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B.Tech.(ME) (2011 Onwards) (Sem.–4)

FLUID MECHANICS

Subject Code : BTME-403

Paper ID : [A1213]

Time : 3 Hrs. **Max. Marks : 60**

INSTRUCTION TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. Write briefly :

a) Define Newtonian and Non-Newtonian Fluids

b) What is Cavitation?

c) Explain differential Manometers.

d) Write on Rotameter.

e) Explain the terms :

i) Dynamic Viscosity

ii) Kinematic Viscosity

f) Laminar boundary layer

g) Meta Centre

h) Displacement thickness

i) Pathlines, Steaklines and Streamlines

j) Rotational and irrotational flow

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SECTION-B

2. Find the total of pressure on a triangular plate of base 2 m and height 3 m which is immersed in water in such a way that the plane of the plate makes an angle of 60° with the free surface of the water. The base of the plate is parallel to water and at a depth of 2.5 m from water surface.

3. Calculate the capillary effect in millimetres in a glass tube of 4 mm diameter, when immersed in (i) water, and (ii) mercury. The temperature of the liquid is 20°C and the values of the surface tension of water and mercury at 20°C in contact with air are 0.073575 N/m and 0.51 N/m respectively. The angle of contact for water is zero and that for mercury is 130°. Take density of water at 20° C as equal to 998 kg/m^3.

4. Find the convective acceleration at the middle of a pipe which converges uniformly from 0.4 m diameter to 0.2 m diameter over 2 m length. The rate of flow is 20 lit/s. If the rate of flow changes uniformly from 20 l/s to 40 l/s in 30 seconds, find the total acceleration at the middle of the pipe at 15th second.

5. A fluid flow is given by V = $x^2y\boldsymbol{i} + y^2z\boldsymbol{j} - (2xyz + yz^2)\boldsymbol{k}$. Prove that it is a case of possible steady incompressible flow. Compute the velocity at point. (2,1,3).

6. A horizontal venturimeter with inlet diameter 30 cm and throat diameter 10 cm is used to measure the flow of water. The pressure intensity at the inlet is 13.734 N/cm^2 while the vacuum pressure head at the throat is 37 cm of mercury. Find the rate of flow. Find also the value of C_d for the venturimeter, assume that 4 % of the differential head is lost between the inlet and throat.

SECTION-C

7. A horizontal pipe line 40 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 25 m of its length from the tank, the pipe is 150 mm in diameter and its diameter is suddenly enlarged to 300 mm. The height of water level in the tank is 8 m above the centre of the pipe. Considering all losses of head which occurs, determine the rate of flow. Take co-efficient of friction, $f = 0.1$ for both sections of the pipe.

8. A siphon of diameter 200 mm connects two reservoirs having a difference in elevation of 20 m. The length of the siphon is 500 m and summit is 3 m above the water level in the upper reservoir. The length of the pipe from the upper reservoir to the summit is 100 m. Determine the discharge through the siphon and also pressure at the summit. Neglect minor losses and co-efficient of friction, $f = 0.005$.

9. Determine the thickness of the boundary layer at the trailing edge of a smooth plate of length 4 m and width of 1.5 m when the plate is moving with a velocity of 4 m/s in stationary air. Take kinematic viscosity of air as 1.5×10^{-5} m^2/s.

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