Q 1

What are the most efficient dimensions (the best hydraulic section) for a concrete (n = 0.022) rectangular channel to carry 7.5 m^3/sec at S = 0.2%

Q 2

Design a best hydraulic section for a concrete (n = 0.022) rectangular channel to carry 10 m^3/sec at S = 0.15%

Q 3,4,5

For a trapezoidal canal cross section, if the normal discharge is 28.8 m^3/sec, longitudinal slope is 170 cm /km, maning's n = 0.02, bed level at the beginning of canal = 415 m, length of the canal is 2500 m, use 55 cm freeboard.

Required:

Q3/ Design best dimensions for the canal section.

Q4/ Bank top level and water surface level at the beginning and end of the canal

Q5/ Check the section for 40 m^3/sec exceptional discharge.

Q 6,7,8

For a trapezoidal canal cross section, if the normal discharge is 30.6 m^3/sec, longitudinal slope is 2m /km, side slope = 1V : 2H, maning's n = 0.02, bed level at the beginning of canal = 415 m, length of the canal is 1000 m, bed width = 4 m and free board = 0.55 m , Find;

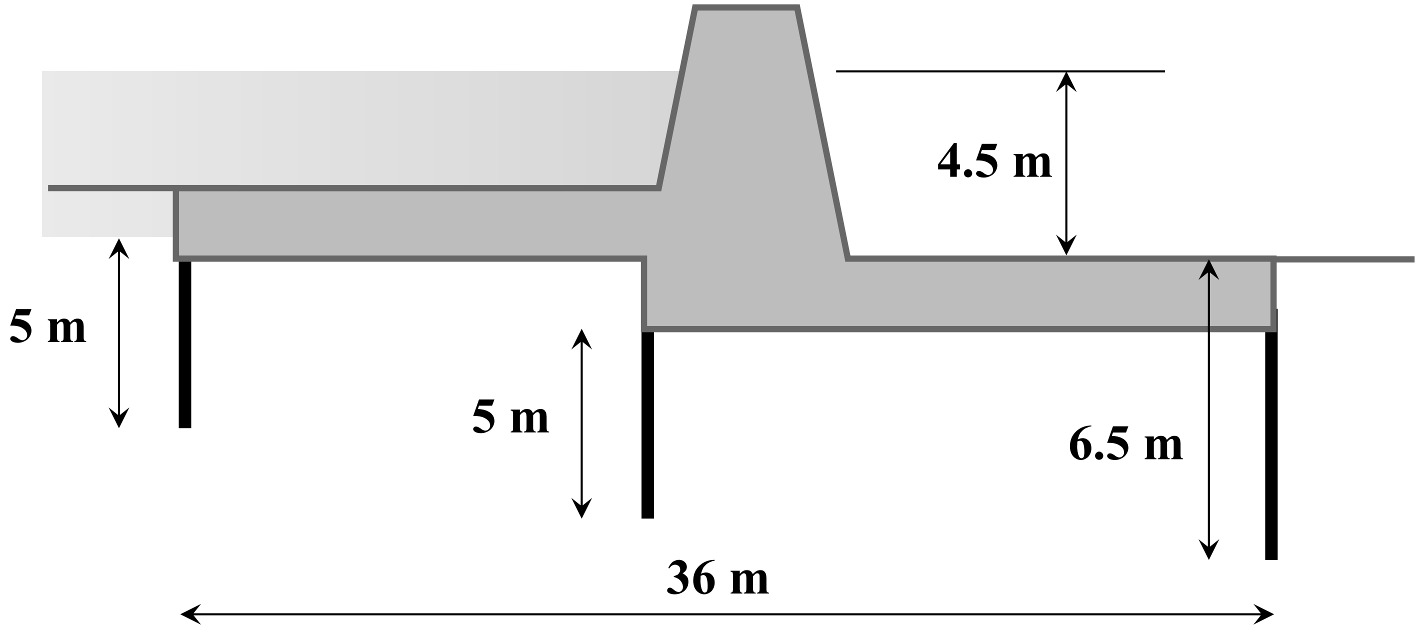
Q6/ depth of water in the canal

Q7/ bank top level and water surface level at the beginning and end of the canal

Q8/ draw cross section of canal

Q 9

Using khosla theory check safety of the hydraulic structure shown in the Fig. against piping failure, take Gs = 1/7

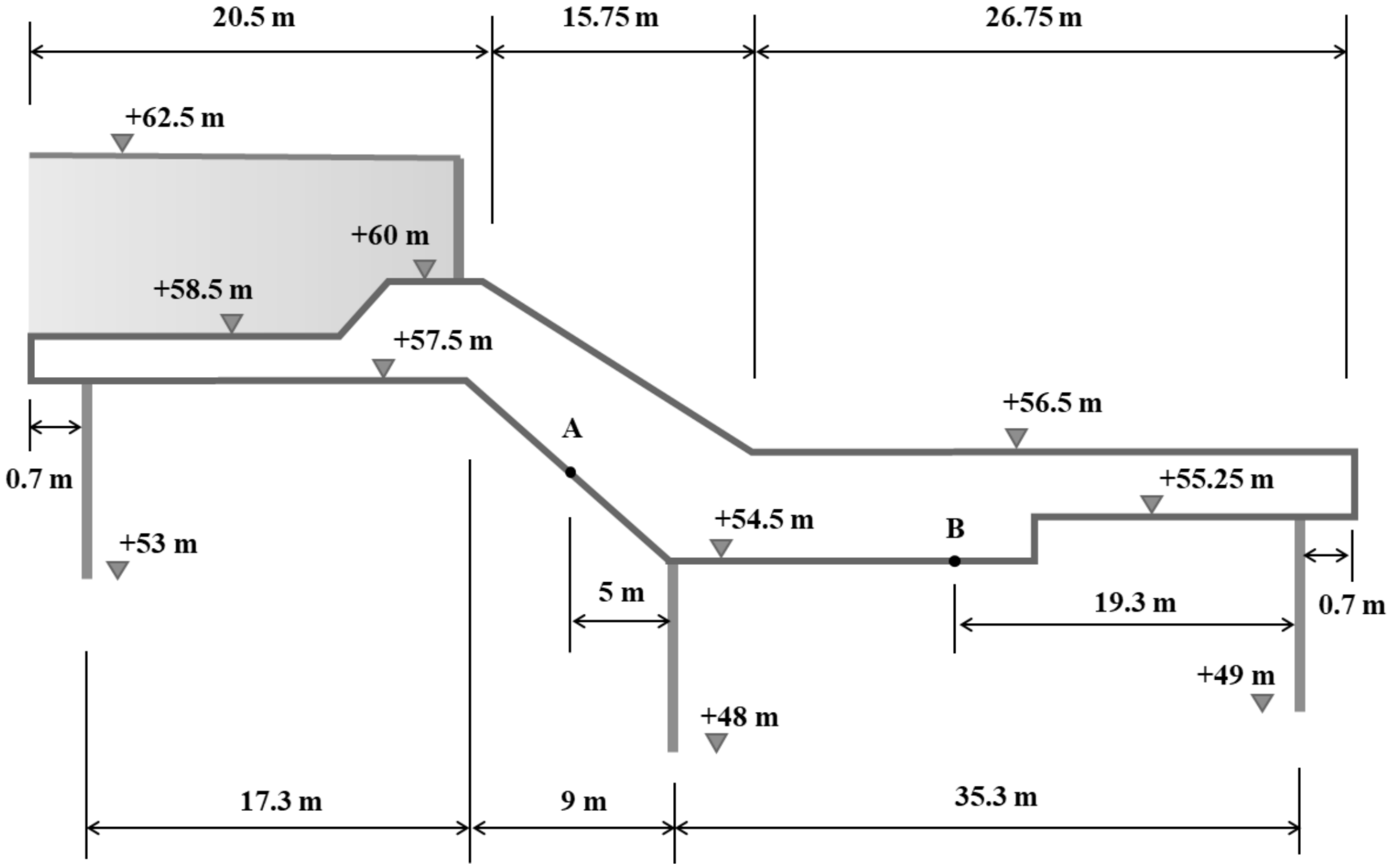


Q 10,11

For the hydraulic structure shown in the Fig. , Using khosla theory:

Q10/ Determine uplift coefficients at key points.

Q11/ Determine the uplift coefficients at points A and B.

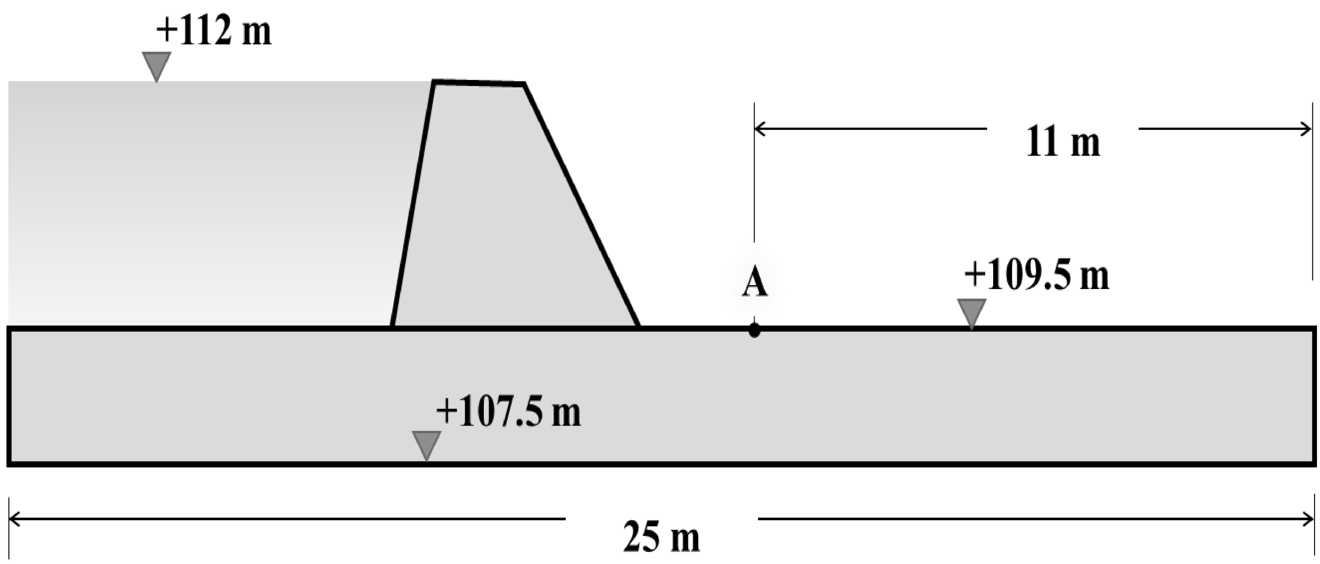


Q 12, 13

For the Hydraulic structure shown, use Khosla's theory to:

Q12/ Find the uplift coefficient at point A

Q13/ Check safety of the floor against piping failure, take Gs = 1/6



Q 14, 15, 16

For the hydraulic structure shown in the Fig.

Assume:

$q = 12\ m^3/sec/m$,

US TEL = + 64.05 m, DS TEL = + 61.8 m,

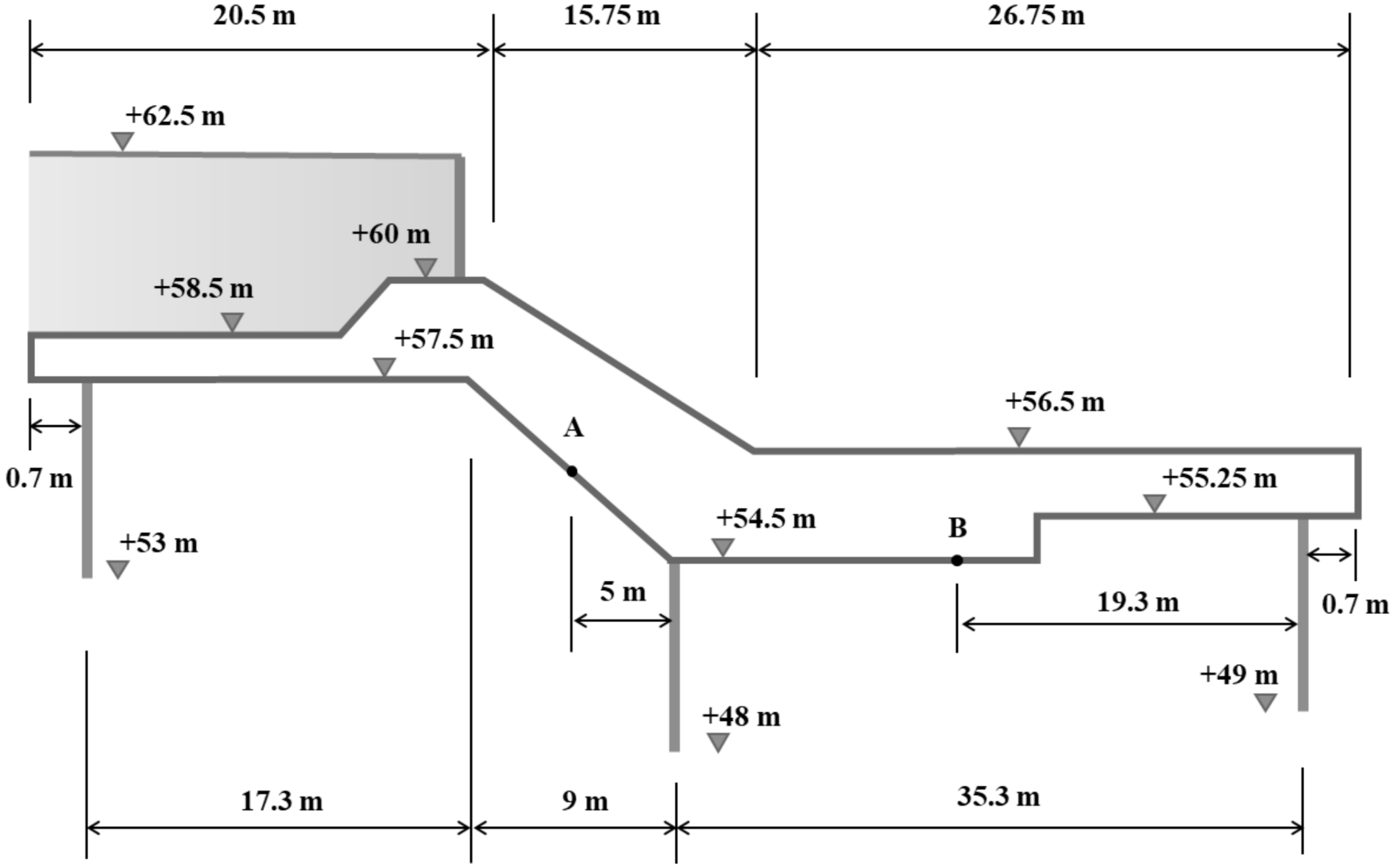
US HFL = +63.5 m DS HFL = + 61.15 m

Required:

Q14/ Sketch the HGL at Static and Dynamic Conditions.

Q15/ Find the Unbalanced Static and Dynamic Heads at A and B .

Q16/ Check the floor thickness at points A and B .



Q 17/

Design a barrage for the following data:

- **Max flood discharge = 12 320 m^3/sec**
- **HFL before construction = 525 m**
- **River bed level = 520 m**
- **Crest length of other barrage part = 2 m**
- **Gates available of width 15 m**
- **Width of piers 2.5 m**
- **Divide wall = 2.5 m**
- **Pond level = 524 m**
- **Safe exit gradient = 1/6 (Khosla)**
- **US glacis 1H:1V**
- **DS glacis 5H:1V**
- **Permissible afflux = 1.5 m**
- **Silt factor f =1**
- **Concrete s.g. = 2.4**
- **Concentration = 20%**
- **Retrogression = 0.5 m.**
- **U.S. Floor Thickness = 1 m**
- **D.S. Floor Thickness = 1.7 m**
- **U.S. & D.S. end distance to the pile = 0.75 m**
- **Kp = 0.1**

Q 18, 19, 20, 21

Design the following parameters for a U.S.B.R. type Stilling basin and show them in neat sketches:

Q18/ Type and length of the basin.

Q19/ Dimensions, spacings and numbers of chute blocks

Q20/ Position, Dimensions and numbers of basin blocks

Q21/ Dimensions of end sill

Given:

- Discharge intensity "q" = 7 m^3/sec/m
- Head loss = 4.5 m
- Slope of glacis = 3H : 1V
- Width of the basin = 4.5 m.

Q 22, 23, 24

For the profile of the gravity dam shown, Compute

Q22/ Forces acting on the dam and their moments about toe,

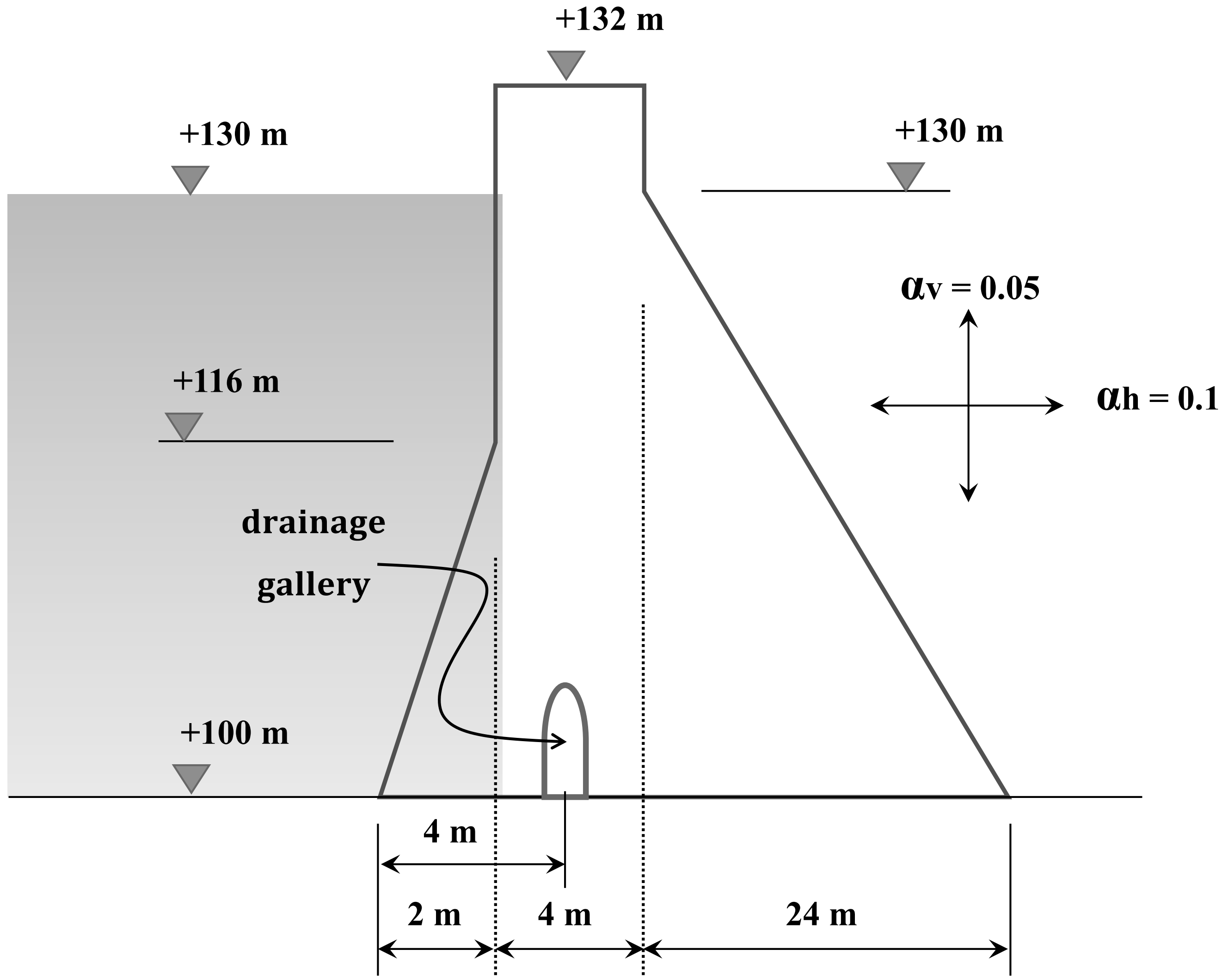
(neglect silt, wind, ice and wave forces).

Q23/ Factors of safety against Sliding , Overturning

Q24/ Normal stresses at toe and heel.

Assume:

- Consider earthquake acceleration for loading condition , $\alpha v = 0.05$ and $\alpha h = 0.1$
- Crush strength of concrete and rock = 1500 ton/m^2
- Shear strength of rock = 150 ton/m^2
- Coefficient of shear friction = 0.7
- Weight density of concrete = 2.4 ton/m^3
- Weight density of water = 1 ton/m^3



Q 25

Design and draw the downstream protection works for a barrage having the following data:

- **DS HFL = 90 m**
- **DS floor level = 82 m**
- **Silt factor (f) = 0.855**
- **Discharge intensity q = 23 m^3/sec/m**

Q 26, 27, 28

A trapezoidal canal designed to conveys a normal discharge 33.5 m^3/sec, maning's n = 0.02, bed level at the beginning and end of the canal are 415.35 m & 411.85 m respectively, length of the canal is 7 km, use 50 cm freeboard.

Required:

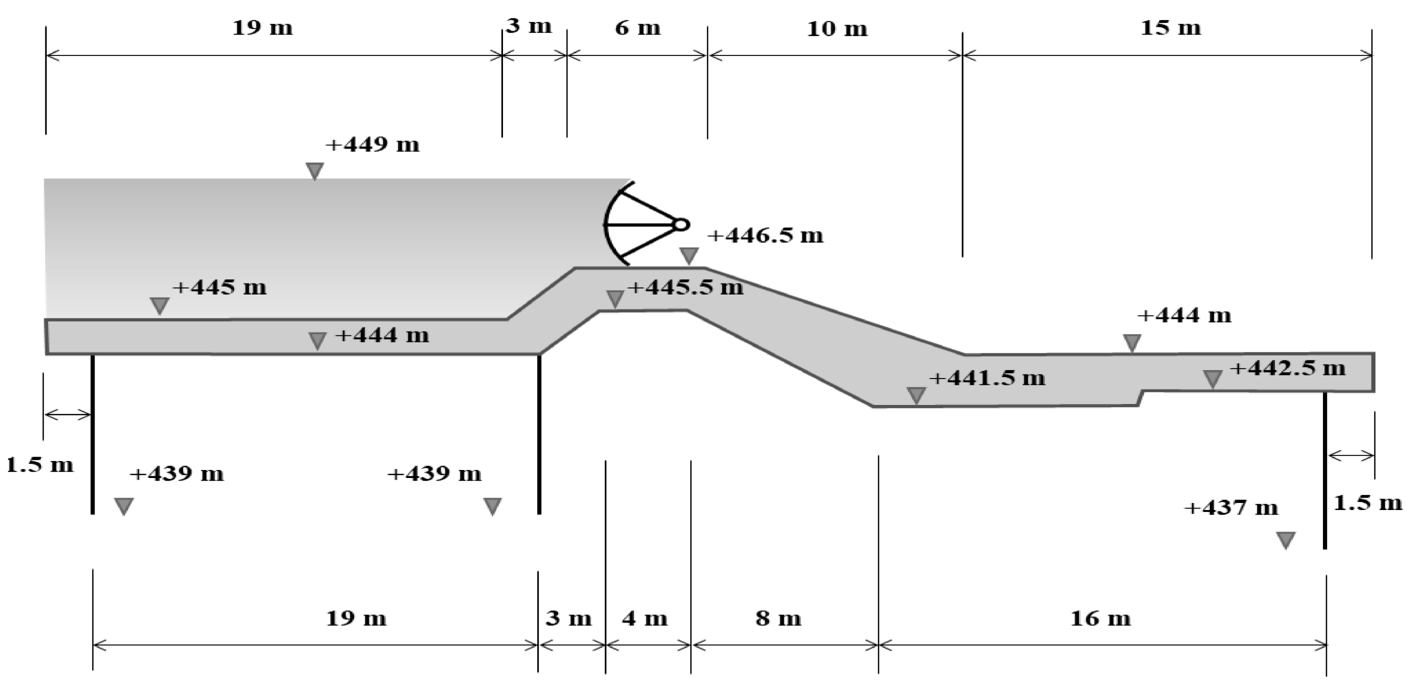
Q26/ Design best hydraulic section for the canal.

Q27/ Bank top level and water surface level at the beginning and end of the canal

Q28/ Check the section for 40 m^3/sec exceptional discharge.

Q 29

For the barrage shown in the Fig., use Khosla's theory to Find the uplift coefficients at key points C1, E2, C2 and E3. (Apply all necessary corrections)



Q 30, 31, 32, 33, 34, 35

A barrage constructed across a river having the following data:

- **Max Flood Discharge Q = 4500 m3/sec**
- **HFL before construction = 322 m**
- **Pond level =321 m**
- **River bed level = 318 m**
- **Permissible afflux = 1 m**
- **Retrogression = 0.5 m**
- **Concentration = 20 %**
- **Crest width of the other barrage = 2.5 m**
- **Crest level of the other barrage is 1.35 m higher than the under sluice crest**
- **Width of piers =2.5 m**
- **Width of divide wall =3 m**
- **Safe exit gradient Gs = 1/6**
- **Silt factor f =1**

Under Sluice	Other Barrage
▪ Consists of 4 bays	▪ Consists of 20 bays
▪ Width of bays (Gates) =12 m	▪ Width of bays (Gates) =14 m
▪ DS Floor is 19.4 cm lower than “O”	▪ DS Floor is 24.4 cm lower than “O”
▪ X= 1.266 for DS sheet pile	▪ X= 1.347 for DS sheet pile

Q30/ Design the Crest levels

Q31/ Check the waterway for the max flood Discharge

Q32/ Find Bottom Elevations of DS Sheet Piles

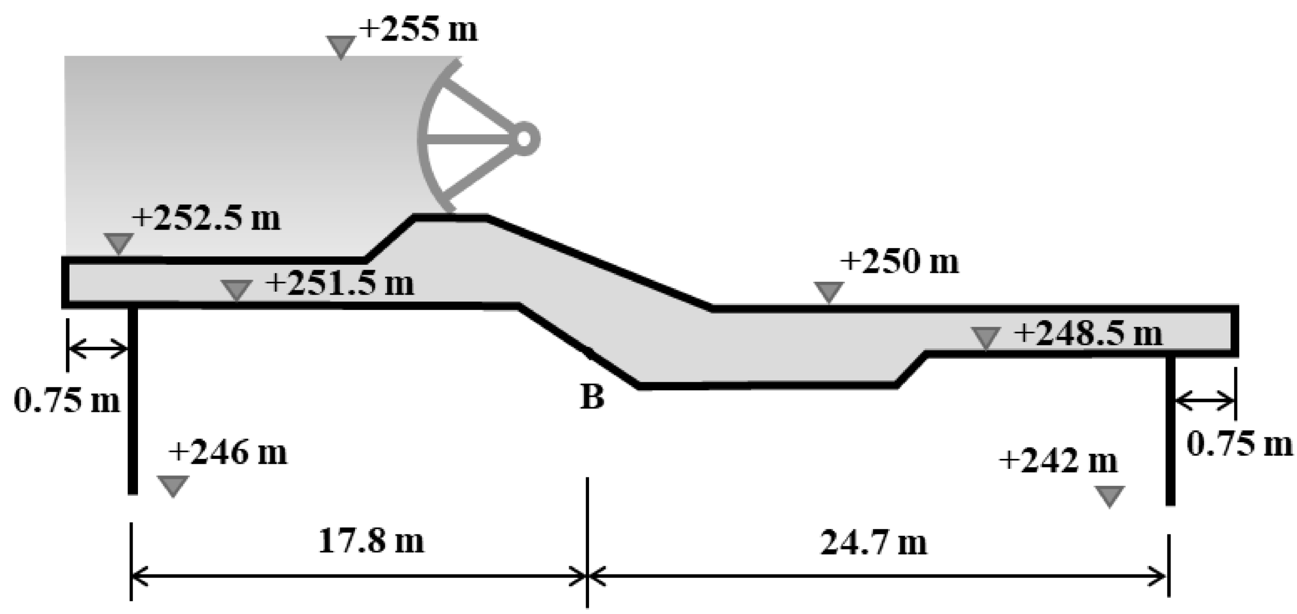
Q33/ Find DS Floor Levels

Q34/ Find DS Floor Lengths

Q35/ Find Total Floor Lengths

Q 36/

For the Barrage shown, using Khosla's theory find **(ϕB)**.



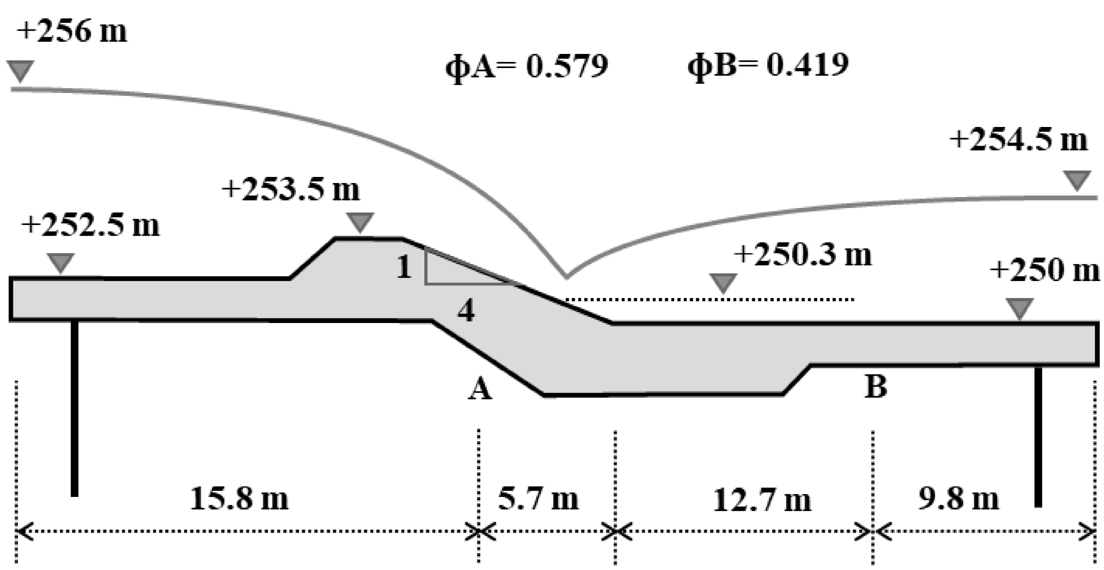
Q 37, 38

For the Barrage shown, given:

Pond level= 255 m, q = 12 m^3/sec/m and HL = 2.25 m

Q37/ Find: $h_{(B)}$ Static

Q38/ Find: $h_{(A)}$ Dynamic



Q 39

A barrage constructed across a river having the following data:

- HFL before construction = 473 m
- River bed level = 468 m
- Approach velocity = 2 m/sec
- Under sluice consists of 4 bays
- The other barrage consists of 21 bays
- Crest width of other barrage bays = 2 m
- Other barrage crest 1.3 m higher than Under sluice crest
- Width of bays (Gates) =15 m
- Width of piers = 3 m
- Permissible afflux = 1.2 m

Find: The Max flood discharge (Q).

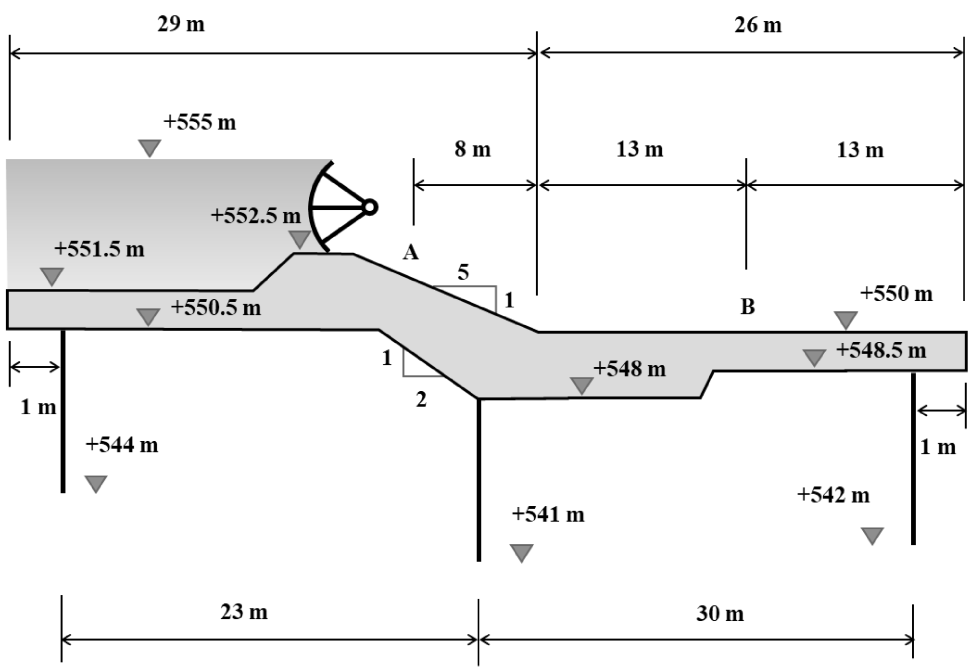
Q 40, 41

For the barrage shown below, use Khosla's theory to:

Q40/ Find the uplift coefficients at key points **C1, E2, C2** and **E3**

(Apply all necessary corrections)

Q41/ Check safety of the floor against piping failure, take Gs = 1/7



Q 42, 43

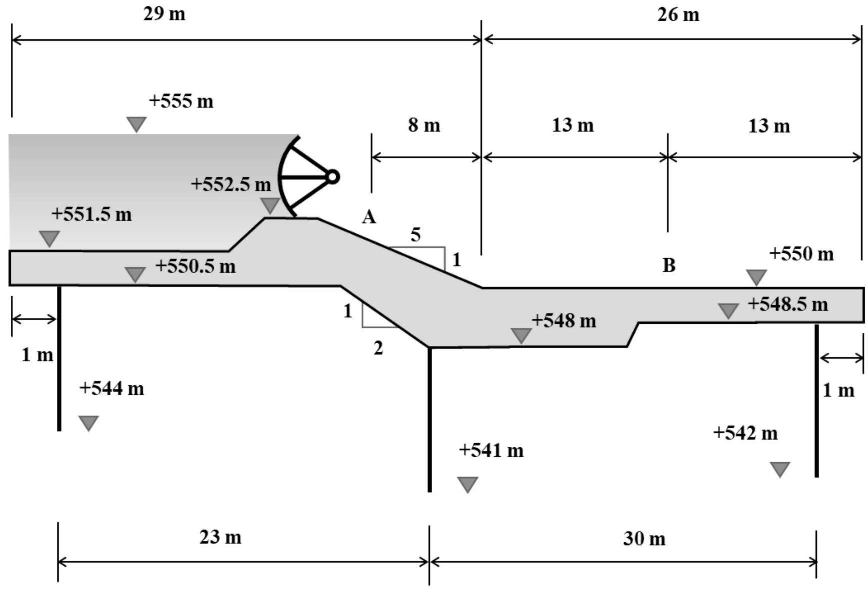
For the barrage shown : Required:

Q42/ Water surface elevations at A and B.

Q43/ Check the floor thickness at A and B

q = 6 m3/sec/m US HFL = + 556 m ϕ A = 0.629 Level of “O” = + 550.3 m

HL = 2.4 m DS WSL = + 553.5 m ϕ B = 0.366



Q 44, 45, 46

A trapezoidal canal designed to conveys a normal discharge 47.8 m^3/sec, maning's n = 0.024, bed level at the beginning of the canal is 535.35 m, longitudinal slop of the canal is 1 m/ km, length of the canal is 12 km, use 80 cm freeboard.

Required:

Q44/ Design best hydraulic section for the canal.

Q45/ Find Bank top level and water surface level at the beginning and end of the canal

Q46/ Check the section for 60 m^3/sec exceptional discharge.

Q 47, 48

A barrage constructed across a river having the following data:

- HFL before construction = 442 m
- River bed level = 438 m
- Approach velocity = 4 m/sec
- Q under sluice = 20% Q max
- Width of bays (Under Sluice) =12.5 m
- Width of bays (Other Barrage) =15 m
- Width of piers =2.5 m
- Width of divide wall = 2.5 m
- Under sluice consists of 6 bays
- Crest width of other barrage bays = 3.5 m
- Other barrage crest is 1.2 m higher than under sluice crest
- Permissible afflux = 1.5 m

Q47/ Find the Max flood discharge (Q).

Q48/ Find the No. of bays for the other barrage part.

Q 49, 50, 51, 52

Design the following parameters for a U.S.B.R. type Stilling basin and show them in neat sketches:

Q49/ Type and length of the basin.

Q50/ Dimensions, spacings and numbers of chute blocks

Q51/ Position, Dimensions and numbers of basin blocks blocks (if required)

Q52/ Dimensions of end sill

Given:

- Discharge Q = 30 m^3/sec
- Head loss = 3 m
- Slope of glacis = 3H : 1V
- Width of the basin = 6 m.

Q 53, 54, 55

For the profile of the gravity dam shown, Compute

Q53/ Forces acting on the dam and their moments about toe,

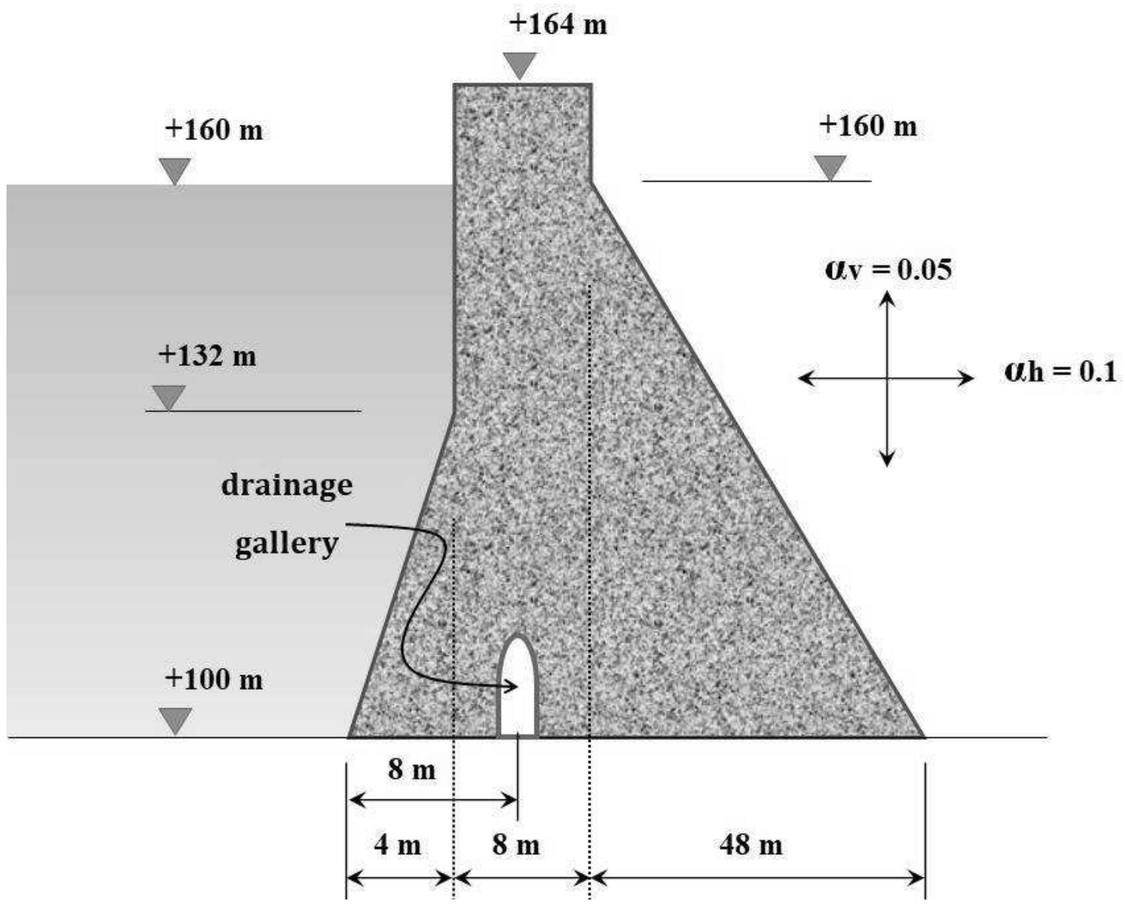
(neglect silt, wind, ice and wave forces).

Q54/ Factors of safety against Sliding , Overturning

Q55/ Normal stresses at toe and heel.

Assume:

- Consider earthquake acceleration for loading condition , $\alpha v = 0.05$ and $\alpha h = 0.1$
- Crush strength of concrete and rock = 1500 ton/m^2
- Shear strength of rock = 150 ton/m^2
- Coefficient of shear friction = 0.7
- Weight density of concrete = 2.4 ton/m^3
- Weight density of water = 1 ton/m^3



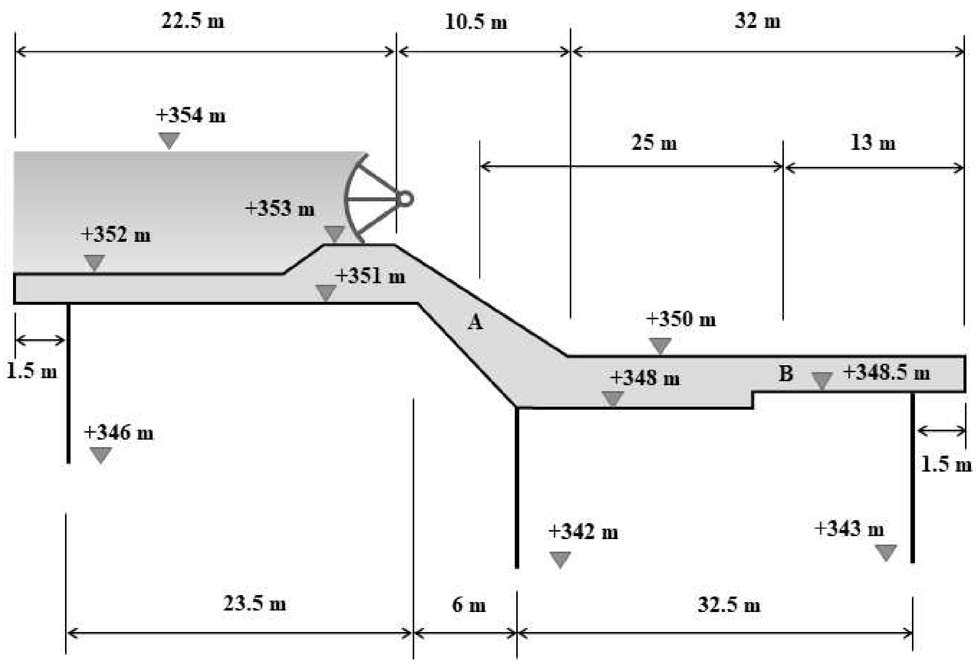
Q 56, 57

For the barrage shown below, use Khosla's theory to:

Q56/ Find the uplift coefficients at key points **C1, E2, C2** and **E3**

(Apply all necessary corrections)

Q57/ Check safety of the floor against piping failure, take Gs = 1/7



Q 58, 59, 60

For the barrage shown : Required:

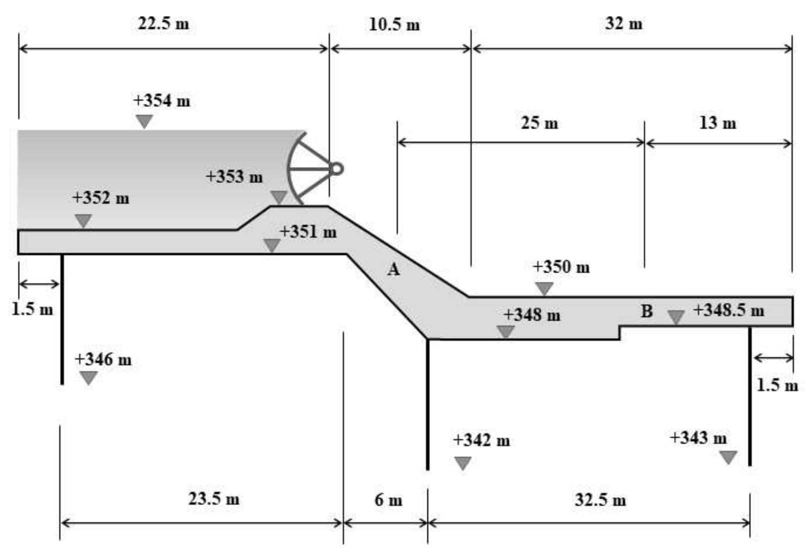
Q58/ Unbalanced Static Heads at A and B.

Q59/ Unbalanced Dynamic Heads at A and B.

Q60/ Check the floor thickness at A and B.

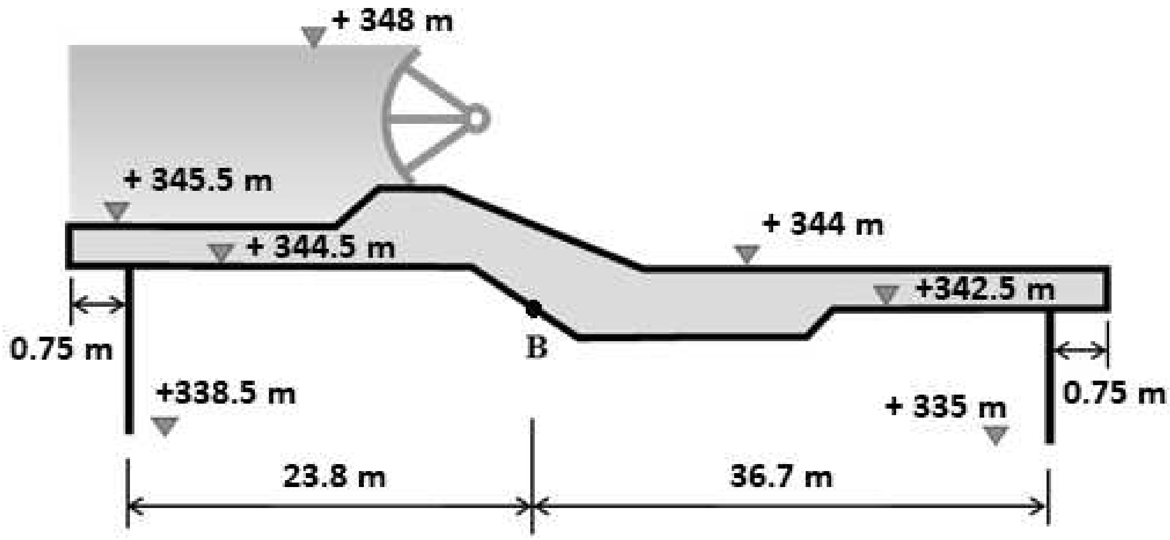
q = 7 m3/sec/m **US HFL = + 355 m** **ϕ A = 0.604** **Level of "O" = + 350.2 m**

HL = 1.6 m **DS HFL = + 353.5 m** **ϕ B = 0.331**



Q 61

For the Barrage shown, using Khosla's theory find **(ϕB)**.



Q 62

A barrage constructed across a river having the following data:

- HFL before construction = 523.5 m
- River bed level = 518 m
- Approach velocity = 3.5 m/sec
- Under sluice consists of 9 bays
- The other barrage consists of 32 bays
- Crest width of other barrage bays = 4.5 m
- Other barrage crest 1 m higher than Under sluice crest
- Permissible afflux = 1.5 m
- Width of divide wall and piers = 3 m
- Width of bays (Under Sluice) =12 m
- Width of bays (Other Barrage) =16 m

Find: The Max flood discharge (Q)

Q 63

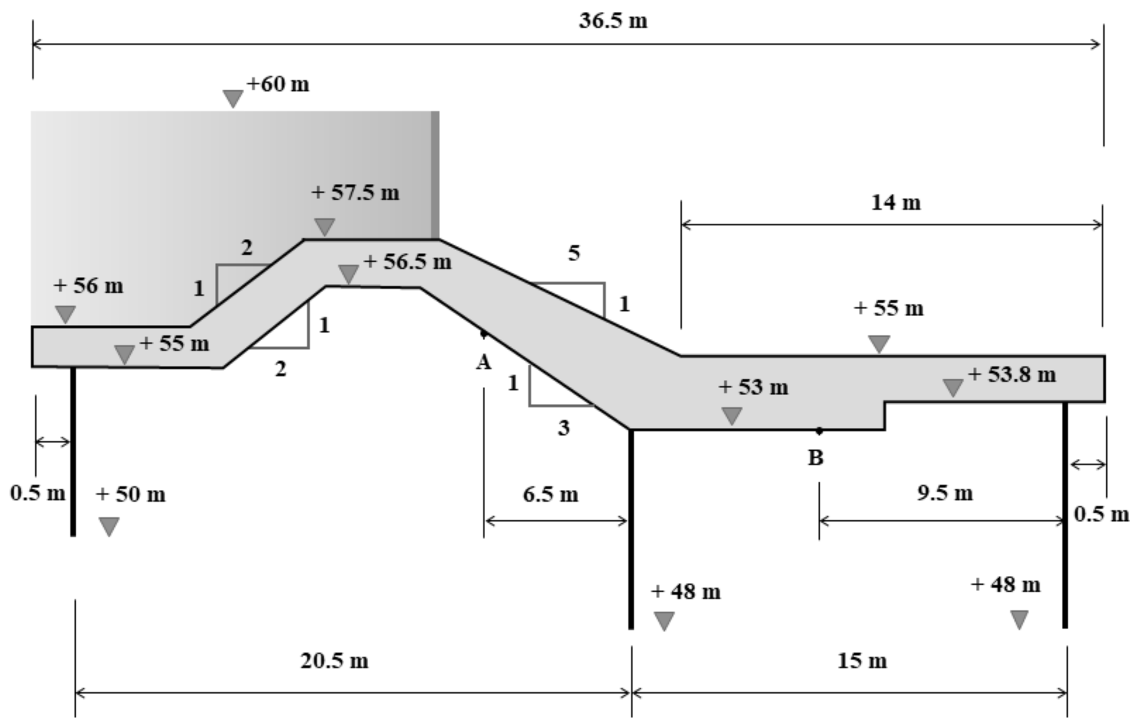
Design a trapezoidal canal (best hydraulic section) to convey 15.5 m^3/sec water, the canal to be built with concrete (n= 0.022) having a longitudinal slope of 0.0012. Use 60 cm freeboard and check the section for 20 m^3/sec exceptional discharge.

Q 64, 65

For barrage shown in the Fig. below, using Khosla's theory:

Q64/ Check safety against piping failure, assume: Gs = 1/7

Q65/ Find the uplift coefficient at point A.



Q 66, 67, 68

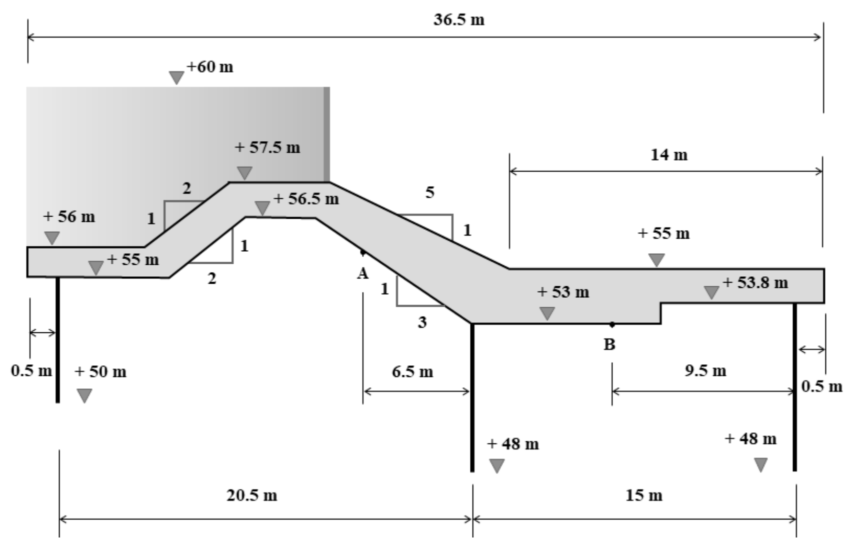
For barrage Figure , given:

q = 14 m^3/sec/m, US TEL = + 61.55 m, DS TEL = + 60.3 m, corrected $\Phi C2$ = 0.403 and corrected $\Phi E3$ = 0.322. :

Q66/ Find Unbalanced Static Head at point B.

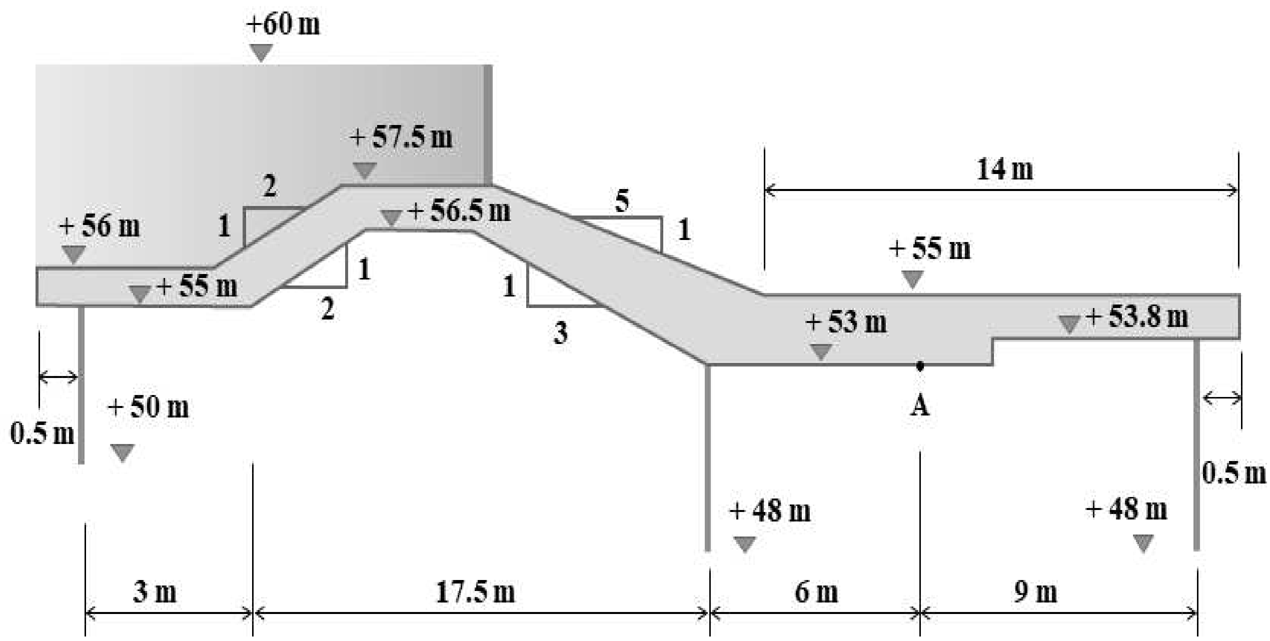
Q67/ Find Depth of water before and after the jump (D1) and (D2).

Q68/ Find Water Surface Elevation above point A.



Q 69

For the Barrage shown, Find (ϕA) using Khosla's theory.



Q 70

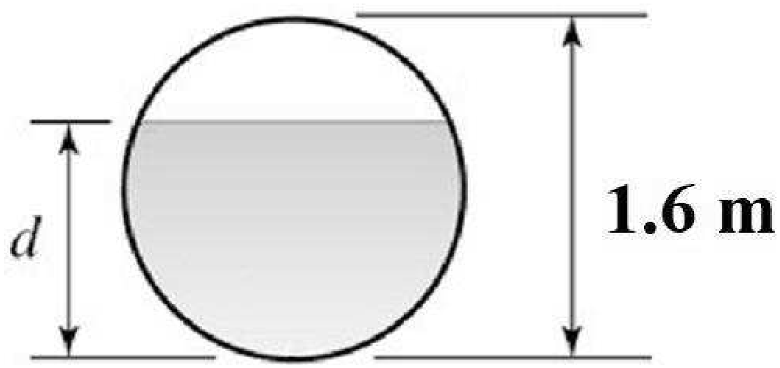
Find the discharge of water and average flow velocity through a 1.6 m diameter metal pipe (n = 0.02) take the pipe slope = 0.007

when:

a) d = 0.8 m

b) d = 0.4 m

c) d = 1.2 m



Q 71, 72, 73, 74

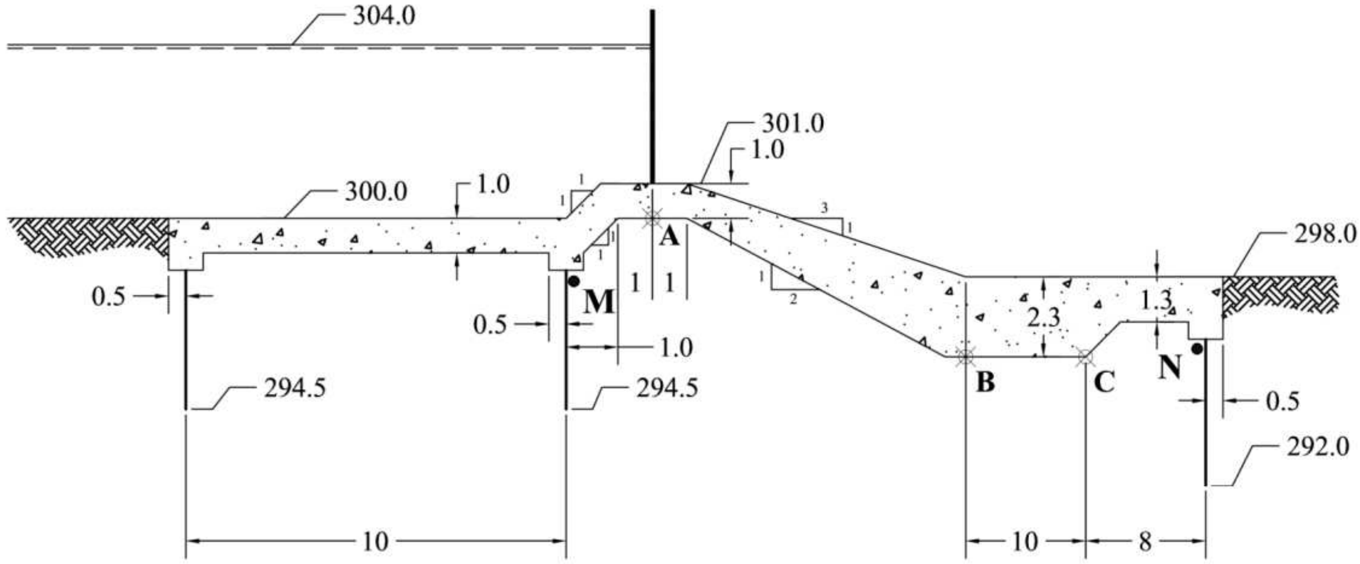
For barrage shown in the Fig. below, using Khosla's theory:

Q71/ Check safety against piping failure, assume: Gs = 1/7

Q72/ Find the uplift coefficient at point A.

Q73/ Find the uplift coefficient at point B.

Q74/ Find the uplift coefficient at point C.



Q 75, 76, 77, 78

For barrage shown, given: q = 14 m^3/sec/m, US TEL = + 306.55 m, DS TEL = + 303.3 m,

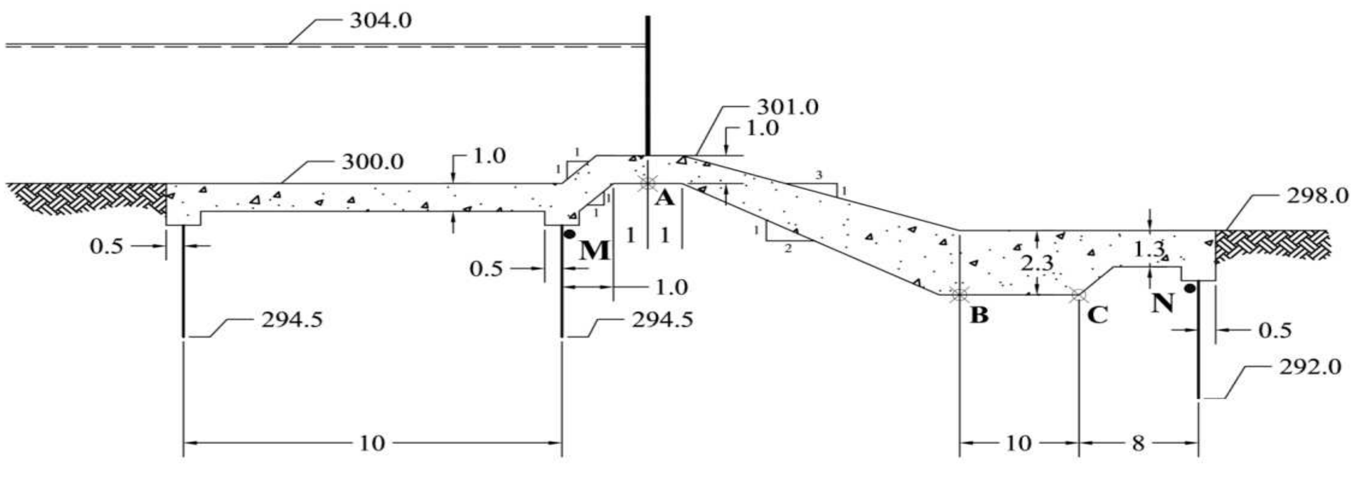
Q75/ Find Unbalanced Static Head at point B.

Q76/ Find Depth of water before and after the jump (D1) and (D2).

Q77/ Check the floor thickness at point A.

Q78/ Check the floor thickness at point B.

Q79/ Check the floor thickness at point C.



Q 80

Find the discharge of water and average flow velocity through a 1.6 m diameter metal pipe (n = 0.02) take the pipe slope = 0.007

when:

- **a) d = 0.6 m**
- **b) d = 0.3 m**
- **c) d = m**