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

PCC-ME208 - Fluid Mechanics

P. Pages : 2 **GUG/S/25/14060**

Time : Three Hours * 2 3 7 7 * Max. Marks : 80

Notes :
1. 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.
2. All questions carry equal marks.
3. Due credit will be given to neatness and adequate dimensions.
4. Assume suitable data wherever necessary.
5. Diagrams and Chemical equation should be given wherever necessary.
6. Illustrate your answers wherever necessary with the help of neat sketches.
7. Use of slide rule, Logarithmic tables, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.

1. a) Explain the following terms. **8**

i) Density ii) Specific volume
iii) Viscosity iv) Capillarity

b) State and derive Pascal's law. **8**

OR

2. a) Explain Newton's law of viscosity. State and explain the types of fluids. **8**

b) A circular plate 3.0 m diameter is immersed in water in such a way that its greatest and least depth below the free surface are 4 m and 1.5 m respectively. Determine the total pressure on one face of the plate and position of the centre of pressure **8**

3. a) State Bernoulli's theorem for steady flow of an incompressible fluid. Derive an expression for Bernoulli's theorem. **8**

b) A solid cylinder of diameter 4.0 m has a height of 4.0 m. find the meta centric height of the cylinder if the specific gravity of the material of cylinder is 0.6 and it is floating in water with its axis vertical. State whether the equilibrium is stable or unstable. **8**

OR

4. a) What do you mean by meta centric height? Explain the conditions of equilibrium of floating body with the help of sketches showing positions of buoyancy, centre of gravity & meta centre. **8**

b) A 30 cm diameter pipe conveying water branches into two pipes of diameters 20 cm and 15 cm respectively. If the average velocity in the 30 cm diameter pipe is 2.5 m/s, find the discharge in this pipe. Also determine the velocity in 15 cm diameter pipe if the average velocity in 20 cm diameter pipe is 2 m/s. **8**

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

b) A horizontal venture meter with inlet & throat diameters 30 cm and 15 cm. respectively is used to measure the flow of water. The reading of differential manometer connected to the inlet & the throat is 20 cm of mercury. Determine the rate of flow. Take Cd 0.98. **8**

OR

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

b) A crude oil of viscosity 0.97 poise and relative density 0.9 is flowing through a horizontal circular pipe of diameter 100 mm and length 10 m. calculate the difference of pressure at the two ends of the pipe, if 100 kg of the oil is collected in a tank in 30 seconds. **8**

7. a) Define minor losses and give example of minor losses. **8**

b) 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: (1) Head lost due to friction, and (ii) Power required to maintain the flow. Take kinematic viscosity of oil as 0.3 stoke. **8**

OR

8. a) Prove that for maximum power transmission through pipe line, head loss due to friction 'hi' is 1/3 of the head 'H' available at inlet. **8**

b) The rate of flow of water through a horizontal pipe is 0.25 m3/s. The diameter of the pipe which is 200 mm is suddenly enlarged to 400 mm. The pressure intensity in the smaller pipe is $11.772\ N/cm^2$. Determine **8**
a) Loss of head due to sudden enlargement.
b) Pressure intensity in the large pipe.
c) Power lost due to enlargement.

9. a) Find the difference in drag force exerted on the flat plate of size 2m * 2m when the plate is moving at a speed of 4 m/s normal to its plane in (i) water, (ii) air of density $1.24\ kg/m^3$. Coefficient of drag is given as 1.15. **8**

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

OR

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

b) Discuss in detail the concept of boundary layer for flow of fluid over the flat plate. **8**

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