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

***(An Autonomous Institution affiliated to VTU, Belagavi)***

## Third Semester, B.E. - Civil Engineering

## Semester End Examination; Dec - 2017 / Jan - 2018

## Fluid Mechanics

*Time: 3 hrs* *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

### UNIT - I

1 a. Define specific mass, specific weight and relative density. Mention the units and the values corresponding to water for each of them. 6

b. Dynamic viscosity of oil used for lubrication between a shaft and a sleeve is 6 poise. The shaft is of diameter 0.4 m and rotates at 190 rpm. Calculate the power lost in the bearing for a sleeve length of 0.09 m. Thickness of oil is 1.5 mm. 7

c. Show that the pressure inside a liquid droplet is half the pressure inside a hollow bubble. 7

2 a. Define;
i) Dynamic viscosity and kinematic viscosity ii) Surface tension and capillarity. Give the units for each of them. 8

b. Explain Vapour pressure and its effect. 4

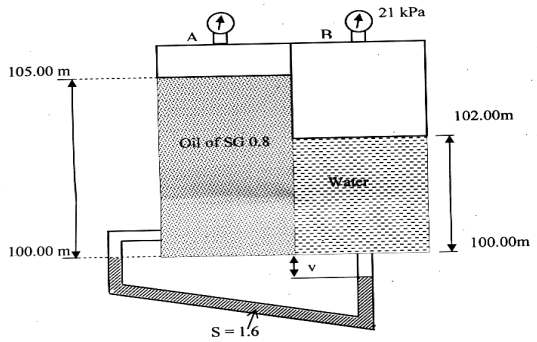
c. Specific gravity of a liquid is 0.7. Find; i) Mass density ii) Specific weight. Also find the mass and weight of 10 liters of liquid. If the change in volume of that liquid is observed to be 0.2% of original volume when pressure on it is increased by 5 MPa. Determine the bulk modulus and compressibility of the liquid. 8

### UNIT - II

3 a. Define pressure and pressure head. 4

b. With a neat sketch, explain how an inverted differential manometer is used for its intended purpose. 8

c. In the figure given, the air pressure in the left tank is 230 mm of Mercury (Vacuum). Determine the elevation of manometer liquid in the right limb, if the liquid in the right tank is water. 8




4 a. Define total pressure and centre of pressure. 4

b. Derive the equation for total pressure on a vertical plane surface immersed in a static mass of fluid and show that it always acts below the centroid of the plane surface. 8

c. Calculate the resultant water pressure on the tainter gate of radius 8 m and width unity as shown in Fig. 8

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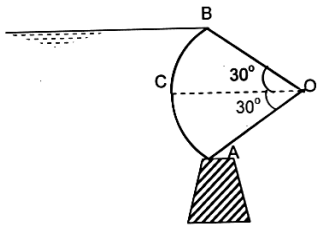


## UNIT - III

5 a. Distinguish between; 4
i) Uniform flow and Non-uniform flow ii) Laminar flow and Turbulent flow.

b. State continuity equation. Derive the same for 2-D flow. 8

c. The velocity components in a 2-D flow are: 8
$u = \frac{y^3}{4} + 3x = x^2 y$ and $v = xy^2 - 3y - \frac{x^3}{3}$ .Obtain an expression for the stream function.

6 a. State and prove Bernoulli's theorem. Extend it to real fluids. 7

b. What is a venturimeter? Derive an expression for the intended purpose of it. 7

c. 300 lps of water are flowing in a pipe having a diameter of 0.3m and is bent by 90º. Find the magnitude of the force on the bend. The pressure of water is 400 kN/m$^2$ (gauge). 6

## UNIT - IV

7 a. List out the losses that occur in a pipe flow. Give the equation for quantifying them. 8

b. Make a note on equivalent pipe. 4

c. Water is supplied to a town of 0.5 million inhabitants from a reservoir 25 km away and the loss of head due to friction in the pipe line is measured as 25 m. Calculate the size of the supply main, if each inhabitant uses 200 litres of water per day and 65% of the daily supply is pumped in $8\frac{1}{2}$ hours. Take friction factor = 0.0195. 8

8 a. Define hydraulic gradient and energy gradient. 6

b. Explain the phenomenon of water hammer in pipes. 4

c. Two reservoirs are connected by a 3 km long 250 mm diameter. The difference in water levels being 10 m. Calculate the discharge in LPM, if friction factor is 0.03. Also find the percentage increase in discharge if for the last 600 m second pipe of the same diameter is laid parallel to the first. 10

## UNIT - V

9 a. Define; i) Orifice ii) Mouthpiece iii) Vena-contracta. 6

b. Distinguished between suppressed weir and contracted weir. Give the ewquation for finding the discharge, when velocity of approach is to be taken into accounting both cases. 6

c. A 4 cm diameter orifice in the vertical side of a tank discharges water. The water surface in the tank is at a constant level of 2 m above the centre of orifice. If the head loss in the orifice is 0.2 m and coefficient of contraction can be assumed to be 0.63. Calculate; 8
i) The values of coeffcient of velocity and coefficient of discharge
ii) Discharge through the orifice
iii) Location of the point of impact of the jet on the horizontal plane located 0.5 m below the centre of the orifice.

10 a. Make a note on ventilation of weirs. 6

b. Show that the coefficient of discharge for an external cylindrical mouth piece is 0.853. 7

c. Calculate the top width and depth of a triangular notch capable of dischaging 700 lps.The weir discharges 5.7 lps when the head over the crest is 7.5 cm. Take Cd = 0.62. 7

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