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06CV35

Third Semester B.E. Degree Examination, June-July 2009
Fluid Mechanics

Time: 3 hrs. Max. Marks:100

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

PART - A

1 a. Define the following terms
i) Specific weight; ii) Mass density; iii) Specific Volume; iv) Specific gravity. **(04 Marks)**

b. State the Newton's law of viscosity. Sketch the Newton's law relationship for Newtonian and Non-Newtonian fluids. Give one example for each fluid. **(08 Marks)**

c. The velocity distribution over a plate is given by $V = \left(\frac{y}{3} - y^2\right)$ in which V is the velocity in mt/sec. at a distance y metres above the plate. Determine the shear stress at $y = 0$ and $y = 0.1m$. Take $\mu = 0.835$ N-sec/m^2. **(08 Marks)**

2 a. Derive the variation of pressure in a static mess of fluid in differentiate form. **(10 Marks)**

b. The left leg of a u-tube mercury manometer is connected to a pipe-line conveying water, the level of mercury in the leg being 0.6m below the center of pipe line, and the right leg is open to atmosphere. The level of mercury in the right leg is 0.45m above than that in the left leg and the space above mercury in the right leg contains Benzene (sp. Gr. 0.88) to a height of 0.3m. Find the pressure in the pipe. **(06 Marks)**

c. A hydraulic press has a ram of 300mm diameter and a plunger of 45mm diameter. Find the weight lifted by the hydraulic press when the force applied at the plunger is 500N. **(04 Marks)**

3 a. Derive an expression for the total pressure on a vertical plane. Show that for plane vertical surface, the center of pressure is always below the center of gravity of the surface. **(10 Marks)**

b. Find the magnitude and line of a action at the resultant force exerted upon the side of a box tank which is 0.6m square and 1.2m deep when filled half fully with liquid having a specific gravity of 2, while the remainder is filled with liquid having a specific gravity of 1. **(10 Marks)**

4 a. Define the following
i) Uniform and Non-uniform flow
ii) Steady and Unsteady flow
iii) Rotational and Irrotational flow **(10 Marks)**

b. Derive the continuity equation in differential form.

c. A stream function (Ψ) in a two-dimensional flow is given by $\Psi = uxy$ Show that the flow is irrotational, and find the corresponding velocity potential function (ϕ). **(10 Marks)**

PART - B

5 a. Derive the Bernoullie's energy equation from the Euler's motion equation, mentioning clearly the assumptions made in the derivation. **(08 Marks)**

b. A pipe 300m long has a slope of 1 in 100 and tapers from 1.2m diameter at the high end to 0.6m diameter at the low end. Quantity of water flowing is 5,400 lit/minute. If the pressure at the high end is 68.67 KPa, find the pressure at the lower end. Neglect losses. **(06 Marks)**

c. A Venturi-meter has its axis vertical, the inlet and throat diameters being 150mm and 75mm respectively. The throat is 223mm above inlet and K = 0.96, Petrol of specific gravity 0.78 flows up through the meter at a rate of 0.029 m^3/sec. Find the pressure difference between the inlet and the throat. **(06 Marks)**

6 a. Derive the equation to find the head loss due to sudden enlargement in a pipe.

b. A pipe line consists of 3 pipes in series: **(06 Marks)**

i) 300m long, 15cm diameter
ii) 150m long, 10cm diameter
iii) 240m long, 20cm diameter

The pipeline takes off from a reservoir with water at an elevation of 500m. The elevation at the exit is 400m. Find the discharge. Neglect minor losses. Take f = 0.04. **(06 Marks)**

c. A pipe line 0.225m in diameter and 1580m long has a slope of 1 in 200 for the first 790mt and 1 in 100 for the next 790mt. The pressure at the upper end of the pipeline is 107.91Kpa and at the lower end is 53.955Kpa. Taking f = 0.032 determine the discharge through the pipe.

(08 Marks)

7 a. Define the following

i) Coefficient of velocity
ii) Coefficient of contraction
iii) Coefficient of discharge
iv) Coefficient of resistance. **(04 Marks)**

b. The head of water over an orifice of diameter 10cm is 10mts. The water coming out from orifice is collected in a circular tank of diameter 1.5m. The rise of water level in this tank is 1.0mt in 25 seconds. Also the co-ordinates of a point on the jet, measured from vena-contract are 4.3mt. horizontal and 0.5m vertical. Find the co-efficients C_d, C_v and C_c. **(08 Marks)**

c. A reservoir discharge through a sluice 0.913m wide by 1.22m deep. The top of the opening is 0.61m below the water level in the reservoir and the downstream water level is below the bottom of the opening. Calculate

i) The discharge through the opening if $C_d = 0.6$ and
ii) Percentage error if the opening is treated as a smallorifice. **(08 Marks)**

8 a. What is the difference between weir and a notch? How are the weirs classified? What is t! difference between a sharp crested and a broad crested weir. **(08 Marks)**

b. Water flows over a rectangular weir 1m wide at a depth of 15cm and afterwards passes through a triangular right angled weir. Taking C_d for the rectangular and triangular weir as 0.62 and 0.59 respectively, Find the depth over the triangular weir. **(06 Marks)**

c. A rectangular notch of crest width 0.4m is used to measure the flow of water in a rectangular channel 0.6m wide and 0.45m deep. If the water level in the channel is 0.225m above the weir crest, find the discharge in the channel. For the notch $C_d = 0.63$ and take velocity of approach into account. **(06 Marks)**

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