

B.Tech. / B.E. Mechanical Engineering (Model Curriculum) Semester-III
ME204 / PCC-ME208 - Fluid Mechanics

P. Pages : 2

Time : Four Hours



GUG/W/23/14060

Max. Marks : 80

- Notes :
1. Attempt 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. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) State and derive Pascal's law. 8
- b) Explain U tube differential manometer with neat sketch. 8

OR

2. a) 1m wide and 1.5m deep rectangular plane surface lies in water in such a way that its plane makes an angle of 30° with the free water surface. Determine the total pressure and position of centre of pressure when the upper edge is 0.75m below free water surface. 8
- b) Define: 8
- | | |
|---------------------|------------------------|
| i) Specific gravity | ii) Centre of pressure |
| iii) Density | iv) Capillarity |
3. a) What is Euler's equation? Derive Bernoulli's equation from Euler's equation. 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 = 10kN). 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) State and derive continuity equation in Cartesian coordinate form. 8
- b) Water is flowing through the pipe having diameters 300mm and 200mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 24.525 N/cm^2 and the pressure at the upper end is 9.81 N/cm^2 . Determine the difference in datum if the rate of flow through the pipe is 40 lit/sec. 8
5. a) Derive an 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) Enlist and explain the hydraulic coefficients. 8
- b) An oil of viscosity 10 poise flows between two parallel fixed plates which are kept at a distance of 50mm apart. Find the rate of flow of oil between the plates if the drop of pressure in a length of 1.2m be 0.3 N/cm^2 . The width of the plates is 200mm. 8
7. a) In a pipe of 300mm diameter and 800m length an oil of specific gravity 0.8 is flowing at the rate of $0.45 \text{ m}^3/\text{s}$. 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) Explain : 8
- i) Kinetic energy correction factor.
- ii) Momentum correction factor.

OR

8. a) Derive Darcy-Weisbach equation for head loss in pipes due to friction. 8
- b) Three pipes of diameters 400mm, 200mm and 3000mm and lengths 400m, 200m and 300m respectively are connected in series. The difference in water surface levels in two tanks is 16m. Determine the rate of flow of water if co-efficients of friction is $f=0.005$ considering:
- i) Minor losses also, and 8
- ii) Neglecting minor losses.
9. a) Define Buckingham's π theorem. Explain its significance in applications. 8
- b) A flat plate $2\text{m} \times 2\text{m}$ moves at 60km/hr in stationary air of density 1.15 kg/m^3 . If the coefficient of drag and lift are 0.15 and 0.75 respectively. Determine: 8
- i) The lift force
- ii) The drag force
- iii) Resultant force
- iv) Power required to keep the plate in motion.

OR

10. a) Explain the importance of dimensional analysis. 8
- b) Discuss the following. 8
- i) Boundary layer thickness.
- ii) Displacement thickness.
- iii) Momentum thickness.
- iv) Energy thickness.
