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

Seat No.	

[5057]-210

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

EXAMINATION, 2016

FLUID MECHANICS

(2012 PATTERN)

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

***N.B.* :—** (*i*) Answer any six questions from 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**, Q. No. **9** or Q. No. **10**, Q. No. **11** or Q. No. **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*) Define viscosity. What is Kinematic viscosity ? Why is it so called ? Give its unit. [2]

(*b*) If the surface tension at air water interfaces is 0.7 N/m, what is the pressure difference between inside and outside of an air bubble of diameter 0.01 mm ? [3]

Or

2. (*a*) Obtain the relationship between the size of a bubble, surface tension and pressure inside it. [3]

(*b*) Discuss why water shows capillary rise and mercury shows capillary depression. [2]

3. (*a*) Define gauge pressure and vacuum pressure. [3]

(*b*) A wooden block 50 cm long, 25 cm wide and 18 cm deep has its shorter axis vertical with the depth of immersion 15 cm. Calculate the position of the metacentric and comment on the stability of the block. [2]

Or

4. (*a*) State and prove hydrostatic law. [2]

(*b*) Explain the term Metacentre and Stability of floating body. [3]

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

(*b*) Distinguish between Rotational or Irrotational flow. Give at least one example of each. [2]

Or

6. (*a*) Obtain a stream function to the following velocity components : [2]

$$U = x + y \text{ and } V = x - y.$$

(*b*) Derive continuity equation for one-dimensional flow. [3]

7. (*a*) Write the Bernoulli's equation and explain the significance of each term in it. [3]

(*b*) Define coefficient of velocity and coefficient of discharge for an orifice. [2]

Or

8. (*a*) What do you understand by "energy correction factor α" ? Write the expression for it. [2]

(*b*) Differentiate between the Eulerian and Lagrangian methods representing fluid flow. [3]

9. (*a*) Explain the development of boundary layer over a flat plate held parallel to the direction of flow and state the factors affecting the growth of boundary layer. [6]

(*b*) What do you understand by Reynolds' number ? How is it connected with the types of flow ? [4]

(*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 25 m is observed in a length of 2500 m, determine :

(*i*) The velocity of flow

(*ii*) Reynolds' number

(*iii*) Friction factor. [5]

Or

10. (*a*) Explain separation of boundary layer, its effects and measures adopted to reduce the same. [6]

(*b*) Explain Stokes' law and state its assumptions. [4]

(*c*) A flat plate 1.5 m wide and length 'L' m is kept parallel to a uniform steam of air flow of velocity of 3 m/s in a wind tunnel. If it is desired to have laminar boundary layer along the plate, what is maximum length 'L' of the plate is required ? For this maximum length of the plate, determine the drag for on one side of plate.

Take $p_{air} = 1.2 \frac{kg}{m^3}$, $v_{air} = 1.45 \times 10^{-5}$ m^2/s. [5]

11. (*a*) For turbulent flow through a pipe 60 cm in diameter, the velocities are 4.5 m/s and 4.2 m/s on the centre line and at a radial distance of 10 cm from pipe axis. Calculate the discharge in the pipe. [5]

(*b*) Define minor energy losses and major energy losses in pipe. Enlist various types of minor losses in pipe flow. [5]

(*c*) Write short notes on : [5]

(*i*) Prandtl's mixing length theory and

(*ii*) Hydrodynamically smooth and rough pipes.

Or

12. (*a*) In a pipe of diameter 100 mm carrying water the velocities at the pipe centre and 20 mm from the pipe centre are found to be 2.5 m/s and 2.3 m/s respectively. Find the wall shear stress. [5]

(*b*) Explain any *four* characteristics of turbulent flow. [5]

(*c*) Derive the Darcy-Weishbach equation loss in pipe. [5]