Total No. of Questions—**12**] [Total No. of Printed Pages—**5**

Seat No.	

[5352]-506

S.E. (Civil Engineering) (Second Semester)

EXAMINATION, 2018

FLUID MECHANICS—I

(2015 PATTERN)

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

N.B. **:—** (*i*) Answer any *six* questions from Q. No, **1** *or* **2**, Q. No. **3** *or* **4**, Q. No. **5** *or* **6**, Q. No. **7** *or* **8**, Q. No. **9** *or* **10**, Q. No. **11** *or* **12.**

(*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*) Explain in brief phenomenon of cavitation. [2]

(*b*) Define Specific weight, dynamic viscosity and capillarity. [3]

Or

2. (*a*) Derive an expression for a pressure inside a liquid jet of radius R and surface tension σ. [3]

(*b*) State and explain Newton's law of viscosity. [2]

P.T.O.

3. (*a*) Define 'Metacentre and Metacentric Height'. How are they important in case of floating body ? [3]

(*b*) Discuss conditions of stability of a submerged body in short. [2]

Or

4. (*a*) Distinguish between simple manometer and differential manometer. [2]

(*b*) Define gauge pressure, vacuum pressure and absolute pressure. [3]

5. (*a*) Distinguish between irrotational and rotational flow. [2]

(*b*) Define path line and streak line, stream tube and give the example of each. [3]

Or

6. (*a*) What is velocity potential and stream function ? [2]

(*b*) Define : [3]

(1) Steady and unsteady flow

(2) Uniform and non-uniform flow.

7. (*a*) What is an orifice ? What is meant by 'Large orifice' ? How does it differ from a small orifice ? [2]

(*b*) Define coefficient of contraction, coefficient of discharge and coefficient of velocity. [3]

Or

8. (*a*) Explain how Bernoulli's theorem, applied to two points in flow, is modified to account for : [3]

(*i*) Loss of head,

(*ii*) Installation of pump,

(*iii*) Non-uniform velocity variation in pipe.

(*b*) What do you understand by dynamics of fluid flow ? How does it differ from kinematics of fluid flow ? [2]

9. (*a*) What is laminar sublayer ? How is its existence established ? [4]

(*b*) Starting from first principles, derive Hagen-Poiseuille equation for steady laminar flow in pipes. [5]

(*c*) A plate 3m × 1.5m is held horizontally in water moving at 1.25 m/s parallel to its length. If the flow in the boundary layer is laminar at the leading edge of the plate : [6]

(*i*) Find the distance from the leading edge where the boundary layer flow changes from laminar to turbulent,

(*ii*) Find the thickness of the boundary layer at this section

(*iii*) Find the frictional drag on this plate consisting both its sides. Assume negligible thickness of the plate. Take the dynamic viscosity of water as 0.01 P and assume that the laminar boundary layer exists up to Re = 5×10^5.

Or

10. (*a*) Define displacement thickness and derive an expression for the same. [5]

(*b*) Explain different methods for controlling the boundary layer. [5]

(*c*) An oil of mass density 950 kg/m^3 and dynamic viscosity 1.5 poise is pumped through a 100 mm diameter and 600 m long pipe at a rate of 0.01 m^3/s.

Find :

(*i*) Reynolds' number,

(*ii*) Calculate the pressure required at the pump, if outlet, which is free to atmosphere is 25m above pump level,

(*iii*) What would be the power input if the overall efficiency of pump is to be 75% ? [5]

11. (*a*) A horizontal pipe of 0.075 m diameter delivers a discharge of 0.01 m^3/sec. This pipe has sudden expansion of 0.10 m diameter at a section. If the pressure at just upstream of sudden expansion is 25 kN/m^2, determine pressure at just downstream. Take specific weight of water as 9.79 kN/m^3. [5]

(*b*) Define turbulent flow, Instantaneous velocity and temporal mean velocity. Write all the characteristics of turbulent flow. [5]

(*c*) Write a short note on Prandtl's mixing length theory. [5]

Or

12. (*a*) A 60 cm diameter pipe carries water. The velocity at 4 cm from the pipe wall is 3 m/s and the velocity gradient at the same point is 11.25 s^{-1}.

Determine :

(*i*) the mean velocity of the flow,

(*ii*) friction factor,

(*iii*) average shear stress at the wall,

(*iv*) average height of roughness protrusions.

(*b*) Enlist all the minor losses and write their expressions. [4]

(*c*) Derive the expression for major loss of head in pipe. [5]