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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. - 2015

Fluid Mechanics

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each **unit**.*
ii) Missing data if any, may suitably assumed.

UNIT - I

1 a. Define the following terms :
i) Specific gravity ii) Viscosity iii) Surface tension
iv) Capillarity v) Adhesion and cohesion. 10

b. Determine the mass density, specific volume and specific weights of the fluid of specific gravity 0.85. 10

2 a. Define term vapour pressure. 4

b. Derive expression for rise or fall of liquid in capillary tube. 6

c. A metal plate 1.25 m x 1.25 m x 6 mm thick weighting 90 N is placed midway in the 24 mm gap two vertical plane surfaces. The gap is filled with an oil of specific gravity 0.85 and dynamic viscosity 3.0 N-s/m^2. Determine the force required to lift the plate with a constant velocity of 0.15 m/s. 10

UNIT - II

3 a. State and prove Hydraulic law as differential equation. 8

b. Define Absolute pressure and gauge pressure. 4

c. A U-tube manometer is used to measure the pressure of oil of specific gravity 0.85 flowing in a pipeline. Its left end is connected to the pipe and the right limp open to atmosphere. The centre of pipe is 100 mm below the level of mercury (Sp. Gravity 13.6) in the right limb. The manometer reading is 160 mm. Determine the absolute pressure of the oil in pipe. 8

4 a. Define total pressure and centre of pressure. Prove that centre of pressure is always below centroid for an inclined flat plate immersed in a fluid. 12

b. A cylinder having 3 m diameter and 1.5 m length in resting on the floor of a channel. One side, water is filled upto half the depth and on other wide an oil of relative density 0.8 filled upto the top. If the weight of the cylinder is 33.75 kN, determine the magnitudes of the horizontal and vertical components of the force to keep the cylinder, just touching the floor. 8

Contd…2

UNIT - III

5 a. Derive the continuity equation in the differential form for incompressible flow of fluid. 10

b. In a 2-dimensional flow of fluid the velocity potential $\phi = 3xy$. Determine the corresponding stream function ψ. 10

6 a. Derive Euler's equation of motion and the resulting Bernoulli's energy equation. 10

b. An inclined venturimeter (400 mm x 200 mm) with 30° to horizontal is connected in a pipeline with a fluid of relative density 0.7 flowing through it. The linear distance between inlet and throat in 600 mm. The mercury manometer reading (13.6) is 50 mm. C_d for venturimeter is 0.98. Find the discharge in pipe. 10

UNIT - IV

7 a. Derive Durcy-Weisbach formula for head loss due to friction in pipe line in a pipe line. Further derive the head loss in terms of discharge in the pipe line. 10

b. Two reservoirs are connected by a 250 mm pipe and 4 km long. The water levels in the reservoirs are differs by 70 m. The pipeline is tapped at the midway to draw water at 0.04 m^3/s. Determine the flow rate into lower reservoir. Its friction factor is 0.04. 10

8 a. With a neat sketch explain water hammar. 4

b. Derive an expression for rise in pressure due to sudden closure of valve in an elastic pipe with fluid flowing through the pipe. 8

c. In a 600 mm dia pipe of length 3 km, water is flowing with a velocity of 2 m/s. If velocity is 1500 m/s find;

(i) Pressure rise if the valve is closed in 20 sec 8

(ii) Pressure rise if the valve is closed in 2.5 sec.

Assume the pipe to be rigid with bulk modulus of water as 2 GPa.

UNIT - V

9 a. Define the following :

i) Orifice ii) Mouth Piece iii) Veena Contracta 10

iv) Coefficient of Construction iv) Submerged orifice.

b. A tank has two identical orifices in one of its vertical sides. The upper orifice is 1.5 m below the water surface and the lower one is 3 m below the water surface. Find the point at which the two jets will intersect. If the coefficient of velocity is 0.92 for both the orifices. 10

10 a. Derive an expression for flow over a rectangular notch. 8

b. List the advantages of triangular weir over rectangular weir. 4

c. Find the discharge through a trapezoidal notch which is 1.2 m wide at the top and 0.5 m at bottom and is 0.4 m high. The head over weir crest is 0.3 m. Assume C_d for rectangular and triangular portions are 0.6 and 0.62 respectively. 8

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