

**DIPLOMA IN CIVIL ENGINEERING (DCLE(G)) /  
DIPLOMA IN MECHANICAL ENGINEERING  
(DME)**

**Term-End Examination**

**December, 2015**

**BET-037 : FLUID MECHANICS**

*Time : 2 hours*

*Maximum Marks : 70*

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**Note :** Answer *all* questions. All questions carry equal marks. Use of scientific calculator is permitted.

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1. Choose the correct answer from the given alternatives.  $14 \times 1 = 14$
- (a) Mass density of liquid ( $\rho$ ) is given by
- (i)  $\rho = \text{mass/volume}$
  - (ii)  $\rho = \text{metric slug/m}^4$
  - (iii)  $\rho = \text{kg sec}^3/\text{m}^4$
  - (iv) All of the above
- (b) An ideal flow of any fluid must fulfil the following :
- (i) Newton's law of motion
  - (ii) Pascal's law
  - (iii) Continuity equation
  - (iv) Newton's law of viscosity

- (c) The dimensions of coefficient of viscosity
- (i)  $M^1 L^{-1} T^{-1}$
  - (ii)  $M^{-1} L^{-1} T^{-1}$
  - (iii)  $M^1 L^{-1} T^1$
  - (iv)  $M^{-1} L^1 T^1$
- (d)  $h_L = [V_1 - V_2]^2 / 2g$  is the equation of
- (i) Loss of head due to bends
  - (ii) Loss of head due to sudden contraction
  - (iii) Loss of head due to sudden enlargement
  - (iv) Loss of head due to friction
- (e) The velocity of water, if discharge is 0.04 cumecs and diameter of the pipe is 15 cm is
- (i) 3.265 m/sec
  - (ii) 2.265 m/sec
  - (iii) 4.265 m/sec
  - (iv) 1.265 m/sec
- (f) The sum of potential head and pressure head  $\left(z + \frac{P}{\gamma}\right)$  at a point is called
- (i) Hydraulic gradient line
  - (ii) Total hydraulic head
  - (iii) Piezometric head
  - (iv) Energy gradient line

- (g) Venturimeter has the advantage of
- (i) Small head loss
  - (ii) Low cost
  - (iii) Convenient use
  - (iv) Low coefficient value
- (h) Mercury does not wet glass. This is due to the property of liquid known as
- (i) Adhesion
  - (ii) Cohesion
  - (iii) Viscosity
  - (iv) Surface tension
- (i) The flow at critical depth in an open channel is
- (i) Maximum
  - (ii) Minimum
  - (iii) Zero
  - (iv) Half of the normal flow
- (j) The hydraulic radius in the case of an open channel with great width is equal to
- (i) the depth of channel
  - (ii)  $1/2$  the depth of channel
  - (iii)  $1/3^{\text{rd}}$  the depth of channel
  - (iv)  $1/4^{\text{th}}$  the depth of channel

(k) Continuity equation for an incompressible fluid is (where A = Area, V = Velocity,  $\rho$  = Density)

(i)  $A_1 V_1 = A_2 V_2$

(ii)  $\rho_1 A_1 V_1 = \rho_2 A_2 V_2$

(iii)  $\frac{A_1 V_1}{\rho_1} = \frac{A_2 V_2}{\rho_2}$

(iv)  $\frac{\rho_1 A_1}{V_1} = \frac{\rho_2 A_2}{V_2}$

(l) Capillary action is due to the

(i) Surface tension

(ii) Cohesion

(iii) Adhesion of liquid molecules and molecules on the surface of solid

(iv) All of the above

(m) Flow meters based on obstruction principle, like orifice plates can be used with Reynolds number upto approximately

(i) 500

(ii) 1000

(iii) 2000

(iv) 4000

- (n) Hydraulic mean depth or the hydraulic radius is the ratio of
- (i) Area of cross-section of flow to the wetted perimeter
  - (ii) Wetted perimeter to the area of cross-section
  - (iii) Area of cross-section to the discharge
  - (iv) Discharge to the area of cross-section

2. Answer any *two* of the following :  $2 \times 7 = 14$

- (a) Describe the Absolute pressure, Gauge pressure and Vacuum pressure.
- (b)  $10 \text{ m}^3$  of kerosene oil weighs  $78.48 \text{ kN}$ . Calculate its specific weight, mass density and specific gravity.
- (c) Determine the resultant of the following four co-planar concurrent forces :
  - (i) Force of  $15 \text{ N}$  acting along X-axis
  - (ii) Force of  $25 \text{ N}$  acting along Y-direction
  - (iii) Force of  $20 \text{ N}$  acting at an angle of  $30^\circ$  with X-axis
  - (iv) Force of  $10 \text{ N}$  acting at an angle of  $60^\circ$  with X-axis

3. Answer any *two* of the following : 2×7=14

- (a) Describe the principle of conservation of energy.
- (b) The velocity of a body of mass 100 kg changes from 2 m/s to 4 m/s in the same direction, in a time of 25 seconds. Determine the applied force and the impulse.
- (c) A reservoir discharges water through a large orifice 1 m wide and 1.5 m deep. The top of the orifice is 0.80 m below the water level in the reservoir. Assuming that the downstream water level is below the bottom of the orifice, calculate the discharge through the orifice, if  $C_d = 0.60$ .

4. Answer any *two* of the following : 2×7=14

- (a) A circular orifice of 3.5 cm diameter is made in the vertical wall of a tank. The jet falls vertically through 0.5 m; while moving horizontally through a distance of 1.5 m. Calculate the coefficient of velocity, if the head causing flow is 1.2 metres. If the discharge is  $2.80 \times 10^{-3}$  cumecs, calculate  $C_c$  and  $C_d$ .
- (b) A pipe, carrying water, suddenly enlarges from a diameter of 40 cm to 60 cm. If the discharge is 0.615 cumecs, calculate the loss of head due to sudden enlargement.

- (c) A 10 cm diameter external cylindrical mouthpiece discharges under a head of 4 m. Determine the discharge and the pressure at the vena contracta.

Take  $C_c = 0.60$  and Atm. pressure =  $10.3$  m of water.

5. Answer any *two* of the following :  $2 \times 7 = 14$

- (a) Find the loss of head due to friction in a pipe of 8 cm diameter and 30 m long, if the mean velocity of flow is 2 m/sec. Use Chezy's formula. Take  $C = 55$ .

- (b) A cylindrical boiler of diameter 2 m and length 10 m is lying in the horizontal position with its axis horizontal. The boiler is half full of water and is to be emptied through an orifice at the bottom. Area of the orifice is  $44.2 \text{ cm}^2$  and the coefficient of discharge is 0.62. How long will it take to empty the boiler ?

- (c) A circular sewer with diameter 0.5 m is laid at a slope of 1 in 225. What is the maximum velocity of flow that can occur ? What would be the discharge at this velocity ? Take  $C = 60$ .