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

Seat No.	

[5668]-106

S.E. (Civil) (II Sem.) EXAMINATION, 2019

FLUID MECHANICS–I

(2015 PATTERN)

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

N.B. **:—** (*i*) Answer Q. **1** *or* Q. **2**, Q. **3** *or* Q. **4**, Q. **5** *or* Q. **6**, Q. **7** *or* Q. **8**.

(*ii*) Answers to the all questions should be written in single answer book.

(*iii*) Neat diagram must be drawn wherever necessary.

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

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

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

1. (*a*) Explain in brief :

(*i*) Rheological Diagram, and

(*ii*) Newtonian and non-Newtonian Fluid. [3+3]

P.T.O.

(*b*) Figure 1 (*b*) shows a manometer connected to a pipeline, containing an oil of specific gravity 0.8. Find the pressure of oil in the pipe. [6]

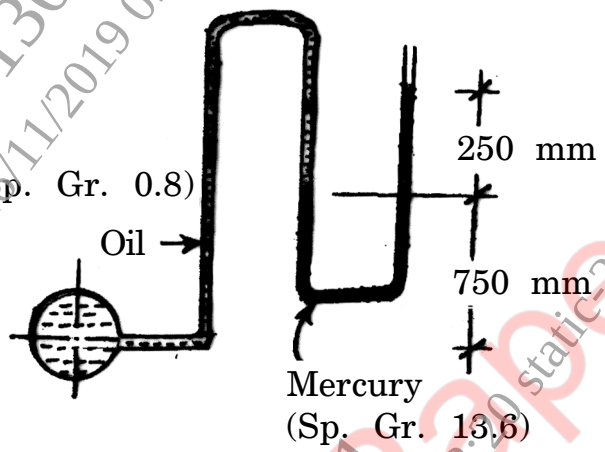

Fig. 1 (*b*)

Or

2. (*a*) What do you mean by dimensional homogeneity ? Explain the procedure for solving problems by Buckingham's π Theorem. [6]

(*b*) A wooden block of specific gravity 0.75 floats in water with its 0.4 m side vertical. If the size of the block is 1 m × 0.5 m × 0.4 m, find its metacentric height. [6]

3. (*a*) Derive the Bernoulli's Equation with usual notations. [6]

(*b*) The velocity components in a fluid flow are given by :

$$u = 2xy;\ v = a^2 + x^2 - y^2$$

(*i*) Show that the flow is possible

(*ii*) Derive the relative stream function. [6]

Or

4. (*a*) Derive the continuity equation for one-dimensional flow along a stream line with usual notations. [6]

(*b*) A horizontal venturimeter with inlet diameter 200 mm and throat diameter 100 mm is used to measure the flow of water. The pressure at inlet is 0.18 N/mm^2 and the vacuum pressure at the throat is 280 mm of mercury. Find the rate of flow. The value of C_d may be taken as 0.98. [6]

5. (*a*) A fluid of viscosity 8 poise and specific gravity 1.2 is flowing through a circular pipe of diameter 100 mm. The maximum shear stress at the pipe wall is 210 N/m^2. Find :

(*i*) The pressure gradient,

(*ii*) The average velocity, and

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

(*b*) Explain with neat sketches "Boundary Layer Separation and its control". [6]

Or

6. (*a*) In case off low of viscous fluid through circular pipe; show that the loss of pressure head is given by the following expression : [6]

$$\frac{p_1 - p_2}{\rho g} = \left[\frac{32\,\mu\bar{u}L}{\rho g D^2}\right].$$

(*b*) Find the momentum thickness, displacement thickness and energy thickness for 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. Also calculate the value of $\frac{\delta^*}{\theta}$. [7]

7. (*a*) A pipe of 100 mm diameter is carrying water. If the velocities at the pipe centre and 30 mm from the pipe centre are 2.0 m/s and 1.5 m/s respectively and flow in the pipe is turbulent, calculate the shear friction velocity and wall shearing stress. [6]

(*b*) The main pipe divides into two parallel pipes which again forms one pipe. The data is as follows :
First parallel pipe : Length = 1000 m, Diameter = 0.8 m
Second parallel pipe : Length = 1000 m, Diameter = 0.6 m
Coefficient of friction for each parallel pipe = 0.005
If the total rate of flow in the main is 2 m^3/s, find the rate of flow in each parallel pipe. [7]

Or

8. (*a*) Derive the following expression with usual notations for loss of head in pipes due to sudden enlargement. [7]

$$h_e = \frac{(V_1 - V_2)^2}{2g}.$$

(*b*) Explain the "Prandtl's mixing length theory" for turbutent shear stress. [6]