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

Seat No.	

[4857]-1006

S.E. (Civil) (Second Semester) 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 side 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*) Explain the necessity of study of fluid mechanics with context to civil engineering application. State Newton's law of viscosity and its application in fluid mechanics. [3]

(*b*) What are the application of surface tension and capillarity effect ? Derive the equation for excess pressure inside water drop. [3]

(*c*) A differential manometer is connected at two points A & B of two pipes as shown in Fig. 1. Pipe A contains liquid of specific gravity 1.6, while pipe B contains liquid of specific gravity 0.8. If the pressure at A & B are 11.80×10^4 N/m^2 and

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19.60×10^4 N/m^2, find the difference in mercury level in the differential manometer. [6]

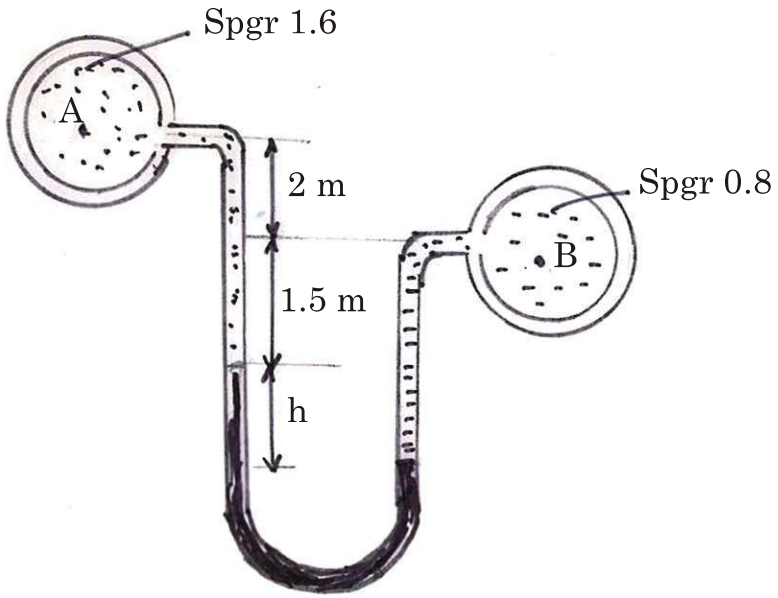

Fig. 1

Or

2. (*a*) What is dimensional analysis and its uses ? Explain principle of dimensional homogenity and check dimensional homogenity of : [3]

$$h_f \frac{f\,LV^2}{2gd}$$

(*b*) Define metacentre and metacentric height. Explain experimental of determining metacentric height of floating bodies. [4]

(*c*) A vertical rectangular plane surface has width of 1.5 m and depth of 3.0 m. It is placed in water such that the upper edge is 1 m below free water surface. Find the total pressure and the depth of centre of pressure on the rectangular plane. [5]

3. (*a*) Define streamline, pathline and streakline. Give mathematical expression for each. [6]

(*b*) A stream function is given by $\phi = 2x^2 - 3y$. Check if the flow is rotational and satisfies continuity equation. [6]

Or

4. (*a*) Derive the Euler's equation of motion for 1 dimensional flow of an inviscid, incompressible fluid and integrate to obtain Bernoulli equation. [6]

(*b*) Explain the necessity of always measuring the pressure difference between inlet and throat of an venturimeter. Explain why C_d for an orificemeter is considerably less than that of venturimeter. [6]

5. (*a*) An oil of viscosity 15 poise flows through a pipe of diameter 150 mm at an velocity of 2.5 m/s. If the specific gravity of oil is 0.9, find : [7]

(1) Pressure gradient in direction of flow

(2) Shear stress at the wall of pipe

(3) Reynold number of flow of oil

(4) Velocity at a distance of 50 mm from wall.

(*b*) Explain laminar boundary layer, turbulent boundary layer and laminar sublayer. [6]

Or

6. (*a*) Prove that maximum velocity of flow between two fixed parallel plates and for laminar flow is equal to 1.5 times of average velocity of flow. [6]

(*b*) Explain the phenomenon of boundary layer separation. What are the different methods to control boundary layer separation and explain any 2 methods. [7]

7. (*a*) Explain the condition for development of turbulent flow in pipes and what are the different types of velocity of flow involved in turbulent flow and develop a relationship between them. [6]

(*b*) Explain major loss and minor loss that occur in flow through pipe. Show that the loss due to sudden contraction can be expressed as :

$$h_c = k_c \left(\frac{V_2^2}{2g} \right), \quad \text{where} \quad k_c = \left(\frac{1}{c_c} - 1 \right)^2 .$$

Explain the variation of K_c with respect to ratio of diameter of two pipes. [7]

Or

8. (*a*) A 45 m long pipe connects 2 reservoirs, surface of which are exposed to atmosphere, each pipe is 15 m in length, the first and last pipe is 50 mm in diameter and the intermediate pipe is 30 mm in diameter. If the difference in water surface elevation between 2 reservoir is 15 m and friction factor '*f*' for the pipes is 0.005, calculate the flow rate and draw hydraulic gradient and total energy line. [7]

(*b*) Explain the determination of friction factor using Moody diagram. [3]

(*c*) What are the various types of minor loss that occur in flow through pipes ? Give the equation to measure each of the loss. [3]