribution of steady laminar flow between fixed parallel plates is parabolic. [6]

(*b*) A Pitot tube records a reading of 7.85 kN/m^2 as the stagnation pressure when it is held at the centre of a pipe of 250 mm diameter conveying water. The static pressure in the pipe is 40 mm of mercury (gauge). Calculate the discharge through the pipe assuming that the mean velocity of flow is 0.8 times the maximum velocity. Take C_d = 0.98. [6]

5. (*a*) The pressure drop through a diffuser depends on rate of flow, inlet area, exit area and fluid density. Obtain the relation between appropriate dimensionless parameters to describe the flow conditions. [6]

(*b*) Explain the concept of Equivalent pipe and derive Dupit's equation. [7]

Or

6. (*a*) The losses $\frac{\Delta H}{l}$ per unit length of pipe in turbulent flow through a smooth pipe depends on velocity C, diameter D, gravity *g*, dynamic viscosity μ and mass density ρ. With dimensional analysis establish the following relation : [7]

$$\frac{\Delta H}{l} = f\left(\frac{\rho CD}{\mu}, \frac{C^2}{gD}\right).$$

(*b*) A farmer wishes to connect two pipes of different lengths and diameters to a common header supplied with 0.008 m^3/s of water from a pump. One pipe is 100 m long and 5 cm in diameter. The other pipe is 800 m long. Determine the diameter of other pipe such that both pipes have the same flow rate. Assume the pipes to be laid on ground level and friction coefficient for both pipes as 0.02. Also determine the head loss of water in the pipes. [6]

7. (*a*) Explain the following terms : [4]

(*i*) Skin friction drag

(*ii*) Induced drag.

(*b*) Define the following : [3]

(*i*) Chord length

(*ii*) Camber

(*iii*) Angle of attack.

(*c*) Explain the following terms : [6]

(*i*) Boundary layer thickness

(*ii*) Displacement thickness

(*iii*) Momentum thickness and

(*iv*) Energy thickness.

Or

8. (*a*) An automobile has a coefficient of drag of 0.3 before streamlining. The streamlining reduces the coefficient to 0.22. Find the percentage increase in the speed assuming the driving power to remain same. [7]

(*b*) Explain the following terms : [6]

(*i*) Laminar boundary layer

(*ii*) Turbulent boundary layer and

(*iii*) Laminar sublayer.