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BIME-004

B.Tech. – VIEP – Mechanical Engineering / B.Tech. Civil Engineering (BTMEVI/BTCLEVI)

Term-End Examination

00432

December, 2017

BIME-004 : FLUID MECHANICS

Time : 3 hours *Maximum Marks : 70*

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

1. (a) What is the difference between U-tube differential manometers and Inverted U-tube differential manometers ? 7

   (b) A solid cylinder of diameter 5·0 m has a height of 5·0 m. Find the metacentric height of the cylinder if the specific gravity of the material of the cylinder is 0·7 and it is floating in water with its axis vertical. State whether the equilibrium is stable or unstable. 7

2. (a) Explain the classification of orifices and mouthpieces based on their shape, size and sharpness. 7

(b) A closed cylindrical vessel of diameter 20 cm and height 100 cm contains water up to a height of 70 cm. The air above the water surface is at a pressure of 78·48 kN/m^2. The vessel is rotated at a speed of 300 rpm about its vertical axis. Find the pressure head at the bottom of the cylinder, if it is rotated about its vertical axis at 300 rpm. Find the pressure head at the bottom of the vessel (a) at the centre, and (b) at the edge. 7

3. (a) What do you understand by turbulent flow ? What factors decide the flow in pipes ? 7

(b) An oil of specific gravity 0·9 is flowing through a venturimeter having inlet diameter 20 cm and throat diameter 10 cm. The oil-mercury differential manometer shows a reading of 20 cm. Calculate the discharge of oil through the horizontal venturimeter. Take $C_d = 0{\cdot}98$. 7

4. (a) How will you determine the metacentric height of a floating body ? Explain with a neat sketch. 7

(b) A jet of water, issuing from a sharp-edged vertical orifice under a constant head of 60 cm, has the horizontal and vertical co-ordinates measured from the vena contracta at a certain point as 10·0 cm and 0·45 cm respectively. Find the value of C_v. Also find the value of C_v if $C_d = 0{\cdot}60$. 7

5. (a) What do you understand by the terms fully submerged orifice and partially submerged orifice ? Explain with a suitable sketch. 7

(b) A pipe of diameter 1·8 m is required to transport an oil of specific gravity 0·8 and viscosity 0·04 poise at the rate of 4 m^3/sec. Tests were conducted on a 20 cm diameter pipe using water at 20°C. Find the velocity and rate of flow in the model. Viscosity of water at 20°C = 0·01 poise. 7

6. (a) Explain the term "coefficient of friction". What factors does this coefficient depend upon ? 7

(b) A rough pipe of diameter 300 mm and length 800 m carries water at the rate of 0·4 m^3/s. The wall roughness is 0·015 mm. Determine the coefficient of friction, wall shear stress, centre line velocity and velocity at a distance of 100 mm from the pipe wall. 7

7. (a) Explain the construction and working of an electromagnetic flow meter with a neat sketch. 7

(b) A smooth flat plate of length 5 m and width 2 m is moving with a velocity of 4 m/s in stationary air of density 1·25 kg/m^3 and kinematic viscosity $1{\cdot}5 \times 10^{-5}$ m^2/s. Determine the thickness of the boundary layer at the trailing edge of the smooth plate. Find the total drag on one side of the plate assuming that the boundary layer is turbulent from the very beginning. 7

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

(a) Boundary Layer Separation

(b) Couette Flow

(c) Reynolds Number

(d) Ultrasonic Flow Meter

(e) Dimensionless Number

(f) Relative Equilibrium