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BME-028

B.Tech. MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

00452

Term-End Examination

December, 2017

BME-028 : FLUID MECHANICS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **five** questions. All questions carry equal marks. Use of calculator is permitted.*

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1. (a) Explain the principle employed in manometers used for the measurement of pressure. *4*

(b) Describe with the help of neat sketches, different types of manometers. *5*

(c) State the advantages of mechanical pressure gauges over manometers. *5*

2. (a) Derive an expression for the depth of centre of pressure from free surface of liquid of an inclined plane surface submerged in the liquid. *4*

(b) A circular plate 1·5 m diameter is submerged in water with its greatest and least depths below the surface being 2 m and 0·75 m respectively. Determine : *10*

(i) The total pressure on one face of the plate

(ii) The position of centre of pressure

3. (a) What are the assumptions made in Bernoulli's equation ? *4*

(b) A venturimeter is to be fitted in a pipe 0·25 m diameter, where the pressure head is 7·6 m of the flowing liquid and the maximum flow is 8·1 m^3 per minute. Find the least diameter of the throat to ensure that the pressure head does not become negative. (Take $C_d = 0{\cdot}96$) *10*

4. (a) Describe the different methods for the determination of the various coefficients for an orifice. *6*

(b) A large tank having a circular orifice $6{\cdot}45 \times 10^{-4}$ m^2 in area on its vertical side rests on a smooth horizontal surface. When the depth of water in the tank is 1·22 m, the discharge through the orifice is $1{\cdot}9 \times 10^{-3}$ m^3/sec and a horizontal force of 9·123 N in line with the centre of the orifice is required to keep the tank at rest. From this data, determine the coefficients C_v, C_c and C_d. *8*

5. The mean point velocities measured with the help of a pitot tube at mid-point and quarter point of a 0·2 m diameter pipe were found to be 1·5 m/sec and 1·35 m/sec respectively. If the flow in the pipe is turbulent, determine the discharge, friction factor and average height of roughness projections. *14*

6. (a) Derive an expression for head loss in sudden expansion in the pipe. Also list all the assumptions made in the derivation. *6*

   (b) Find the loss of head when a pipe of diameter 200 mm is suddenly enlarged to a diameter of 400 mm. The rate of flow of water through the pipe is 250 litres/sec. *8*

7. Using Buckingham's π-theorem, show that the velocity through a circular orifice is given by

$$v = \sqrt{2gH}\,\phi\left[\frac{D}{H}, \frac{\mu}{\rho\, v\, H}\right],$$

where H is the head causing flow, D is the diameter of the orifice, μ is the coefficient of viscosity, ρ is the mass density and g is the acceleration due to gravity. *14*

8. Write short notes on any ***four*** of the following : $4 \times 3\frac{1}{2} = 14$

(a) Boundary Layer Thickness

(b) Boundary Layer Separation

(c) Drag on Cylinder

(d) Flow Pattern Over a Rotating Cylinder

(e) Compressible and Incompressible Flow

(f) Meta Centre