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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Third Semester, B.E. - Civil Engineering

Semester End Examination; Dec. - 2014

Fluid Mechanics

Time: 3 hrs *Max. Marks: 100*

***Note** : i) Answer **FIVE** full questions, selecting **ONE** full question from each Unit.*
ii) Assume suitable missing data if any.

Unit - I

1. a. Define fluid. Bring out clearly the difference between a solid and a fluid. 6

   b. What do you understand by the term fluid continum. Explain. 4

   c. If $5m^3$ of oil weighs 45 kN, determine the specific mass, specific weight, specific gravity of oil. Also calculate kinematic viscosity of oil if viscosity is 20 poise. 10

2 a. Distinguish between,

   i) Cohesion and adhesion. 4

   ii) Dynamic viscosity and kinematic viscosity.

   b. The velocity distribution for flow over a flat plate is given by $u = 0.75y - y^2$ in which u is the velocity in meters per second at a distance y meters about the plate. Determine the Shear stress at y = 0.15 m. Take dynamic viscosity of fluid as 8.5 poise (0.85 Pa-s). 6

   c. A capillary tube having on inside diameter of 4 mm is dipped in water at atmospheric temperature of 20ºC. Determine the height of water which will rise in the tube. Take surface tension of water as 0.075 N/mm and contact angle of 60º. What will be the percentage change in capillarity, if the tube diameter is reduced to half? 10

Unit - II

3 a. Differentiate between:

   i) Gauge pressure and absolute pressure ii) Pressure and pressure head 8

   iii) Piezometers and monometer iv) Single monometer and differential monometer.

   b. Explain Bourdon tube pressure gauge with a neat sketch. 6

   c. The left leg of a U – tube measuring monometer is connected to a pipe line conveying water. The level of mercury in the leg being 0.6 m below the center of pipe line and the right leg is open to atmosphere. The level of mercury in the right leg is 0.45 m about that in the left leg and the space above mercury in the right leg contains benzene having a specific gravity of 0.88 to a height of 0.3 m. Find the pressure in the pipe. 6

4 a. Define; i) Center of pressure ii) Total pressure 4

Contd….2

b. Derive the formula for hydrostatic force and depth of center of pressure for an inclined plane surface submerged in a liquid. 8

c. Find the magnitude and direction of the resultant force due to water on a roller gate of cylindrical form of 5 m diameter. The gate is 10 m long placed on the dam in such a way that water is just going to spill. The axis of gate is parallel to the length of the gate. 8

Unit - III

5 a. Differentiate

i) Stream line and streak line ii) Path line and potential line 6

iii) Rotational and irrotational flow

b. Obtain an expression for continuity equation in three dimensional form. 8

c. The velocity potential function is given by $\phi = 5(x^2 - y^2)$ Calculate the velocity components at the point (4, 5). 6

6 a. Derive the Bernoulli's energy equation from the Euler's motion equation. Mentioning clearly the assumption made in the derivation. 8

b. Apply Bernoulli's equation for Venturimeter and derive the discharge equation. 6

c. A submarine moves horizontally in sea and has its axis 15 m below the surface of water. A Pitot tube properly placed just in front of the submarine and along its axis is connected to the two limbs of a **u** – tube containing mercury. The difference of Hg level in found to be 170 mm. Find the speed of the submarine knowing that the specific gravity of Hg is 13.6 and that the sea water is 1.026 with respect of fresh water. 6

Unit - IV

7 a. Define Reynolds number and how do you use it to classify the flow in pipes. 4

b. Distinguish between: 4

i) Hydraulic gradient line and total energy line ii) Pipes in series and pipes in parallel.

c. A pipeline of 0.6 m diameter is 1.5 km long. To increase the discharge, another line of the same diameter is introduced parallel to the first in the second half of the length. Neglecting minor losses. Find the increase in discharge if 4f = 0.04. The head at inlet is 300 mm. 12

8 a. Derive the Darcy' Weisbah equation for the loss of head due to friction for the flow through pipe. 6

b. What do you mean by water hammer? Derive an expression for sudden rise of pressure due to gradual closure of value. 6

c. Determine the difference in elevation between the water surfaces in the two tanks which are connected by a horizontal pipe of dia 30 cm and length 400 m. The rate of flow of water through the pipe is 300 LPS. Consider all losses and take the value of f = 0.02. Sketch the total energy line, showing the calculations at salient points. 8

Contd….3

Unit - V

9 a. Define the following theory and find out the relation among them;
i) Coefficient of velocity (C_v)
ii) Coefficient of contraction (C_c)
iii) Coefficient of discharge (C_d) 6

b. What is mouth piece? How are they classified? 4

c. In performing an experiment to determine different coefficients of a sharp edged orifice a jet of water issuing horizontally flow from the orifice 25 mm dia under a constant head of 150 cm fall through 0.9m vertically and struck the ground at 2.3 m horizontally from vena contracta. The time required to discharge 91 liters of water was found to be 53 seconds. Calculate all the hydraulic coefficients for the orifice. 10

10 a. What are the advantages of V Notch over rectangular Notch? Obtain an expression for the discharge through a V Notch. 6

b. What is ventilation of a weir? Why it is necessary? How it is provided? 6

c. A sharp crested rectangular notch is used to measure flow in a rectangular channel of 4 m width. The weir crest is 0.25 m above the bed of channel. If the depth of flow in the channel is 3 m, find the discharge neglecting velocity of approach. If the same discharge flow out a 90º triangular notch, what is the depth of flow above its crest? Assume C_d = 0.62 for both notches. 8

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