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

Seat No.	

[4957]-1006

S.E. (Civil) (Second Sem.) EXAMINATION, 2016
FLUID MECHANICS-I
(2012 COURSE)

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

N.B. **:—** (*i*) Attempt 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 date, if necessary.

1. (*a*) The space between two square flat parallel plates is filled with oil. Each side of the plate is 720 mm. The thickness of the oil film is 15 mm. The upper plate, which moves at 3 m/s requires a force of 120 N to maintain the speed. Determine :

(*i*) The dynamic viscosity of oil.

(*ii*) The kinematic viscosity of oil if the specific gravity of oil is 0.95. [6]

(*b*) An inverted differential manometer having an oil of specific gravity 0.75 was connected to two different pipes carrying water under pressure as shown in Fig. 1(*b*). Determine the pressure in the pipe B in terms of kPa, if the manometer reads as shown in the figure. Take pressure in the pipe 'A' as 1.5 m of water. [6]

P.T.O.

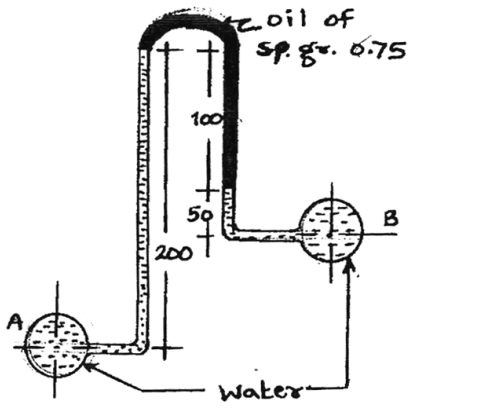

Figure :- 1 (b)

(Note :- All dimensions are in mm)

Or

2. (*a*) What do you mean by "dimensional analysis"? State the uses and advantages of dimensional analysis. [6]

(*b*) A solid cylinder 2 m in diameter and 2 m high is floating in water with its axis vertical. If the specific gravity of the material of cylinder is 0.65, find its metacentric height. State also whether the equilibrium is stable *or* unstable. [6]

3. (*a*) Explain classification of flow w.r.t. the following : [6]

(*i*) Steady and unsteady

(*ii*) Uniform and non-uniform

(*iii*) Laminar and turbulent

(*b*) Derive Euler's equation of motion along a streamline and also derive Bernoulli's equation from it. [6]

Or

4. (*a*) If $\phi = 3xy$, find x and y components of velocity at (1,3) and (3,3). Determine the discharge passing between streamlines passing through these units. [6]

(*b*) Derive an expression for flow rate through venturimeter. [6]

5. (*a*) Show that the ratio of maximum velocity to average velocity = 2.0 for flow of viscous fluid through circular pipe. [7]

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

(*i*) The displacement thickness (δ^*)

(*ii*) The momentum thickness (Θ)

(*iii*) The energy thickness (δ_e)

Or

6. (*a*) Show that in case of generalised Couette flow the velocity distribution is given by : [7]

$$u = \frac{u}{b} y - \frac{1}{2\mu} \cdot \frac{\partial p}{\partial x} (by - y^2) .$$

(*b*) Explain the following terms with neat sketches : [6]

(*i*) Boundary layer separation.

(*ii*) Control of boundary layer separation.

7. (*a*) A pipeline carrying water has average height of irregularities projecting from the surface of the boundary of the pipe as 0.15 mm. What type of boundary is it ? The shear stress developed is 4.9 N/m^2. The kinematic viscosity of water is 0.01 stokes. [6]

(*b*) Derive Darcy Weisbach equation with usual notations. [7]

Or

8. (*a*) (*i*) Determine the wall shearing stress in a pipe of diameter 100 mm which carries water. The velocities at the pipe centre and 30 mm from the pipe centre are 2 m/s and 1.5 m/s respectively. The flow in pipe is given as turbulent : [4]

(*ii*) Explain "Prandtl's mixing length theory. [3]

(*b*) Three pipes of lengths 800 m, 500 m and 400 m and of diameters 500 mm, 400 mm and 300mm respectively are connected in series. These pipes are to be replaced by a single pipe of :

(*i*) Length 1700 m

(*ii*) Diameter 450 mm.

Find the corresponding diameter and length of single pipe. Use Dupuit's equation. [6]