Total No. of Questions—8] [Total No. of Printed Pages—4

Seat No.	

[4757]-1010

S.E. (Civil) (II Sem.) EXAMINATION, 2015

FLUID MECHANICS—I

(2012 PATTERN)

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

N.B. :— (*i*) Answer 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**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*v*) Assume suitable data, if necessary.

1. (*a*) Define :

(*i*) Mass density

(*ii*) Specific gravity

(*iii*) Surface tension

(*iv*) Capillarity

(*v*) Specific weight

(*vi*) Specific volume. [6]

P.T.O.

(*b*) A circular plate 2.95 m diameter is immersed in water in such a way that its greatest and least depth below the free surface is 4.1 m and 1.6 m respectively. Determine the total pressure on one face of the plate and position of centre of pressure. [6]

Or

2. (*a*) State Buckingham's π theorem. Explain the procedure for solving problems by Buckingham's π theorem. [6]

(*b*) A rectangular pontoon is 5 m long, 3 m wide and 1.20 m high. The depth of immersion of the pontoon is 0.85 m in sea water. If the centre of gravity is 0.65 m above the bottom of the pontoon, determine the meta-centric height. Take density of sea water = 1025 kg/m^3. [6]

3. (*a*) Explain :

(*i*) Steady flow and Unsteady flow

(*ii*) Uniform flow and Non-uniform flow

(*iii*) Laminar flow and Turbulent flow. [6]

(*b*) Derive the Bernoulli's equation. Also mention the assumptions made for it. [6]

Or

4. (*a*) Explain rotation and vorticity. Derive the rotational components for three-dimensional flow. [6]

(*b*) A 20 cm × 10 cm venturimeter is inserted in a vertical pipe carrying oil of specific gravity 0.8, the flow of oil is in upward direction. The difference of levels between the throat and inlet section is 55 cm. The oil mercury differential manometer gives a reading of 33 cm of mercury. Find the discharge of oil in litres/s. Neglect losses. [6]

5. (*a*) Explain with neat sketches "Boundary layer separation and its control". [7]

(*b*) In case of laminar flow, through a circular pipe, show that ratio of maximum velocity to average velocity = 2.0. [6]

Or

6. (*a*) A fluid of viscosity 0.7 N.s/m^2 and specific gravity 1.3 is flowing through a circular pipe of diameter 100 mm. The maximum shear stress at the pipe wall is given as 196.2 N/m^2. Find :

(*i*) The pressure gradient

(*ii*) The average velocity

(*iii*) Reynolds number of the flow. [7]

(*b*) Find the displacement thickness, the momentum thickness and energy thickness for the velocity distribution in the boundary layer given by $\frac{u}{U} = \frac{y}{\delta}$, where u is the velocity at a distance y from the plate and u = U at $y = \delta$, where δ = boundary layer thickness. [6]

7. (*a*) Explain in brief :

(*i*) Instantaneous velocity

(*ii*) Temporal mean velocity

(*iii*) Scale of turbulance. [6]

(*b*) Derive the expression for "loss of head due to sudden enlargement" in case of flow through a pipe. [7]

Or

8. (*a*) Explain in brief with neat sketches :

(*i*) Prandtl's mixing length theory

(*ii*) Velocity distribution in turbulent flow. [6]

(*b*) The rate of flow of water through a horizontal pipe is 0.25 m^3/s. The diameter of the pipe which is 200 mm is suddenly enlarged to 400 mm. The pressure intensity in the smaller pipe is 11.772 N/cm^2. Determine :

(*i*) Loss of head due to sudden enlargement

(*ii*) Pressure intensity in the large pipe

(*iii*) Power lost due to enlargement. [7]