

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  $\pi$  theorem, the resistance  $R$  to motion of spheres of diameter  $D$ , moving with uniform velocity  $V$ , through fluid of density  $\rho$ , viscosity  $\mu$ , is given by : [5]

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

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  $750 \text{ kg/m}^3$  is required to float in a fluid of mass density  $950 \text{ kg/m}^3$ . 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]

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

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

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  $0.075 \text{ m}^3/\text{s}$ . 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  $2.4 \times 10^{-6} \text{ m}^2/\text{s}$  and mass density  $990 \text{ kg/m}^3$  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
- $$h_f = \frac{f L V^2}{2gD}. \quad [8]$$
- (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]