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

Seat No.	

[5252]-506

S.E. (Civil Engineering) (Second Semester) EXAMINATION, 2017

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 side indicate full marks.

(*iv*) Use of calculator is allowed.

(*v*) Assume suitable data, if necessary

1. (*a*) Write a short note on vapour pressure. [2]

(*b*) Define Newtonian and non-Newtonian fluids and give *two* examples of each. [3]

Or

2. (*a*) Define the following properties and state their units : [3]

(*i*) Bulk modulus of elasticity

(*ii*) Specific weight

(*iii*) Surface tension.

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

3. (*a*) Explain the three states of equilibrium of a floating body with reference to its metacentric height. [3]

(*b*) Define Buoyancy, centre of Buoyancy. [2]

Or

4. (*a*) State and explain Pascal's law. [2]

(*b*) Explain in brief–Pressure Transducers. [3]

5. (*a*) $u = x^2 + y^2 + 2z^2$, $v = -x^2y - yz - xy$, find ω to satisfy continuity. [3]

(*b*) Define path line and streak line and give the example of each. [2]

Or

6. (*a*) Obtain a stream function to the following velocity components, $u = x + y$, and $v = x - y$. [3]

(*b*) Define : [2]

(*i*) Steady and unsteady flow,

(*ii*) Uniform and non-uniform flow.

7. (*a*) What is an orifice ? State the *two* differences between Orificemeter and Venturimeter. [2]

(*b*) Draw a neat sketch of Rotameter and explain its working in brief. [3]

Or

8. (*a*) List out the assumptions of Bernoulli's equation. [3]

(*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 sub-layer ? How is its existence established ? [4]

(*b*) Derive expression for boundary layer thickness, boundary shear stress and friction drag in a turbulent boundary layer. [6]

(*c*) A fluid of viscosity 0.8 N-s/m^2 and specific gravity 1.2 is flowing through a circular pipe of diameter 100 mm. The maximum shear stress at the pipe wall is given as 200.2 N/m^2. Find :

(*a*) The pressure gradient

(*b*) The average velocity

Reynold's number of the flow. [5]

Or

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

(*b*) For a steady laminar flow in a horizontal circular pipe derive expression for : [5]

(*i*) Shear stress,

(*ii*) The pressure drop.

(*c*) A laminar flow of oil of absolute viscosity 0.20 N-*s*/m^2 and density 900 kg/m^3 flows through a pipe of diameter of 0.35 m. If the head loss of 25m is observed in a length of 2500 m, determine : [5]

(*i*) The velocity of flow,

(*ii*) Reynold's number,

(*iii*) Friction factor.

11. (*a*) Three pipes, 300 m long and 300 mm diameter, 150 m long and 20 mm dia., 200 m long and 250 mm dia. are connected in series in same order. Pipe having 300 mm diameter is connected to the reservoir. Water level in the reservoir is 15 m above the centerline of the pipe which is horizontal. The respective friction factor for the pipes are 0.018, 0.02, and 0.019. Determine :

(*i*) Flow rate

(*ii*) Magnitude of loss of head in each pipe

The equivalent diameter of the single replacing the three pipes. [5]

(*b*) Define minor energy losses and major energy losses in pipe. Enlist various types of minor losses in pipe flow. [4]

(*c*) Write short notes on : [6]

(*i*) Prandtl's mixing length theory

(*ii*) Hydrodynamically smooth and rough pipes.

Or

12. (*a*) A farmer wishes to connect two pipes of different lengths and diameters to a common header supplied with 8×10^{-3} m^3/s of water from a pump. One pipe is 100 mm long and 5 cm in diameter. The other pipe is 800 m long. Determine the diameter of the second pipe such that both pipes have the same flow rate. Assume the pipes to be laid on level ground and friction coefficient for both pipes as 0.02. Also determine the head loss in meters of water in the pipes. [5]

(*b*) Derive Karman-Prandtl equation for velocity distribution in turbulent flow near hydrodynamically smooth boundary. [5]

(*c*) Explain with sketches the difference between hydrodynamically smooth and rough boundaries. [5]