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Section A

Subject Hydraulic structure

Department BE (C)

Instructor Engr. Adeed.

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Q NO1 (a)

Ans:-

Reservoir:-

A water supply scheme drawing water directly from a river or a stream may fail to satify the consumers demands during extremely low flows, while during high flows it may become diffults to carry out its operation due to devastating floods, a barrier in the form of dam is, therefore constructed across the river, so as to form a pool of water on the upstream side of the dam is known as a reservoirs.

As there are three types of reservoir,

Valley-dammed reservoir.
Bank side reservoir.
Service reservoir.

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Service reservoir is the most economical reservoir because it is entirely man made. As we are familiar with the large water towers in the country-side so the cost for these type of reservoir is very much low than the valley-dammed and bank side reservoir. Also construction is easy and takes very much less time as Compared to the other two types.

QNo1 Part (b)

Ans:

As we know that there are ~~three~~ two types of embankment dams, earth fill embankment and rock fill embankment. earth fill are those which contains more than 50% of Compacted soils and rock fill contain more

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than 50% of rocks. So in hilly areas are will suggest. Rock fill embankment because in hilly area rock is easily available and also rock fill embankment has more strength and will have more durable and safe as compare to earth fill embankment. Also their cost low in that area because of stones are easily available their to fill the dam.

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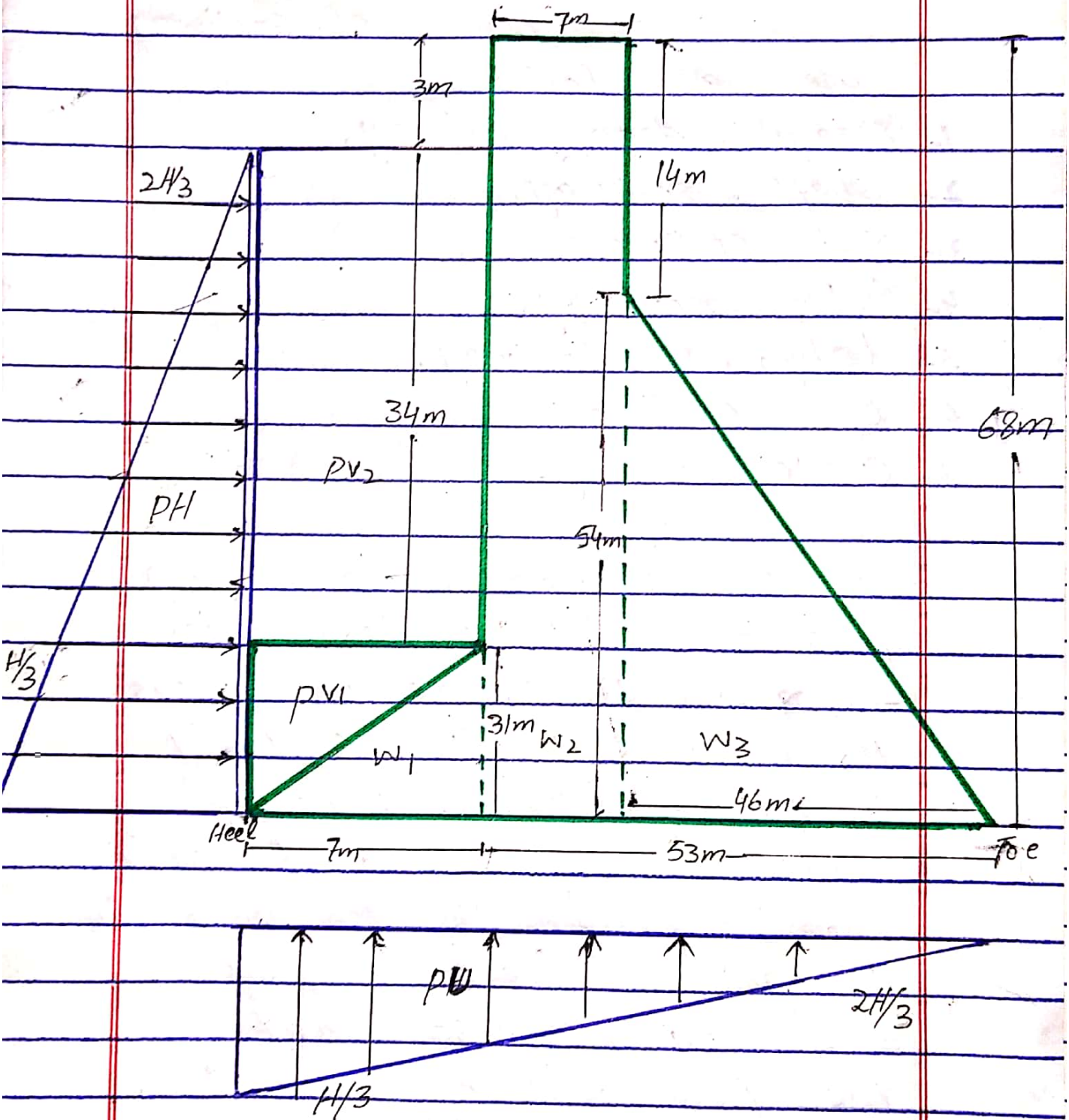
QNo3.

problem:-



Assume; Unit wt of concrete section $\gamma_d = 24\ KN/m^3$
unit wt of water, $\gamma_w = 10\ KN/m^3$
$\mu = 0.65 - 0.75$, $\varphi = 14°$

Moment Calculation:-

Forces	Forces Calculation	Vertical Forces Fv (K.N)	Horizental Forces FH	Levey Arm L.A	Resisting Moment MR (Fv x L.A)	over-turning Moment Mo
W_1	$\frac{1}{2} \times 7 \times 31 \times 24$	2604		$53 + 7/3 =$ 55.33	144079.3	
W_2	$7 \times 68 \times 24$	11424		$46 + 7/2 =$ 49.5	565488	
W_3	$1/2 \times 46 \times 54 \times 24$	29808		$46 \times 2/3 =$ 30.67	914211.36	
PV_1	$\frac{1}{2} \times 7 \times 31 \times 10$	1085		$53 + \frac{2 \times 7}{3} =$ 57.67	62571.95	
PV_2	$34 \times 7 \times 10$	2380		$53 + 7/2 =$ 56.5	134470	
PU	$-1/2 \times 60 \times 65 \times 10$	−19500		$60 \times 2/3 =$ 40		780000
PH	$-65^2/2 \times 10$		−21125	$65 \times 1/3 =$ 21.67		457778.75

ΣFv 2780 / ΣFH 21125 $\Sigma MR = 1820820.61$ 1237778.75

Eccentricity of resultant force,

$$e = \frac{B}{2} - \bar{x} \rightarrow (1)$$

Where;

$\bar{x}$ = location of resultant force from toe.

$$\bar{x} = \frac{\Sigma M_r - \Sigma M_o}{\Sigma F_v}$$

$$\bar{x} = \frac{1820820.61 - 1237778.75}{27801}$$

$$\bar{x} = 20.97m$$

So; eq(1)

$$e = \frac{60}{2} - 20.97$$

$$\boxed{e = 9.03m}$$

Factor of safety against Tension:-

Condition;

$$e < B/6$$

$$e < 60/6$$

$$9.03 < 10 \quad \text{OK safe.}$$

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Stress;

$\gamma_{heel} > 0$

$$\gamma = \frac{\Sigma F_V}{B}\left(1 \pm \frac{6e}{B}\right)$$

$$\gamma_{toe} = \frac{\Sigma F_V}{B}\left(1 + \frac{6e}{B}\right)$$

$$\gamma_{toe} = \frac{27801}{60}\left(1 + \frac{6(9.03)}{60}\right)$$

$$\gamma_{toe} = 881.76\ kN/m^2$$

$$\gamma_{heel} = \frac{\Sigma F_V}{B}\left(1 - \frac{6e}{B}\right)$$

$$\gamma_{heel} = \frac{27801}{60}\left(1 - \frac{6(9.03)}{60}\right)$$

$$\gamma_{heel} = 44.94\ kN/m^2$$

$\gamma_{heel} > 0$ **OK safe.**

Factor of safety aganist overturning:

$$\frac{\Sigma M_r}{\Sigma M_o} < 2$$

$$= \frac{1820820.61}{1237778.75}$$

$$= 1.47 \not> 2 \quad \text{Not safe.}$$

So,

$$\Sigma M_r > \Sigma M_o$$

$$1820820.61 > 1237708.33 \quad \text{ok safe}$$

FOS aganist sliding.

$$\frac{\mu \times \Sigma F_v + B \times q}{\Sigma F_H} > 1$$

$$= \frac{0.75 \times 27801 + 60 \times 1400}{21125}$$

$$= 4.96 > 1 \quad \text{ok safe.}$$

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QNO2

Ans:-

Types of spillways:-

Types of spillway are as follow;

1- Straight drop spillway.
2- Shaft spillway.
3- Side spillway.
4- Siphon spillway.
5- Labyrinth spillway.
6- Ogee spillway
7- Chute spillway.

In a condition where freezing point of water is less than -10 degree centigrade in winters the most efficient spillway is Chute spillway. Because chute spillway disposed water from upstream to the downstream through a steepy sloped open channel so that the flow will be very fast, and the flow ↑ water pressure will

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be high and will be in Supercritical condition. So the energy will be dissipated from falling water due to kinetic energy because of the water in motion, energy dissipators are also ~~created~~ provided in this type of spillway thus the temperture of water will go high and it will not allow water to freeze and stop. So water is moving freely in that cold area.