KATHMANDU UNIVERSITY
End Semester Examination [C]
December, 2024

Marks Scored:

Level : B.E.
Year : II
Course : CIEG 204
Semester : I
Exam Roll No. :
Time: 30 mins.
F. M. : 10
Registration No.:
Date : 17 DEC 2024

SECTION "A"
[20Q. × 0.5 = 10 marks]

Choose and encircle the most appropriate option from each set of choices.

1. The discharge through a V- notch varies as
   a. $H^{1/2}$ b. $H^{3/2}$ c. $H^{5/2}$ d. $H^{5/4}$

2. The discharge of a liquid of kinematic viscosity 4 cm^2/sec through an 8cm diameter pipe is 3200 cm^3/sec. The type of flow is
   a. Laminar b. Transitional c. Turbulent d. Unsteady

3. Free surface of a liquid tends to contract to the smallest possible area due to force of
   a. Surface tension b. Viscosity c. Friction d. Cohesion

4. The theoretical velocity of jet at vena contracta is (where H= head of water at vena contracta) is
   a. 2gH b. $H.\sqrt{2g}$ c. $2g\sqrt{H}$ d. $\sqrt{2gH}$

5. A pipe of 0.1m^2 cross sectional area suddenly enlarges to 0.3 m^2 cross sectional area. If the discharge of the pipe is 0.3m^3/s, head loss is
   a. 0.3m b. 0.4m c. 0.1m d. 0.2m

6. Continuity equation deals with the law of conservation of
   a. Mass b. Momentum c. Energy d. Soil

7. An orifice is known as large orifice when the head of liquid from the center of orifice is
   a. More than 10 times the depth of orifice b. Less than 10 times the depth of orifice
   c. Less than 5 times the depth of orifice d. More than 5 times the depth of orifice

8. Select the **CORRECT** statement
   a. Absolute pressure = Gage pressure – Atmospheric pressure
   b. Gage pressure = Absolute pressure – Atmospheric pressure
   c. Absolute pressure = Atmospheric + Vacuum pressure
   d. Gage pressure = Atmospheric – Vacuum pressure

9. A control volume refers to
   a. A fixed region in space b. A specified mass
   c. A closed system d. A reversible process only

10. The tangential component of a force acting on a surface per unit area is called _____
a. Normal stress b. Shear stress c. Horizontal stress d. Vertical stress

11. In experimental method of determination of metacentric height, the metacentric height is given by
a. GM= (W. x/w)*(l/d) b. GM= (W. x/w)*(d/l)
c. GM=(W./w.x)*(l/d) d. GM= (w. x/W)*(l/d)

12. _____ approach concentrates on the movement of individual particle.
a. Bernoulli's b. Langrangian c. Euler's d. Stoke's

13. If axis of body of parallel to direction of fluid flow, lift force is
a. 1 b. 0 c. 2 d. 0.5

14. The specific weight of one liter of petrol of specific gravity 0.7 is
a. 7686 N/m^3 b. 8766 N/m^3 c. 6687 N/m^3 d. 6867 N/m^3

15. For a submerged curved surface, the vertical component of hydrostatic force is
a. Mass of liquid supported by the curved surface
b. weight of liquid supported by the curved surface
c. the force on the projected area of the curved surface
d. buoyant force acting upward

16. Newton's law of viscosity states that
a. Shear stress is directly proportional to the velocity
b. Shear stress is directly proportional to the velocity gradient
c. Shear stress is directly proportional to the displacement
d. Shear stress is directly proportional to the viscosity

17. The Bernoulli's equation can take the form of
a. $p_1/\rho_1+v_1^2/2g+z_1 = p_2/\rho_2+v_2^2/2g+z_2$
b. $p_1/\rho_1 g+v_1^2/2+gz_1 = p_2/\rho_2 g+v_2^2/2+z_2$
c. $p_1/\rho_1 g+v_1^2/2g+gz_1 = p_2/\rho_2 g+v_2^2/2g+gz_2$
d. $p_1/\rho_1 g+v_1^2/2g+z_1 = p_2/\rho_2 g+v_2^2/2g+z_2$

18. The discharge through Venturimeter is given as
a. $Q = [A_1^2.A_2^2/\sqrt{A_1^2 - A_2^2}]*\sqrt{2gh}\,]$ b. $Q = [A_1 A_2/\sqrt{2A_1^2 - A_2^2}]*\sqrt{2gh}\,]$
c. $Q = [A_1 A_2 * \sqrt{2gh}/\sqrt{A_1^2 - A_2^2}]$ d. $Q = [\sqrt{A_1^2 - A_2^2}/A_1 A_2/]*\sqrt{2gh}\,]$

19. When a vertical wall is subjected to pressure due to liquid on both sides, the resultant pressure is the _____ of the two pressures
a. Sum b. Difference c. Arithmetic mean d. Geometric mean

20. Time of emptying a tank through an orifice at its bottom is given by
a. $2A*\sqrt{H_1}/(C_d*a*2g)$ b. $2A*\sqrt{H_1}/(C_d*a*\sqrt{2g}\,)$
c. $A*\sqrt{H_1}/(C_d*a^2*\sqrt{2g})$ d. $4A*\sqrt{H_1}/(C_d*a^2*\sqrt{2g})$

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SECTION "B"
[40 marks]

Attempt ALL questions. Make suitable assumptions when needed. The figures in the parenthesis indicate the marks allocated for the question.

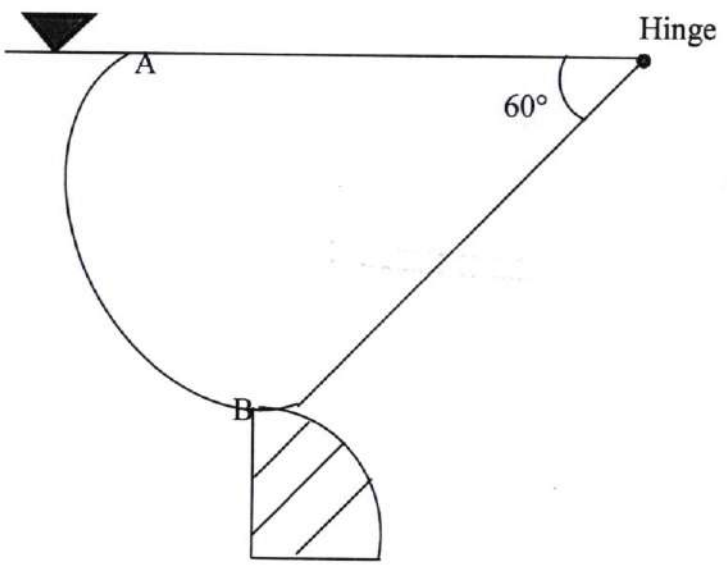
1. Two large fixed parallel planes are 14mm apart. The space between the surfaces is filled with oil of viscosity 0.85 Ns/m^2. A flat thin plate of 0.3m^2 area moves through the oil at a velocity of 0.3m/s. Calculate the drag force [2+2]
   a. When the plate is equidistant from both the planes, and
   b. When the thin plate is at a distance of 6mm from one of the plane surfaces

2. What is the velocity of approach? What are its applications? [1+3]

3. A pipeline carrying oil of specific gravity 0.8, changes in diameter from 300 mm diameter at position A to 450mm diameter at position B which is 3m at a higher level. If the pressure at A and B are 10N/cm^2 and 6N/cm^2 respectively and the discharge is 300 liters/sec. determine the loss of head and direction of flow. [3]

4. What is the principle of dimensional homogeneity? Differentiate between Rayleigh's method and Buckingham Π- theorem method. [1+4]

5. **Figure 1** shows a radial gate in water. If it is 2.5m long, find the magnitude and direction of the resultant force acting on it. [5]



P.T.O.

6. A bend in a pipeline carrying water gradually reduces from 0.6m to 0.3m in diameter and deflects the flow through angle an of 45°. At the larger end, the gauge pressure is 180 kN/cm^2. Determine the magnitude and direction of the force exerted on the bend when the flow is 800 liters per second. [5]

OR

Water is flowing in a rectangular channel of 1.5m wide and 0.9m deep. Find the discharge over a weir of crest length 0.75cm, if the head of water over the crest of the weir is 30cm and water from the channel flows over the weir. Take the velocity of approach into consideration.

7. Write short notes on (***ANY TWO***) [2×3=6]
   a. Manometer
   b. Sluice gate
   c. Losses of energy in pipes
   d. Compressibility and bulk density

8. **Figure 2** shows an inverted differential manometer having an oil of specific gravity of 0.8 connected to two different pipes carrying water under pressure. Determine the pressure in the pipe B. The pressure in pipe A is 2 m of water. [3]

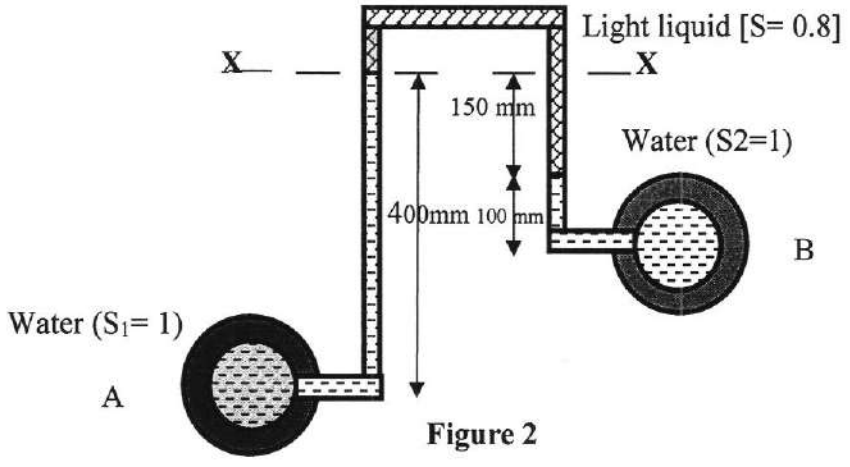


Figure 2

9. Derive the continuity equation of two dimension, $\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0$ [5]