Diploma in Civil Engineering / Diploma in Electrical & Mechanical Engineering

Term-End Examination

00542

December, 2011

BET-037 : FLUID MECHANICS

Time : 2 hours *Maximum Marks : 70*

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

1. Choose the correct answer from the given alternatives. **14x1=14**

(a) Newton's law of viscosity relates :

(i) pressure, velocity and viscosity

(ii) shear stress, and rate of angular deformation in a fluid.

(iii) shear stress, temperature, velocity and viscosity

(iv) pressure, viscosity and rate of angular deformation.

(b) Surface Tension has the dimensions :

(i) F (ii) FL^{-1}

(iii) FL^{-2} (iv) FL^{-3}

(c) The height of liquid in a capillary tube :

(i) increases with an increase in diameter.

(ii) increases with a decrease in diameter

(iii) decreases with an increase in surface tension.

(iv) increases with an increase in specific weight.

(d) The pressure in metres of oil (sp.gv.0.8), equivalent to 80 m of water is :

(i) 64 (ii) 80

(iii) 100 (iv) 88

(e) Continuity equation :

(i) expresses the relation between energy and work

(ii) relates the momentum per unit volume for two points on a stream line.

(iii) relates mass rate of flow along a stream tube.

(iv) concerns constant discharge through a long straight tapering pipe.

(f) Steady flow occurs when :

(i) conditions do not change with time at any point

(ii) conditions are the same at adjacent points at any instant.

(iii) when $\left(\partial v / \partial s\right)$ is constant.

(iv) conditions change steadily with the time.

(g) The hydraulic grade line is :

(i) always above the energy grade line

(ii) the velocity head below the energy grade line

(iii) always above the closed conduit.

(iv) always slopping downward in the direction of flow.

(h) In parallel-pipe problems :

(i) the discharge is the same through all the pipes

(ii) the head losses through each pipe are added to obtain the total head loss

(iii) the head loss is the same through each pipe.

(iv) a direct solution gives the flow through each pipe when the total flow is known.

(i) In open-channel flow

(i) the energy grade line coincides with the free surface.

(ii) hydraulic grade lines coincide

(iii) the hydraulic grade line can never rise

(iv) the hydraulic grade line and free surface coincide.

(j) $[ML^{-1} T^{-2}]$ is the dimension of

(i) force (ii) pressure

(iii) energy (iv) power

(k) The viscosity of gases :

(i) increases with decrease in temperature

(ii) increases with increase in temperature

(iii) does not change with change in temperature

(iv) increases upto certain temperature and then decreases.

(l) The dimensions of dynamic viscosity are :

(i) $[MLT^{-1}]$ (ii) $[ML^{-1}T]$

(iii) $[ML^{-1}T^{-1}]$ (iv) $[ML^{-2}T]$

(m) In a capillary rise in a glass tube the weight of the liquid raised is supported by :

(i) the atmospheric pressure

(ii) the friction on the walls of the tube

(iii) both the atmospheric pressure and friction on the walls of the tube

(iv) vertical component of surface tension.

(n) The centre of pressure for a plane surface immersed vertically in a static mass of liquid is :

(i) always below the centroid of the area

(ii) always above the centroid of the area

(iii) always coincident with the centroid of the area.

(iv) sometimes above and sometimes below the centroid of the area.

2. Answer *any two* of the following : **2x7=14**

(a) Define the various coefficients for an orifice.

(b) If 5.27 m^3 of a certain oil weighs 44 kN, calculate the specific weight, mass density and specific gravity of the oil.

(c) A jet of water issues from a sharp edged vertical orifice under a constant head of 0.51 m. At a certain point of issuing jet, the horizontal and vertical coordinates measured from the vena-contract a are 0.406 m and 0.085 m respectively. Determine C_v. If C_d = 0.62, find C_c.

3. Answer *any two* of the following : **2x7=14**

(a) A pipe of 40 cm diameters carries water with a mean velocity of 6 m/sec. If the pipe is bifurcated into two pipes of 20 cm diameter each, find the velocity in each pipe.

(b) If the volume of a liquid decreases by 0.2 percent for an increase of pressure from 6.867 MN/m^2 to 15.696 MN/m^2, what is the value of the bulk modulus of the liquid ?

(c) A 0.25 m diameter pipe carries oil of specific gravity 0.8 at the rate of 120 litres per second and the pressure at a point A is 19.62 kN/m^2 (gage). If the point A is 3.5 m above the datum line, calculate the total energy at point A in metres of oil.

4. Answer *any two* of the following : **2x7=14**

(a) Explain the terms hydraulic gradient and total energy lines.

(b) Find the loss of head due to friction in a pipe 9 cm diameter and 32 m long if the mean velocity of flow is 2.5 m/sec. Use Chezy's formula. Take C = 55.

(c) Find the loss of head due to friction in a pipe carrying water. The pipe is 320 m long and 18 cm in diameter. The discharge through the pipe is 0.05 cumecs. Take f = 0.042

5. Answer *any two* of the following : **2x7=14**

(a) What is meant by water hammer ?

(b) Water is discharged from a tank through a pipe of 320 mm diameter at the rate of 0.20 m^3/sec. Calculate the loss of head at.

(i) The entry of the pipe if it is short-edged

(ii) The exit of the pipe and

(iii) The gate valve

Assume K = 0.20

(c) A pipe carrying water suddenly enlarges from a diameter of 50 cm to 70 cm. If the discharge is 0.720 cumecs, calculate the loss of head due to sudden enlargement.