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

Seat No.	

[4957]-1014

S.E. (Mechanical/Automobile Engg.) EXAMINATION, 2016

FLUID MECHANICS

(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 calculator is allowed.

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

1. (*a*) Explain the following fluid properties in brief : [6]

(*i*) Capillarity

(*ii*) Surface Tension

(*iii*) Vapor Pressure.

(*b*) Prove that the centre of pressure of a plane surface is always below the centre of gravity when immersed in liquid. [6]

Or

2. (*a*) One litre of oil weight 8 N. Calculate its specific weight, specific volume and relative density. [6]

(*b*) A stream function for two dimensional flow is given by

$$\psi = 3x^2 - y^2.$$

Determine equation of streamline. Find the components of velocity at (2, 2). [6]

P.T.O.

3. (*a*) With a neat sketch descrie the working of a Prandtl's static Pitot Tube. [6]

(*b*) Curde oil of relative density 0.9 is pumped through a smooth horizontal pipe 400 m, long 100 mm diameter. Kinematic viscosity of oil is 2.5 stokes differential pressure head between two ends of the pipe is 16.31 m of oil. Assuming the flow of oil to be laminar, find :

(*i*) Rate of flow of oil through pipe and

(*ii*) Power requried to maintain the flow. [6]

Or

4. (*a*) With the help of neat sketches, explain how pipe boundaries behave hydro dynamically smooth and rough ? [6]

(*b*) At a point in the pipeline where the diameter is 20 cm, the velocity of water is 4 m/sec and the pressure is 3.5 bar. At a point 15 m downstream, the diameter reduces to 10 cm. Calculate the pressure at this point, if the pipe is :

(*i*) Horizontal

(*ii*) Vertical with flow downward and

(*iii*) Vertical with flow upward. [6]

5. (*a*) What is siphon ? Where it is used ? Explain its working. [6]

(*b*) The pressure drop through a diffuser depends on rate of flow, inlet area, exit area and fluid density. Obtain the relation between appropriate dimensionless parameters to describe the flow conditions. [7]

Or

6. (*a*) State and write Reynolds law for models and state giving examples where it can be used. Derive an expression for discharge ratio and power ratio for Reynolds model law. [7]

(*b*) Three pipes 300 m long, 300 mm diameter; 150 m long, 200 mm diameter and 200 m long, 250 mm diameter are connected in series in the same order. Pipe having 300 mm diameter is connected to reservoir. Water level in the reservoir is 15 m above the pipe axis which is horizontal. The respective friction factors for three pipes are 0.018, 0.02 and 0.019. Determine : [6]

(*i*) Flow rate

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

(*iii*) the diameter when the three pipes are replaced by a single pipe (having $f = 0.016$) to give the same discharge.

7. (*a*) Explain development of lift on an aerofoil. [6]

(*b*) Explain the development of boundary layer over a flat plate held parallel to the direction of flow. State the factors affecting growth of boundary layer. [7]

Or

8. (*a*) A spherical balloon 1.5 m in diameter is filled with hydrogen and held stationary in air by anchoring it to the ground with the help of a string of negligible weight. The balloon is subjected to an upward force of 20 N. Determine the inclination of the string with the ground if the wind is flowing with a velocity of 18 km/hr. Take the mass density of air as 1.2 kg/m^3 and the drag coefficient as 0.5. Also find the tension in the string. [8]

(*b*) Explain the concept of boundary layer and state where it is useful. [5]