Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

Seat No.	

[5057]-14

S.E. (Mechanical) (First Semester) EXAMINATION, 2016

FLUID MECHANICS

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. **:—** (*i*) Answer *three* questions from each section.

(*ii*) Answers to the two sections should be written in separate answer-books.

(*iii*) Draw diagrams wherever necessary.

(*iv*) Use of scientific calculator is allowed.

(*v*) Assume suitable data wherever necessary.

SECTION I

1. (*a*) Explain the following terms : [8]

(*i*) Compressibility

(*ii*) Surface tension

(*iii*) Viscosity

(*iv*) Capillarity.

(*b*) Discuss various types of flows. [8]

(*c*) What is fluid ? What is the difference between real and ideal fluids ? [2]

P.T.O.

Or

2. (*a*) A 400 mm diameter shaft is rotating at 200 RPM in a bearing of length 120 mm. If the thickness of oil film is 1.5 mm and the dynamic viscosity of the oil is 0.7 N.s/m^2, determine : [8]

(*i*) Torque required to overcome friction in bearing

(*ii*) Power utilized in overcoming viscous resistance.

(*b*) Explain : [6]

(*i*) Stream function

(*ii*) Velocity potential.

(*c*) Define Stream lines, Path lines and Streak lines. [4]

3. (*a*) State and prove hydrostatic law. [8]

(*b*) Explain with neat sketch the method of determining metacentric height of floating body. [8]

Or

4. (*a*) An isosceles triangular plate of base 3 m and altitude 3 m is immersed vertically in an oil of specific gravity 0.8. The base of the plate coincides with the free surface of oil.

Determine : [8]

(*i*) Total pressure on the plate

(*ii*) Center of pressure.

(*b*) State and prove Pascal's law. [8]

5. (*a*) Derive an expression of Bernoulli's equation using first principle. [8]

(*b*) A 300 mm × 150 mm venturimeter is provided in a vertical pipeline carrying oil of specific gravity 0.9, flow being upward. The difference in elevation of the throat section and entrance section of the venturimeter is 300 mm. The differential U-tube mercury manometer shows a gauge deflection of 250 mm. Calculate : [8]

(*i*) The discharge of oil, and

(*ii*) The pressure difference between the entrance section and the throat section.

Take C_d = 0.98 and specific gravity of mercury as 13.6.

Or

6. (*a*) Compare Venturimeter and Orifice meter. [4]

(*b*) Discuss various arrangements of Pitot tube. [8]

(*c*) List of forces acting on fluid mass. Explain the significance of each term. [4]

SECTION II

7. (*a*) Derive Hagen-Poiseuille equation for laminar flow in the circular pipes. [12]

(*b*) What are repeating variables ? What points are important while selecting repeating variables ? [6]

Or

8. (*a*) Discharge Q of a centrifugal pump can be assumed to be dependent on density of liquid ρ, viscosity of liquid μ, pressure, impeller diameter D, and speed N in RPM. Using Buckingham π-theorem, show that : [10]

$$Q = ND^3 \phi\left[\frac{gH}{N^2D^2}, \frac{\nu}{ND^2}\right].$$

(*b*) Derive expression for velocity distribution for flow in fixed parallel plates. [8]

9. (*a*) Derive an expression for the power transmission through the pipes. Find also the condition for maximum transmission of power. [8]

(*b*) A siphon of dia. 200 mm connects two reservoirs having a difference of elevation of 15 m. The total length of siphon is 400 m and the summit is 3 m above the water level in

the upper reservoir. The length of siphon from upper reservoir to summit is 120 m. Take friction factor = 0.02, determine : [8]

(*i*) Discharge through the siphon, and

(*ii*) Pressure at the summit. Neglect minor losses.

Or

10. (*a*) A piping system consists of three pipes arranged in series; the lengths of the pipes are 1200 m, 750 m and 600 m and diameters 750 mm, 600 mm and 450 mm respectively. [6]

(*i*) Transform the system to an equivalent 450 mm diameter pipe, and

(*ii*) Determine an equivalent diameter for the pipe, 2550 m long.

(*b*) Derive Darcy Weisbach equation. [6]

(*c*) Explain minor losses occurred in pipe. [4]

11. (*a*) Discuss boundary layer development over flat plate. [8]

(*b*) Discuss flow around cylinder and airfoil. [8]

Or

12. (*a*) Write a short note on "Separation of Boundary Layer-its Control". [8]

(*b*) A plate 450 mm × 150 mm has been placed longitudinally in a stream of crude oil (specific gravity 0.925 and kinematic viscosity of 0.9 stokes) which flows with velocity of 6 m/s. Calculate : [8]

(*i*) The friction drag on the plate

(*ii*) Thickness of the BL at the trailing edge, and

(*iii*) Shear stress at the trailing edge.