Third Semester B.E. Degree Examination, Dec.2015/Jan.2016
Fluid Mechanics

Time: 3 hrs.   Max. Marks: 100

Note: *Answer FIVE full questions, selecting*
at least TWO questions from each part.

PART – A

1   a. $10m^3$ of mercury weighs $136 \times 10^4 N$. Calculate its specific weight, mass density, specific volume and specific gravity.   (05 Marks)
    b.   State Newton Law of viscosity. Classify different types of fluids.   (05 Marks)
    c.   Derive an expression for a surface tension on liquid droplet.   (05 Marks)
    d.   Derive on expression for a capillary fall, when the glass tube is dipped in mercury. (05 Marks)

2   a.   State and explain Pascal and hydrodynamic laws. List the application of these laws. (05 Marks)
    b.   The right limb of a simple U-tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of sp gravity 0.9 is flowing. The centre of the pipe is 12cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe if the difference of mercury level in the two limb is 20cm.   (05 Marks)
    c.   A Tank contains water upto a height of 0.5m above the base. An immiscible liquid of Sp. gravity 0.8 is filled on the top of water upto 1m height.
         Calculate
         i) Total pressure on one side of the tank   ii) The position of centre of pressure for one side of the tank which is 2m wide.   (05 Marks)
    d.   A rectangular plane surface 3m wide and 4m deep lies in water in such a way that its plane makes on angle of 30° with the free surface of water. Determine the total pressure force and position of centre of pressure, when the edge is 2m below the free surface.   (05 Marks)

3   a.   Derive an expression for the meta-centric height of a floating body.   (10 Marks)
    b.   Classify the different types of Fluid Flow.   (05 Marks)
    c.   The stream function for a two dimensional flow is given by $\psi = 2xy$. Calculate velocity at the point P(2, 3), find the velocity potential function ϕ.   (05 Marks)

4   a.   Derive Bernoulli's equation for the flow of an incompressible frictionless fluid from consideration of momentum.   (10 Marks)
    b.   The water is flowing through a pipe having diameter 20cm and 10cm at section 1 and 2 respectively. The rate of flow through pipe is 35 litres/s. The section 1 is 6m above datum and section 2 is 4m above datum.   (10 Marks)

PART – B

5   a.   A venturimeter is used for measurement of discharge of water in a horizontal pipe line. If the ratio of upstream pipe diameter to that of throat is 2:1 up stream diameter is 300mm, the difference of pressure between the throat and upstream is equal to 3m head of water and loss of head through meter is one eighth of the throat velocity head, calculate discharge in the pipe.   (10 Marks)
    b.   Explain different types of forces acting in moving fluid.   (05 Marks)
    c.   Explain the methods of Dimensional Analysis.   (05 Marks)

6 a. How to determine the loss of head due to friction in pipes by using
   i) Darcy Formula   ii) Chezy formula
   (05 Marks)
   b. Explain the terms i) Major energy loss   ii) Minor loss
                        iii) Hydraulic gradient line   iv) Total energy line.   (10 Marks)
   c. Find the diameter of a pipe of length 2000m when the rate of flow of water through the pipe is 200 ℓ/s and the head lost due to friction is 4m take the value of e = 50 in Chezy's Formula.

   (05 Marks)

7 a. Derive on expression for laminar flow through circular pipe [Hagen Poiseuille equation].
   (10 Marks)
   b. Derive on expression for laminar flow between two parallel stationary plates.   (10 Marks)

8 a. Derive on expression for drag and lift.
   (10 Marks)
   b. State the Bernoulli's theorem for compressible flow. Derive an expression for Bernoulii's equation when the process is i) Isothermal ii) Adiabatic process.   (10 Marks)

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