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

Seat No.	

[5152]-516

S.E. (Mechanical/Auto.) (II Sem.) EXAMINATION, 2017

FLUID MECHANICS

(2015 PATTERN)

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

N.B. :— (*i*) Neat diagram must be drawn wherever necessary.
(*ii*) Figures to the right indicate full marks.
(*iii*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables and p-h chart is allowed.
(*iv*) Assume suitable data, if necessary.

1. (*a*) Explain : [6]
(*i*) Surface tension
(*ii*) Compressibility
(*iii*) Vapour pressure.

(*b*) Explain stream function and velocity potential. [6]

Or

2. (*a*) Define with mathematical expression : [6]
(*i*) Uniform and Non-uniform flow
(*ii*) Steady and unsteady flows
(*iii*) One, two and three dimensional flow.

(*b*) A square plate 6m × 6m is placed in a liquid of specific gravity 0.8 at an angle of 30º with free liquid surface.

P.T.O.

A square hole of 1.5 m × 1.5 m is cut exactly in centre of the plate. Its greatest and the least depths below the free liquid surface are 5 m and 2 m respectively. Determine the total pressure on one face of the plate and position of centre of pressure. [6]

3. (*a*) Derive Euler's equation for flow along streamline and deduce the Bernoulli's equation for the same. [6]

(*b*) A 0.2 m diameter pipe carries liquid in laminar region. A Pitot tube placed in the flow at a radial distance of 15 mm from the axis of the pipe indicates velocity of 0.5 m/s. Calculate : [6]

(*i*) The maximum velocity

(*ii*) The mean velocity

(*iii*) The discharge in the pipe.

Or

4. (*a*) Derive an expression of velocity and shear stress distribution for laminar flow between fixed parallel plates. [6]

(*b*) The inlet and throat diameters of horizontal venturimeter are 30 cm and 10 cm respectively. The liquid flowing through the meter is water. The pressure intensity at inlet is 13.734 kN/m^2 while vacuum pressure head at the throat is 37 cm of mercury. Find the rate of flow. Assume that 4% of the differential heads is lost between the inlet and outlet. Find also the value of C_d for venturimeter. [6]

5. (*a*) A 2500 m long pipeline is used for transmission of power. 120 kW power is to be transmitted through the pipe in which water having a pressure of 4000 kN/m^2 at inlet is flowing. If the pressure drop over the length of pipe is 800 kN/m^2 and f = 0.024, find : [7]

(*i*) Diameter of the pipe

(*ii*) Efficiency of transmission.

(*b*) Explain : [6]

(*i*) Mach Number

(*ii*) Froude Number

(*iii*) Euler Number.

Or

6. (*a*) Discharge Q of a centrifugal pump can be assumed to be dependent on density of liquid , viscosity of liquid μ, pressure, impeller diameter D, and speed N in RPM. Using Buckingham -theorem, show that : [7]

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

(*b*) Derive an expression for Darcy-Weisbach equation. [6]

7. (*a*) Write a short note on "Boundary layer formation over flat plate. [7]

(*b*) A cylinder 80 mm diameter and 200 long is placed in a stream of fluid flowing at 0.5 m/s. The axis of the cylinder is normal to the direction of flow. The density of fluid is 800 kg/m^3. The drag force is measured and found to be 30 N. Calculate the drag coefficient. At a point on the surface the pressure is measured as 96 Pa above the ambient level. Calculate the velocity at this point. [6]

Or

8. (*a*) Derive an expression for displacement, momentum and energy thicknesses. [9]

(*b*) What is Drag and Lift ? Explain different types of drag on an immersed body. [4]