CE 323
Mid Exam
Name:.....

1st term 1445 H / 2023
Time : 1.15 hr
Number:...936 102 833.

CLO	%
1	20
3	80

10

Q1: (10 marks)

27

1) How is fluid compressibility estimated.

using modulas of elasticity → $K = \frac{dP}{\frac{dv}{v}}$

2) Reynold number = $Re = \frac{VD}{r}$

Where:

(Dimensionless)

V → Flow velocity

D → Pipe Diameter

r → Viscosity Kinematics

3) Give an example of a reason for energy loss and one for energy gain.

1) Energy Gain → Pump

2) Energy Loss → friction

4) Write the expression of Manning equation. Is it used for open channel or closed conduit or both.

1) $Q = \frac{A}{n} \times R^{\frac{2}{3}} \times S^{\frac{1}{2}}$

A = Cross section; S = bed slope
Q = Discharge
n = manning;
R = Radius ;

2) open Channel

5) What is the difference between steady and unsteady flow.

1) steady flow: features flow Do not change with time at given point

2) unsteady flow: otherwise

(River could be either)

CLO	%
2	100

Q2: (10 marks)

8

A cubic water tank with $64m^3$ volume is half full of water. Find :

1. Water pressure at a point 0.5m from tank base.
2. Water force on any tank side.
3. If a piezometer with mercury (s = 13.7) is fixed at tank base, what will be height of mercury.

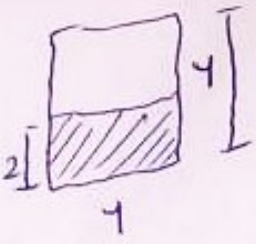
Cube height = Cube width = cube base

$\sqrt[3]{64} = 4$, and since tank is only half water ≈ 2

1) $w_{p_{0.5}} = \gamma \times h = (\rho \times g \times h) = [1000 \times 9.81 \times (2 - 0.5)] = 14715$ Pascal

2) $F = P_c A$

$= (\gamma_c h \times A) = \rho \times g \times h \times A = 9810 \times 4 \times (4 \times 2) = 313920$ (N)



3) height $= \frac{2}{13.7} = 0.14598 \approx 0.146$ m

CLO	%
3	100

Q3): (10 marks)

$A_1 = 4m^2$, $v_1 = 2m/s$, A2 = 3m2 (open channel)

1- Find difference in potential energy between the 2 points.

2- What force water carries in flow direction.

3- If this flow drains in a lake with volume of $10000m^3$, how much is time required to fill it.

1) Potential energy difference:

eq① $E_1 = E_2$

eq② $\frac{P_1}{\gamma_1} + \frac{v_1^2}{2g} + z_1 = \frac{P_2}{\gamma_2} + \frac{v_2^2}{2g} + z_2$

$\frac{2^2}{2\times 9.81} + z_1 = \frac{(v_2)^2}{2\times 9.81} + z_2$

1) $Q = A_1 v_1 = 4 \times 2 = 8 \frac{m^3}{s}$

2) $Q = A_2 V_2$

$v_2 = \frac{Q}{A_2} = \frac{8}{3} = 2.66$ m/s

3) substitute:

$\frac{2^2}{2\times 9.81} + z_1 = \frac{2.66^2}{2\times 9.81} + z_2$

$(z_1 - z_2) = \frac{2.66^2}{2\times 9.81} - \frac{2^2}{2\times 9.81}$

$(z_1 - z_2) = 0.15675$ [redacted] Joul ([redacted])

2) force [redacted] $f = \rho Q (v_2 - v_1)$

$\rho_w = 1000$, $Q = 8 \frac{m^3}{s}$

$= 1000 \times 8 \times (2.66 - 2) = 5280$ Newton

3) $\frac{Q}{1} = \frac{\text{volume}}{\text{Time}} \Rightarrow \text{Time} = \frac{\text{volume}}{Q} = \frac{10,000}{8} = 1250$ seconds

[redacted]