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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

Make-up Examination; Jan/Feb - 2017

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 Fluid mechanics. Explain its scope and importance. 6

b. Differentiate between : 6

i) Real fluid and Ideal fluid ii) Liquid and Gas.

c. A 15 cm ϕ vertical cylinder rotates concentrically inside another cylinder of ϕ 15.10 cm. Both cylinders are 25 cm high. The space between the cylinders is filled with a liquid whose viscosity is unknown. If a torque of 12.0 N-m is required to rotate the inner cylinder at 100 rpm. Determine the viscosity of the fluid. 8

2 a. Define capillarity. Derive an expression for capillary. 6

b. With neat sketch, explain surface tension. Derive the equation for pressure inside a liquid droplet. 8

c. The dynamic viscosity of oil used for lubrication between a shaft and 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 90 mm. The thickness of the oil film is 1.5 mm. 6

UNIT - II

3 a. State and prove Pascal's law. 8

b. With neat sketch, explain the working of "Diaphragm" Pressure gauge. 4

c. The diameter of small piston and a large piston of a hydraulic jack are 3 cm and 10 cm respectively. A force of 80 N is applied on the small piston. Find the load lifted by the large piston when, 8

i) The piston are @ the same level

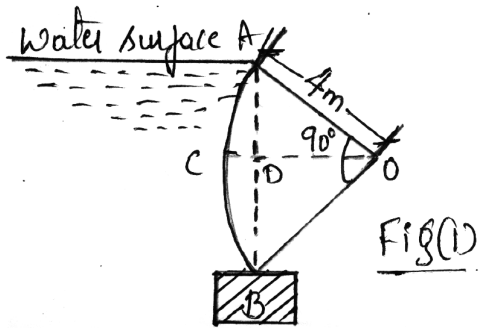
ii) Small piston is 40 cm above the large piston.

The density of the fluid in the jack is given as 1000 kg/cm^3.

4 a. Derive an expression for the depth of centre of pressure from free surface of liquid of an Inclined plane surface submerged in the liquid. 12

b. Find the horizontal and vertical component of water pressure acting on the face of a Tainter gate of 90^o sector of radius 4 m as shown in Fig. (1). Take width of gate unity. 8

Contd…2



Fig(1)

UNIT - III

5 a. Differentiate between the Euluian and Lagrangian method of representing fluid flow. 4

b. Define : 8

i) Stream line ii) Streak line iii) Path line iv) Stream tube.

c. The velocity component of the 2-D plane motion of a fluid are; 8

$$u = \frac{y^2 - x^2}{\left(x^2 + y^2\right)^2} \quad \text{and} \quad v = \frac{2xy}{\left(x^2 + y^2\right)^2}$$

Show that the fluid is incompressible and flow is Irrotational.

6 a. State Bernoulli's theorem. Starting from Euler's equation of motion along a stream line, derive Bernoulli's equation. List the assumptions. 8

b. State Momentum equation. Write expression for the same. 4

c. A horizontal Venturimeter with inlet diameter 20 cm diameters and throat diameter 10 cm is used to measure the flow of water. The pressure at inlet is 17.658 N/cm^2 and the vacuum pressure at the throat is 30 cm of Hg. Find the discharge of water through venturimeter $c_d = 0.98$ 8

UNIT - IV

7 a. List the cases (types) in minor losses. 4

b. Find the head lost due to friction in a pipe of diameter 300 mm and length 50 m, through which water is flowing at a velocity of 3 ms^{-1} using, 6

i) Darcy formula ii) Chezy's formula for which C = 60, Take μ for water = 0.01.

c. Derive Darcy-Weisbach equation for head loss due to friction in pipe. 10

8 a. Explain the phenomenon of water hammer in pipes. 5

b. The water is flowing with a velocity of 1.5 ms^{-1} in a pipe of length 2500 m and of diameter 500 mm. At the end of the pipe, a value is provided. Find the rise in pressure if the valve is closed in 25 sec. Take the value of C = 1460 ms^{-1}. 5

c. Give expression for rise in pressure due to gradual closure and sudden closure of values. 10

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UNIT - V

9 a. Define Hydraulic coefficients of an orifice. Derive the relation between them. 9

b. Derive the expression $C_v = \frac{X}{2\sqrt{YH}}$ with usual notation. 5

c. An internal mouth piece of 800 mm diameter is discharging water under a constant head of 8 m. Find the discharge through mouthpiece. when, 6

i) The mouth piece is running free

ii) The mouth piece is running full.

10 a. Derive an expression for discharge over a triangular notch/weir. 8

b. What is the difference between a notch and a weir? 4

c. i) A broad-crested weir of 50 m length, has 50 cm height of water above its crest. Find the maximum discharge. Take $C_d = 0.6$. Neglect velocity approach. 8

ii) If the velocity of approach is to be taken into consideration, find the maximum discharge when the channel has a cross-sectional area of 50 m^2 on the u/s side.

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