Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

Seat No.	

[5152]-106

S.E. (Civil Engineering) (II Sem.) EXAMINATION, 2017
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** and 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. Differentiate between surface tension and capillarity. Give practical examples of each. Derive the relation showing the capillary rise or fall depends upon surface tension. [5]

Or

2. (*a*) A fluid a specific gravity of 0.83 and a kinematic viscosity of 4×10^{-4} m^2/s. What is its absolute viscosity in S.I. units ? [3]

(*b*) Define : mass density, specific weight, specific volume, relative density. [2]

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3. (*a*) 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. [3]

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

Or

4. (*a*) Define Buoyancy and centre of Buoyancy. [2]

(*b*) A vertical square area 1 m × 1 m is submerged in water with upper edge horizontal and 0.5 m below water surface. Locate a horizontal line on the surface such that the force on the upper portion equals the force on the lower portion. [3]

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

(*b*) Distingusih between Uniform and non-uniform flow, give at least *one* example of each. [2]

Or

6. (*a*) Check whether $\psi = (y^2 - x^2)$ function is possible irrotational flow field. [3]

(*b*) Define stream lines and equipotential lines, give at least *one* example of each. [2]

7. (*a*) Write all the assumptions made in derivation of Bernoulli's equation. [2]

(*b*) What do you understand by "energy correction factor α" ? Write the expression for it. [3]

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Or

8. (*a*) Define coefficient of velocity, coefficient of discharge and coefficient of resistance for an orifice. [3]

(*b*) Write short note on Pitot tube. [2]

9. (*a*) Explain Laminar sub layer. What is Boundary Layer separation and its control ? [5]

(*b*) The velocity distribution in the boundary layer is : [6]

$$\frac{u}{U} = 2\left(\frac{y}{\partial}\right) - \left(\frac{y}{\partial}\right)^2,$$

∂ = thickness of boundary layer.

Calculate displacement thickness and momentum thickness.

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

Or

10. (*a*) A smooth float plate with a sharp edge is placed at zero incidence in a free stream of water flowing at 3.5 m/s. Determine the distance from the leading edge where the transition from laminar to turbulent flow may commence. Take viscosity of water is 0.01 poise. Also calculate boundary layer thickness at the transition point. [6]

(*b*) Prove that the momentum thickness and energy thickness for boundary layer flow are given by : [5]

$$\phi = \int_0^{\partial} \frac{u}{U}\left(1 - \frac{u}{U}\right)dy \quad \text{and}$$

$$\partial e = \int_0^{\partial} \frac{u}{U}\left(1 - \frac{u^2}{V^2}\right)dy.$$

(*c*) Explain Stoke's law and state its assumptions. [4]

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11. (*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. [4]

(*c*) Derive an expression for "loss of head due to sudden enlargement" in case of flow through a pipe. [6]

Or

12. (*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*) Explain in brief : Instantaneous velocity and Temporal mean velocity. [4]

(*c*) Write short note on : Prandtl's mixing length theory and Hydrodynamically smooth and rough pipes [6]

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