B.E. Mechanical Engineering (Model Curriculum) Semester - III

PCC-ME208 - Fluid Mechanics

P. Pages : 2 **GUG/S/23/14060**

Time : Four Hours * 2 7 9 7 * Max. Marks : 80

Notes : 1. All questions carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Diagrams and Chemical equation should be given wherever necessary.
5. Illustrate your answers wherever necessary with the help of neat sketches.
6. Solve: Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q. 7 or Q. 8, Q. 9 or Q. 10.

1. a) Define & explain Newton's law of viscosity. Explain Newtonian and Non Newtonian fluids. **8**

b) Enlist type of simple manometer. Explain U tube manometer with neat sketch. **8**

OR

2. a) 1 m wide and 1.5 m deep rectangular plane surface lies in water in such a way that its plane makes an angle of 30º with the free water surface. Determine the total pressure and position of centre of pressure when the upper edge is 0.75 m below free water surface. **8**

b) Define. **8**
i) Total pressure.
ii) Centre of pressure.
iii) Compressibility and bulk modulus.
iv) Capillarity.

3. a) State and derive continuity equation in Cartesian coordinate form. **8**

b) A wooden block (Sp. Gr. 0.7) of width 15cm, depth 30cm & length 150cm floats horizontally on surface of sea water (specific weight = 10 kN). Calculate the volume of water displaced, depth of immersion & position of centre of buoyancy. Also find metacentric height. Comment on stability of block. **8**

OR

4. a) Explain: **8**
i) Velocity potential function. ii) Stream function.

b) Water is flowing through the pipe having diameters 600 mm and 400 mm at the bottom and upper end respectively, determine the difference in datum if the rate of flow through the pipe is 60 lit/sec. **8**

5. a) Derive a expression for the discharge over the Rectangular Notch. **8**

b) A horizontal Venturimeter with inlet diameter 20cm & throat diameter 10cm 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 30cm of mercury. Find the discharge of water through venturimeter. Take coefficient of discharge as 0.98. **8**

OR

6. a) Explain: **8**
i) Kinetic energy correction factor.
ii) Momentum correction factor.

b) Two large fixed parallel planes are 12 mm apart. The space between the surfaces is filled with oil of viscosity 0.972 N.s/m2. A flat thin plate 0.25 m 2 area moves through the oil at a velocity of 0.3 m/s. calculate the drag force: i) When the plate is equidistant from both the planes, and ii) When the thin plate is at a distance of 4 mm from one of the plane surfaces. **8**

7. a) In a pipe of 300 mm diameter and 800 m length an oil of specific gravity 0.8 is flowing at the rate of 0.45 m3/s. Find: i) Head lost due to friction, and ii) Power required to maintain the flow. Take kinematic viscosity of oil as 0.3 stoke. **8**

b) Describe Prandtl mixing length theory for finding the shear stress in turbulent flow. **8**

OR

8. a) Derive Darcy - Weisbach equation for head loss in pipes due to friction. **8**

b) Three pipes of diameters 300 mm, 200 mm and 400 mm and lengths 450 m, 255 m and 315 m respectively are connected in series. The difference in water surface levels in two tanks is 18 m. Determine the rate of flow of water if co-efficients of friction are 0.0075, 0.0078 and 0.0072 respectively considering: i) Minor losses also, and ii) neglecting minor losses. **8**

9. a) Discuss the following. **8**

i) Boundary layer thickness.

ii) Displacement thickness.

iii) Momentum thickness.

iv) Energy thickness.

b) A flat plate 2mx2m moves at 60 km/hr in stationary air of density 1.15 kg/m3. If the coefficient of drag and lift are 0.15 and 0.75 respectively. Determine (i) The lift force (ii) The drag force (iii) Resultant force (iv) Power required to keep the plate in motion. **8**

OR

10. a) Explain the importance of dimensional analysis. **8**

b) Define Buckingham's π theorem. Explain its significance in applications. **8**

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