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

Seat No.	

[5459]-104

S.E. (Civil) (Second Semester) EXAMINATION, 2018

FLUID MECHANICS—I

(2015 PATTERN)

Time : 2 Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Answer any *four* questions from Q. No. **1** *or* **2**, **3** *or* **4**, **5** *or* **6**, **7** *or* **8**.

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

(*iii*) Draw neat diagram wherever necessary.

(*iv*) Use of logarithmic table, slide rule and electronic pocket calculator is allowed.

(*v*) Assume suitable data if necessary, stating it clearly.

1. (*a*) What is the difference between Mechanical Gauges and pressure transducers. Explain Practical applications of hydrostatic pressure. [4]

(*b*) Show by Buckingham π theorem, the resistance R to motion of spheres of diameter D, moving with uniform velocity V, through fluid of density ρ, viscosity μ, is given by : [5]

$$R = \rho V^2 D^2 \phi \frac{(\mu)}{\rho VD}$$

P.T.O.

Or

2. (*a*) Define surface tension and capillarity. What is the surface tension for Droplet and soap bubble. [4]

(*b*) A wooden cylinder of mass density 750 kg/m^3 is required to float in a fluid of mass density 950 kg/m^3. Find the ratio of diameter '*d*' and length '*l*' of the cylinder in order that the cylinder can just float with its longitudinal axis vertical. [5]

3. (*a*) Draw a neat sketch of venturimeter and derive the equation for discharge through venturimeter. [4]

(*b*) Determine the stream function if the velocity components of a two-dimensional incompressible fluid flow are given as : [5]

$$u = y^3/3 + 2x - x^2y$$

$$v = xy^2 - 2y - x^3/3 .$$

Or

4. (*a*) What are the different methods of drawing flow net ? Explain electrical analogy method and its uses with the help of neat sketch in detail. [4]

(*b*) The horizontal venturimeter with inlet diameter 150 mm and throat diameter 75 mm is installed in a pipeline. The pipeline carries oil having relative density 0.85. The discharge through venturimeter is 0.075 m^3/s. What is the deflection of mercury in the differential manometer ? Take the coefficient of discharge 0.97. [5]

5. (*a*) Derive the expression for maximum velocity and discharge for a laminar flow between parallel plates when both plates are fixed. [6]

(*b*) Determine the velocity of flow at a distance 75 mm from the axis of a pipe 200 mm in diameter, when Reynolds' number of flow is 1500. Oil of kinematic viscosity 2.4×10^{-6} m^2/s and mass density 990 kg/m^3 flows through the pipe. [6]

(*c*) Give a practical example of flow through porous media. Explain the importance of Darcy law for flow of groundwater. [4]

Or

6. (*a*) Explain : [4]

1. Laminar sublayer,

2. Hydrodynamically Smooth and Rough boundaries.

(*b*) Why does the boundary layer separate from the body ? Explain any *two* methods for controlling the Boundary Layer separation. [6]

(*c*) What are the principles of measurement of viscosity ? Explain any *one* method of measuring viscosity of fluid stating the principle of measurement. [6]

7. (*a*) What is major loss in flow through pipe and what causes the major loss ? Derive the equation for the major loss given by

$$h_f = \frac{f\,LV^2}{2gD}.$$ [8]

(*b*) What is scale of turbulence ? Explain Prandtl Mixing Length theory. [4]

(*c*) What is Equivalent sand grain roughness and its application in the study of friction factor of commercial pipe ? [4]

Or

8. (*a*) What is turbulent flow and its characteristics and explain wall turbulence and free turbulence. [4]

(*b*) Explain the concept of equivalent pipe and derive Dupit's equation for equivalent pipe. [4]

(*c*) Three pipes 350 m long, 350 mm diameter, 175 m long, 250 mm diameter and 250 m long, 300 mm diameter are connected in series in the same order. Pipe having 350 diameter is connected to reservoir. Water level in the reservoir is 20 m above the pipe axis which is horizontal. The respective friction factors for three pipes are 0.020, 0.022 and .0021.

Determine :

(*i*) Flow rate

(*ii*) Magnitude of loss in each pipe section and

(*iii*) Diameter when the three pipes are replaced by a single pipe assuming f = .018 for all three pipes and to give the same discharge. Neglect minor losses. [8]