KATHMANDU UNIVERSITY
End Semester Examination
July/August 2024

Level : B.E.
Year : II
Time : 2 hrs. 30mins.

29 JUL 2024

Course : CIEG 204
Semester : I
F. M. : 40

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. What are the conditions to be checked for the stability of dam? [5]

2. Two large fixed parallel planes are 21mm apart. The space between the surfaces is filled with oil of viscosity 0.97 Ns/m^2. A flat thin plate 0.25m^2 area moves through the oil at a velocity of 0.25m/s. Calculate the drag force. [2+2]
   a. When the plate is equidistant from both planes, and
   b. When the thin plate is at distance of 5mm from one of the plane surface.

3. Write short notes on (***ANY TWO***) [2×3=6]
   a. System and control volume
   b. Viscosity
   c. Boundary layer theory

4. A triangular plate of 2m base and 1.5m altitude is immersed in water **(Figure 1)**. The plane of the plate is inclined at 30° with free water surface and the base is parallel to and at a depth of 2m from water surface. Find the total pressure on the plate and the position of center of pressure. [2+2]

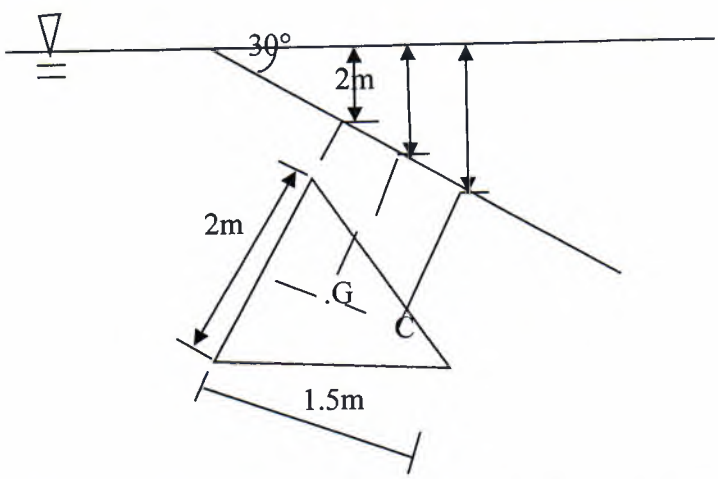

Figure 1

5. Derive Euler's equation of motion. How will you obtain Bernoulli's equation from it? [5]

6. Show by the method of dimensional analysis that the resistance R to the motion of sphere of diameter D moving with uniform velocity V through a fluid having density ρ and viscosity μ may be expressed as $R = \rho D^2V^2\phi[\mu/\rho VD]$ [5]

P.T.O.

7. Water is flowing in a rectangular channel of 1m wide and 0.75m deep. Find the discharge over a rectangular weir of crest length 70cm, if the head of water over the crest of weir is 25cm and water from channel flows over the weir. Take C_d =0.6.
Neglect end corrections. Take velocity of approach into consideration. [4]

8. A pipe carrying water changes in diameter from 200mm at a position A to 500mm at a position B, which is at a height of 4m from A. If the pressure at A and B are 9.8N/cm^2 and 5.9 N/cm^2 respectively and the discharge is 200 liters per second. Determine the loss of head and direction of flow. [4]

9. **Figure 2** shows a U-tube differential manometer connecting two pressure pipes at A and B. The pipe A contains a liquid of specific gravity 1.6 under a pressure of 115kN/m^2. The pipe B contains oil of specific gravity 0.78 under a pressure of 200 kN/m^2. Find the difference of pressure measured by mercury as fluid filling U-tube. [3]

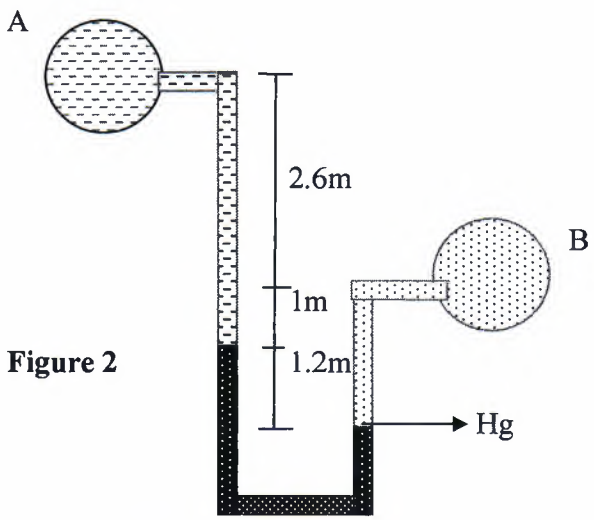

Figure 2

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Marks Scored:

Level : B.E.
Year : II

Course : CIEG 204
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date :

SECTION "A"
[20Q. × 0.5 = 10 marks]

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

1. If the pressure applied in water having bulk modulus of 2.2×10^9 N/m^2 is 1.32×10^7 N/m^2. The percentage reduction in volume is
   a. 4% b. 6% c. 4.5% d. 7%

2. Manometers use the principle of
   a. Bernoulli's equation b. Euler's equation
   c. Continuity equation d. Basic hydrostatic equation

3. The range of coefficient of discharge for orificemeter is
   a. 0.6 to 0.7 b. 0.7 to 0.85 c. 0.85 to 0.85 d. 0.95 to 0.98

4. A V-notch is used to measure
   a. Velocity in a pipe b. Wind velocity
   c. Discharge of liquid in open channel d. Viscosity

5. The drag on a sphere is (F_D) is given by
   a. $F_D = 5\pi\mu DU$ b. $F_D = 3\pi\mu DU$ c. $F_D = 2\pi\mu DU$ d. $F_D = \pi\mu DU$

6. The coefficient of discharge through the venturimeter is given by
   a. $C_d = \frac{A_1^2 - A_2^2}{\sqrt{A_1^2 - A_2^2}} \times \sqrt{2gh}$
   b. $C_d = \frac{A_1 X A_2}{\sqrt{2A_1^2 - A_2^2}} \times \sqrt{2gh}$
   c. $C_d = \frac{A_1 X A_2}{\sqrt{A_1^2 - A_2^2}} \times \sqrt{2gh}$
   d. $C_d = \frac{A_1^2 - A_2^2}{\sqrt{A_1 - A_2}} \times \sqrt{2gh}$

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

8. Fluids for which the rate of deformation is proportional to shear stress is called
   a. Real fluid b. Ideal fluid
   c. Non Newtonian fluid d. Newtonian fluid

9. The relation between surface tension and difference of pressure p between inside and outside of liquid drop is given by
   a. $p = 2\sigma/d$ b. $p = 8\sigma/d$ c. $p = 4\sigma/d$ d. $p = 4d/\sigma$

10. 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)

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

12. The flow in which fluid characteristics like velocity, pressure, density etc at a point do not change with time is called _____
a. Uniform b. Laminar c. Steady d. Compressible

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

14. The continuity equation is based on the principle of conservation of
a. Energy b. Momentum c. Force d. Mass

15. If the head of liquid from the center of orifice is less than five times the depth of orifice, the orifice is known as
a. Large b. Small c. Rectangular d. Submerged

16. Loss of head due to sudden expansion, contraction, bend in pipe and pipe fittings are called_____
a. Major losses b. Minor losses c. Frictional losses d. Head losses

17. If the dimensions of each term in an equation on both sides are equal, it is called
a. Dimensional homogeneity
b. Dimensional analysis
c. Rayleigh's method
d. Buckingham's Π-theorem

18. Select the correct statement
a. Absolute pressure = Gage pressure – Atmospheric pressure
b. Gage pressure = Absolute pressure - Atmospheric
c. Absolute pressure = Atmospheric pressure + Vacuum pressure
d. Gage pressure = Atmospheric + Vacuum pressure

19. Buoyant force is
a. The resultant force on a body due to the fluid surrounding it
b. The resultant force acting on a floating body
c. Equal to the volume of liquid displaced
d. The force necessary to maintain equilibrium of a submerged body

20. The losss of head due to sudden expansion of a pipe is
a. $h_L = \frac{V_1^2 - V_2^2}{2g}$ b. $h_L = \frac{0.5\,V_1^2}{2g}$ c. $h_L = \frac{V_2^2}{2g}$ d. $h_L = \frac{(V_1 - V_2)^2}{2g}$