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06CV35(CV/TR/EV)

Third Semester B.E. Degree Examination, Dec.08/Jan.09
Fluid Mechanics

Time: 3 hrs. Max. Marks:100

Note : ***Answer any FIVE full questions selecting at least Two from each part.***

PART - A

1 a. Define a fluid and explain the concept of fluid continuum and its significance. **(06 Marks)**

b. Distinguish between
   i) Dynamic and Kinematic viscosity.
   ii) Cohesion and Adhesion.
   iii) Real and Ideal fluids. **(06 Marks)**

c. A cube of 0.25m sides and mass 28kg slides down a plane inclined at 2V:3H covered by a thin film of oil of viscosity 2.2×10^{-3} pa-sec. If the thickness of the film is 0.02mm determine the steady state velocity of the block. **(08 Marks)**

2 a. With a neat sketch explain the working of a Bourdan's pressure gauge. **(06 Marks)**

b. State and prove Pascal's Law. **(06 Marks)**

c. If the barometric pressure is 760mm of mercury, what should be the gauge reading (A) in Fig.Q.2(c) and what is the pressure of air above the oil in the enclosed tank? **(08 Marks)**

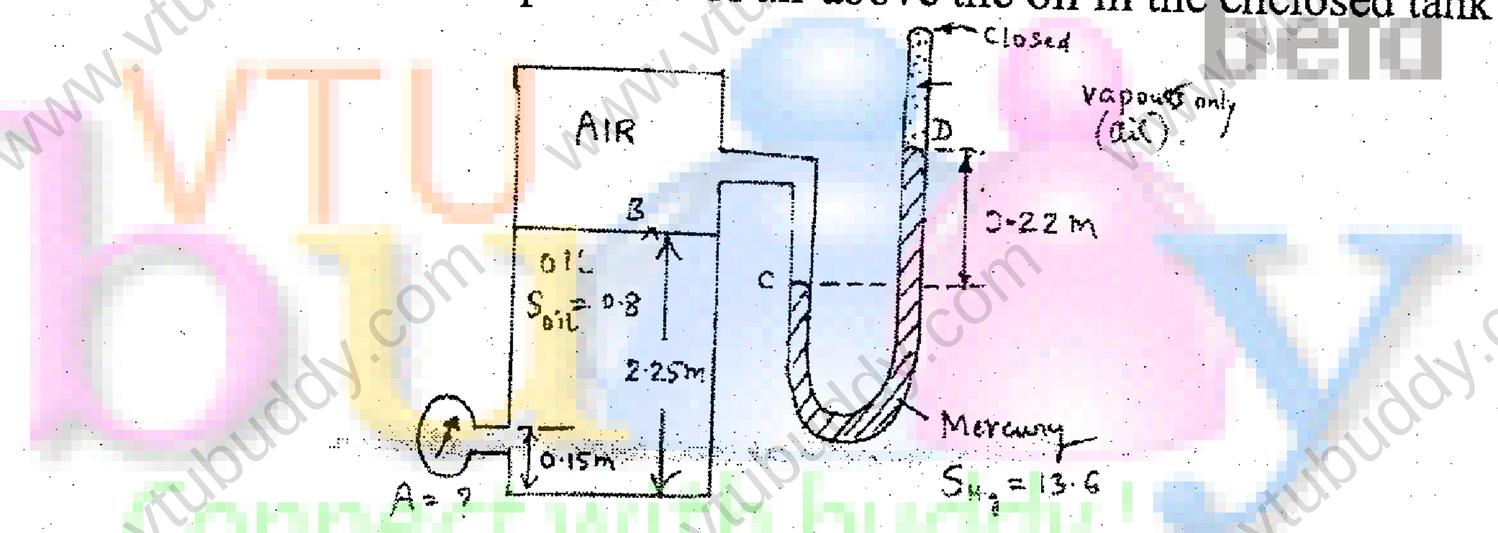

Fig.Q.2(c).

3 a. With a neat sketch, explain the procedure to find the pressure force components (Hor and Ver) and hence their resultant in magnitude and direction for a curved Lamina submerged in a static mass of liquid. **(08 Marks)**

b. A rectangular plate 1.2m x 1.8m size is immersed in water in an inclined position and makes an angle of 30° with the horizontal, the 1.2m side being horizontal. Calculate the magnitude of the net force on one face and position of centre of pressure when i) The top edge of the plate is at the water surface and ii) 30m below the water surface. **(12 Marks)**

4 a. Distinguish between
   i) Path line and stream line.
   ii) Uniform flow and steady flow. **(04 Marks)**

b. Derive the equation of continuity for a steady incompressible fluid flow in three dimensional Cartesian coordinates. **(08 Marks)**

c. A stream function is given by $\Psi = 2x^2 - 2y^2$
   i) Show that the flow is irrotational.
   ii) Find the resultant velocity at a point denoted by x = 1 and y = 3.
   iii) Find the velocity potensial ϕ. **(08 Marks)**

PART - B

5 a. With a neat sketch derive the equation for discharge through a inclined venturimeter with flow downwards using U tube differential manometer. **(06 Marks)**

b. State the assumptions and limitations of Bernoulli's equation. **(06 Marks)**

c. The top and bottom diameters of a 2m long vertical tapering pipe are 10cms and 5cms respectively. Water flows down the pipe at 30 lit/sec. find the pressure difference between the two ends of the pipe. **(08 Marks)**

6 a. What is an equivalent pipe? Derive an expression for the equivalent diameter of the compound pipe. Neglect minor losses. **(06 Marks)**

b. Distinguish between
   i) Hydraulic gradient line and energy gradient line.
   ii) Major and minor losses.
   iii) Pipes in series and pipes in parallel. **(06 Marks)**

c. Consider two pipes of same length and having the same roughness coefficient but with the diameter of one pipe being 60% of the other. Determine
   i) The ratio of discharge through the pipes if the friction loss for both of them is to be the same.
   ii) The ratio of friction losses if the pipes carry the same discharge. **(08 Marks)**

7 a. Define the following
   i) Orifice and Mouth piece.
   ii) Coefficient of velocity and Coefficient of contraction.
   iii) Coefficient of discharge and velocity of approach. **(06 Marks)**

b. An orifice is fitted at the bottom of one side of tank having water to a depth of H metres. Derive an expression to estimate the coefficient of velocity experimentally. **(06 Marks)**

c. In performing an experiment to determine different hydraulic coefficient of a sharp edged orifice a jet of water issuing horizontally from the orifice 25mm diameter under a constant head of 150cm fall through 0.9m vertically and struck the ground at 2.3m horizontally from vena contract. The time required to discharge 91 litres of water was found to be 53 seconds. Calculate all the hydraulic coefficients. **(08 Marks)**

8 a. Distinguish between
   i) Notch and weir.
   ii) Broad crested weir and submerged weir.
   iii) Free nappe and clinging nappe. **(06 Marks)**

b. Derive an expression for the discharge over a rectangular notch. **(06 Marks)**

c. Water flows through a triangular right angled weir first and then over a rectangular weir of 1m crest width. The discharge coefficients of the triangular and rectangular weirs are 0.6 and 0.7 respectively. If the depth of water over the triangular weir is 360mm, find the depth of water over the rectangular weir. **(08 Marks)**

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