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17CV33

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019 Fluid Mechanics

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1.
 - a. Define the term 'fluid'. Distinguish between liquid and gases. (06 Marks)
 - b. Derive the expression for surface tension on a liquid droplet. (06 Marks)
 - c. The dynamic viscosity of an oil, used for lubrication between a shaft and sleeve is 0.6Ns/m^2 . The shaft diameter is 0.4m and rotates at 190rpm . Calculate the power lost in the bearing a sleeve length of 90mm . Take the thickness of the oil film as 1.5mm . (08 Marks)

OR

2.
 - a. Explain the working of a Bourdon's pressure gauge with a diagram. (06 Marks)
 - b. State and prove Pascal's law. (08 Marks)
 - c. A differential manometer is connected to the two points A and B of two pipes as shown in Fig.Q.2(c). The pipe A contains a liquid of sp.gr = 1.5 while pipe B contains a liquid of sp.gr = 0.9. The pressures at A and B are $9.81 \times 10^4 \text{N/m}^2$ and 17.65N/m^2 respectively. Find the difference in mercury level in the differential manometer. (06 Marks)

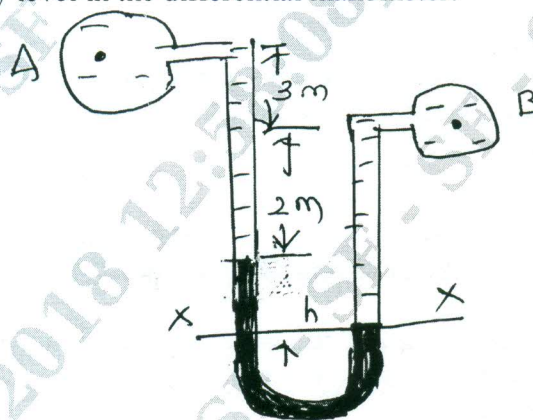


Fig.Q.2(c)

Module-2

3.
 - a. Define: i) Total pressure ii) Centre of pressure. (04 Marks)
 - b. Derive the expression for the total pressure and center of pressure on a vertically immersed plane surface. (08 Marks)
 - c. The velocity potential function $\phi = \frac{-xy^3}{3} - x^2 + x^3y + y^2$.
 - i) Find the velocity component in x and y directions.
 - ii) Show that ϕ represents a possible case of fluid flow. (08 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.



OR

- 4 a. Derive continuity equation in Cartesian coordinates for 3 dimensional flow. (08 Marks)
b. A rectangular plane surface 1m wide and 3m deep lies in water in such a way that its plane makes an angle of 30° with the free surface of water. Determine the total pressure and the depth of center of pressure when the upper edge of the plate is 2m below the free surface. (06 Marks)
c. What is flownet? The stream function for a two dimensional flow is given by $\psi = 2xy$. Find the velocity potential function ' ϕ '. (06 Marks)

Module-3

- 5 a. State the assumptions made in deriving the Euler's equation of motion. Hence obtain Bernoulli's equation from Euler's equation with a neat sketch. (10 Marks)
b. A pipe of diameter 400mm carries water at a velocity of 25m/s. The pressure at the points A and B are given as 29.43 N/cm^2 and 22.563 N/cm^2 respectively, while the datum head at A and B are 28m and 30m. Find the loss of head between A and B. (05 Marks)
c. Show that for a pitot tube actual velocity $V = C_v \sqrt{y h}$ with usual notations. (05 Marks)

OR

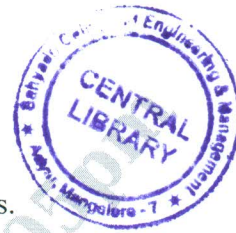
- 6 a. Derive the equation for discharge through a venturimeter. (08 Marks)
b. Water flow at the rate of $0.147 \text{ m}^3/\text{s}$ through a 150mm diameter orifice inserted in a 300mm diameter pipe. If the pressure gauges fitted upstream and down stream of the orifice plate have shown readings of 176.58 kN/m^2 and 88.29 kN/m^2 respectively, find the coefficient of discharge 'C' of the orifice meter. (05 Marks)
c. A 45° reducing bend is connected in a pipe line, the diameters at the inlet and outlet of the bend being 600mm and 300mm respectively. Find the force exerted by water on the bend if the pressure intensity at the inlet to the bend is 8.829 N/cm^2 and rate of flow of water is 600 lit/sec. (07 Marks)

Module-4

- 7 a. Define hydraulic coefficient C_c , C_v and C_d for an orifice and obtain the relation between them. (08 Marks)
b. Derive the expression of discharge through a triangular notch. (08 Marks)
c. Find the discharge over a Cipolletti weir of length 2.0m when the head over the weir is 1m. Take $C_d = 0.62$. (04 Marks)

OR

- 8 a. What are the advantages of triangular notch over rectangular notch? How do you classify mouth pieces? (06 Marks)
b. A jet of water, issuing from a sharp-edged vertical orifice under a constant head of 10.0cm at a certain point, has the horizontal and vertical coordinates measured from the Vena-Contracta as 20.0cm and 10.5cm respectively. Find the value of C_v . Also find the value of C_c if $C_d = 0.60$. (06 Marks)
c. What is broad crested weir? Show that under maximum discharge conditions $h = 2/3 H$ with usual notations for a broad crested weir. (08 Marks)

**Module-5**

- 9 a. Derive Darcy's equation for head loss through pipes. (08 Marks)
 b. Explain: i) Pipes in parallel ii) Pipes in series. (04 Marks)
 c. The rate of water flow of water through a horizontal pipe is $0.025 \text{ m}^3/\text{s}$. The diameter of the pipe which is 200mm is suddenly enlarged to 4000mm. The pressure intensity in the smaller pipe is 11.772 N/cm^2 . Compute:
 i) Loss of head due to sudden enlargement
 ii) Pressure intensity in the large pipe. (08 Marks)

OR

- 10 a. Explain the terms:
 i) Hydraulic gradient and
 ii) Total energy line. (04 Marks)
 b. Derive the expression for pressure loss due to sudden closure of the valve when the pipe is elastic. (08 Marks)
 c. For a pipe network shown in Fig.Q.10(c) find the flow in each pipe. The value of 'n' assumed as 2.0. (08 Marks)

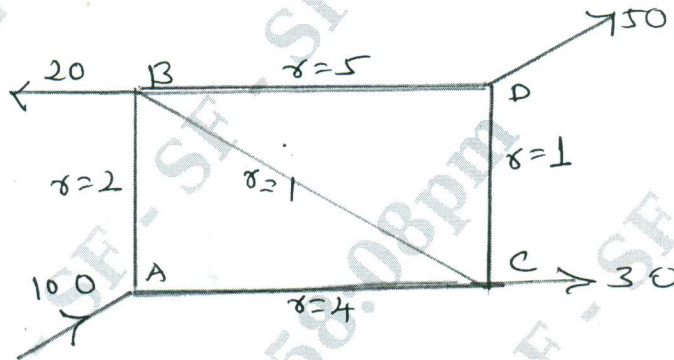


Fig.Q.10(c)
