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

PCC-ME208 : Fluid Mechanics

P. Pages : 2 **GUG/W/22/14060**

Time : Four Hours * 3 2 8 9 * 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. Illustrate your answers wherever necessary with the help of neat sketches.
5. Use of slide rule, Logarithmic tables, Steam tables, Molder's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric chart and Refrigeration charts is permitted.
6. 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 and explain Newton's law of Viscosity. What is the effect of temperature of fluid viscosity? **6**

b) A rectangular plane surface 2m wide and 3m deep lies in water in such a way that its plane makes an angle of 30º with the free SIF of water. Determine the total pressure and position of centre of pressure when upper edge is 1.5 m below the free water surface. **10**

OR

2. a) Define and distinguish between the following fluid properties. **9**

1) i) Specific weight and mass density
ii) Cohesion & adhesion
iii) Dynamic viscosity & kinematic viscosity.

2) Give applications & newtons law of viscosity. **3**

b) State and explain Pascal's law. **4**

3. a) What is Euler's equation of motion? How will you obtain Bernoulli's eq^n from it? **8**

b) i) Enlist types of fluid flow. **4**

ii) Define the term: **4**
a) Velocity potential b) Stream function

OR

4. a) What do you mean by metacentric height? Explain the condition of equilibrium of floating body with the help of sketches showing position of buoyancy, centre of gravity and metacentre. **6**

b) A horizontal venturi meter with inlet diameter 20 cm 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 mercury. Find the discharge of water through venturi meter. Take Cd = 0.98. **10**

5. a) Derive an expression for the discharge through venturi meter. **8**

b) A right – angled V – notch is used for measuring a discharge of 30 litres/s. An error of 1.5 mm was made while measuring the head over the notch. Calculate percentage error in the discharge. Take Cd = 0.62. **8**

OR

6. a) Derive an expression for discharge through nozzle. **8**

b) The rate of flow of water through a horizontal pipe is $0.25\,m^3/s$. The diameter of pipe which is 200 mm is suddenly enlarged to 400 mm. The pressure intensity in the smaller pipe is $11.772\,N/cm^2$. **8**

Determine:

i) Loss of head due to sudden enlargement
ii) Pressure intensity in large pipe
iii) Power loss due to enlargement

7. a) Derive an expression for loss of head due to friction in pipes. **8**

b) Calculate the (a) pressure gradient along flow, (b) average velocity and (c) the discharge for an oil [viscosity $0.02\,Ns/m^2$] flowing between two stationary parallel plate 1m wide, maintained 10mm apart. The velocity midway between the plates is 2 m/s. **8**

OR

8. a) Derive an expression for velocity through circular orifice. Enlist various hydraulic coefficients. **8**

b) Derive Darcy – Weisbach equation for headloss in pipe due to friction. **8**

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

i) Boundary layer thickness
ii) Displacement thickness
iii) Momentum thickness
iv) Energy thickness

b) The steam function for two dimensional flow is given by **8**

$$\psi = 8xy$$

Calculate velocity at a point P (4, 5). Also find velocity potential ϕ.

OR

10. a) What do you understand by Reynold's number? Mention its significance in Fluid Mechanics. **4**

b) Describe Prandtl mixing length theory for finding shear stress in turbulent flow. **6**

c) What do you understand by repeating variables? How are repeating variables selected in Buckingham theorem. **6**

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