Total number of printed pages: 3 **D/4th Semester/DCE 403**

2023

FLUID MECHANICS

Full Marks: 100

Time: Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. Pick up the correct statement: 2×10=20

i) The relationship between mass density and specific weight is

a. $\gamma = \rho g$

b. $\gamma = \rho / g$

c. All of the above

d. None of the above

ii) A volume of 3.2 m^3 of certain oil weighs 27.5 kN. Its mass density is,

a. 9.87 kN/m^3

b. 8.59 kN/m^3

c. 5.87 kN/m^3

d. None of the above

iii) The gauge pressure in meters of water of an absolute pressure of 4 atm is,

a. 31.1 m of water

b. 41.3 m of water

c. 10.2 m of water

d. None of the above

iv) A piezometer shows the reading of 12 cm for a liquid having specific gravity of 1.6, the corresponding pressure is

a. 1883.52 Pa

b. 1783.50 Pa

c. 1783.52 Pa

d. None of the above

v) Manometers are used for measuring

a. the pressure at a point

b. pressure difference between two points

c. large pressure in a liquid

d. All of the above

vi) the discharge of jet of water flowing from a nozzle into the air at a velocity of 40 m/s is

a. 0.55 m/s

b. 0.54 m/s

c. 0.45 m/s

d. None of the above

vii) the one dimensional continuity equation for a steady incompressible flow is

a. $\rho_1 A_1 V_1 = \rho_2 A_2 V_2$

b. $A_1 V_1 = A_2 V_2$

c. $Q_1 = Q_2$

d. Both a. and b.

viii) The Reynold's number of a flow of 0.3 m^3/s of oil (specific gravity=0.86, dynamic viscosity= 0.025 Ns/m^2) through a 500 mm dia. pipe is

a. 26316

b. 25314

c. 26536

d. 25514

ix) major head loss in a pipeline is caused by,

a. bend in pipes

b. pipe fittings

c. friction in pipe

d. sudden enlargement in pipeline

x) Dimensions of dynamic viscosity:

a. $[M][L]^{-1}[T]^{-1}$

b. $[M][L][T]$

c. $[M]^{-1}[L]^{-1}[T]$

d. $[M]^{-1}[L][T]$

2. a) What are the different properties of fluid? Give definitions and unit of each property of fluid? 4+6=10

   b) Glycerin has a density of 1260 kg/m^3 and a kinematic viscosity of 0.00183 m^2/s. what shear stress is required to deform this fluid at a strain rate of 10^4/s? 10

3. a) Oil of specific gravity 0.8 flows through a 0.2 m diameter pipe under a pressure of 100 kN/m^2. If the datum is 5m below the centreline of the pipe and the total energy head with respect to the datum is 35m, calculate the discharge. 10

   b) Explain the different methods of measuring pressure. 10

4. a) What is the flow rate of water in litre/min for a 0.2 m diameter pipe, if the average velocity of flow is 1.5 m/s. if the pipe reduces to 0.1 m diameter at another section, what is the velocity of flow at that section? 10

   b) What are the methods of describing fluid flow? 10

5. a) Write down the Bernoulli's equation for ideal fluid. Also State the assumptions made for Bernoulli's equation? 2+5=7

   b) What are the forces acting in a fluid element? 3

   c) A pipe of diameter 400 mm carries water at a velocity of 25 m/s. the pressure at the points A and B are 29.43 N/cm^2 and 22.563 N/cm^2 respectively while the corresponding datum head at A and B are 28 m and 30 m. Find the loss of head between A and B. 10

6. a) Derive Dupuit's equation for an equivalent pipe. 10

   b) It was observed that the difference of heads between the two ends of a pipe 300 m long and 0.25 m diameter is 1.8 m. taking Darcy's coefficient as 0.01 and neglecting minor losses, calculate the discharge flowing through the pipe. 10

7 a) What do you mean by dimensional analysis? How many numbers of dimensional groups can be formed and what are they? 2+1+5=8

   b) What is dimensional similarity? 2

   c) A pipe of diameter 1.5 m is required to transport an oil of specific gravity 0.9 and viscosity 0.003 poise at the rate of 3 cumecs. Tests were conducted on a 0.15 m diameter pipe using water. Find the velocity and rate of flow in the model. Assume the viscosity of water as 0.01 poise. 10

.....