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Semester :- 12th

Subject :- Hydraulic Structure

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Section :- A

:- 2 CR. HRS

Final Term

QNO1

(a) Differentiate between culvert and causeway

Ans A culvert is a structure that can allows water to flow under a road, railroad, trail, or similar obstruction from one side to other side Typically embedded so as to be surrounded by soil, a culvert may be made from a pipe, reinforced concrete or other material. Or an opening through an embankment for the conveyance of water by mean of pipe or an enclosed channel

A causeway is a track, road or railway on the upper point of embankment across a low or wet place, or piece of water. It can be constructed of earth, masonry, wood or concrete. One of the earliest wooden causeway is the Sweet Track in somerset levels,

(B) Define cross drainage work. why it is necessary? Explain different types of cross drainage work in detail.

Ans In an irrigation project; ~~when~~ the Cross drainage works is a structure constructed when there is a crossing of canal and natural drain, to prevent the drain water from mixing into cannal water, By mixing two, three streams into one and only one cross drainage work to be constructed, to make the structure less expencive and more economical)

=> Necessity of Cross Drainage works
The water-shad canals should not cross the natural drainage. Somehow

Sometime these type of conditions could not be availabe and can be obstructed by the natural drainages across the cannal. So it is very importaut that we ~~sto~~ should provide the cross drainage works

⇒ The Different Types of cross drainage
The different types of cross drainage are as given bellow:-
- Type 1 (Irrigation cannal passes over the drainage)

1a) Aqueduct :-
It is a hydraulic structure in which the irrigation cannal is taken over the drainage e.g: (Streams, rivers). ~~This~~ Such type of structure is suitable when the bed level of the cannal is above the highest flood level of drainage Such type the drainage water passes bellow the canal is

known as aqueduct.

→ Siphon Aqueduct:-

Siphon Aqueduct is defined as that type of hydraulic structure in which the canal is taken over the drainage, but the drain water wont pass easily under the canal. It flows under siphonic action. thats why it is known as siphon aqueduct. Such is type of structure is more suitable when the bed level of canal is below the highest flood level such type is known as siphon Aqueduct.

⇒ Type 2 Drainage Passes over the Irrigation canal.

• Super Passage:-

Super passage is defined as the hydraulic structure in which the drainage is taken over the irrigation cannal. Such type of structure is suitable when the bed level of drainage is above the full supply of canal. The water in the canal will pass easily bellow the drainage and it is known as super passage.

→ Siphon Super Passage:-

Siphon Super Passage is defined as in which the drainge is taken over the irrigation canal. but the canal water passes bellow. the drainage under siphonic action is known as siphon super passage. Such type of structure is suitable when the bed level of drainage is bellow the full supply level of canal. Such type is known as Super Siphon Super passage.

⇒ Type 3: Drainage and canal Interset each other at same level

- Level Crossings :-

Level crossings is defined as when the bed level of canal and the stream are almost the same and quality of water in the canal and stream are not diffrent from Each other. Cross drainage work constructed is called level of crossing where the water of canal and stream is allowed to mix with each other.

- Inlet and Outlet :-

Inlet and outlet is defined as when irrigation canal meets with a small stream or drain at same level. The drain is allowed to enter the canal as an inlet. A some point from inlet point part of wate is allowed to drain as outlet. Which will at last meet the orignal stream. There will be a riquirement of stone pitching at inlet and outlet.

Qno 2

(a) Differentiate between wier and barrage.

Ans

A wier is a simply a concrete or masonry structure which is built through an open channel, for instance a river. In most of the cases it is built to control the flow of water, measure the discharge prevent the flooding. ~~and make~~ It is built with different types of material such as concrete, wood, gravels, or mixture of rocks.

On the other hand, a barrage is a also a concrete structure which consist of series of large gates which can be closed and opened and control the amount of ~~whi~~ water which flows through it. This allows the structure to adjust and stabilize the elevation of upstream water for irrigation. Both wiers and barrages are obstacles to the water course but the barrage is expencive structure while wier is much more cheaper as compared to barrage.

Qno2

(b). Define Reynod's number. what will be the limit of reynolds number for laminar, turbulent and neither laminar nor turbulent flow?. Also define lower and higher critical velocity.

2 (b) Ans

Reynolds Number :-

Reynolds number is defined as the number of inertial forces to viscous forces and is a conventient parameter for predicting if a flow condition will be laminar or turbulent.

⇒ Limit of reynolds number for laminar and turbulent.

The limit of reynolds number for laminar and turbulent is as defined bellow.

- Laminar :- Flow of the pipe will be called laminar if the number is less than 2100

Turbulent:-

If the reynolds number is higher than 4000 that it is known as turbulant flow.

⇒ Niether laminar nor turbulent flow:-

Niether laminar nor turbulent flow is defind as when the Reynold number is in between 2000 and 2800. So it is niether laminar flow nor turbulent flow.

→ Lower Critical Velocity:-

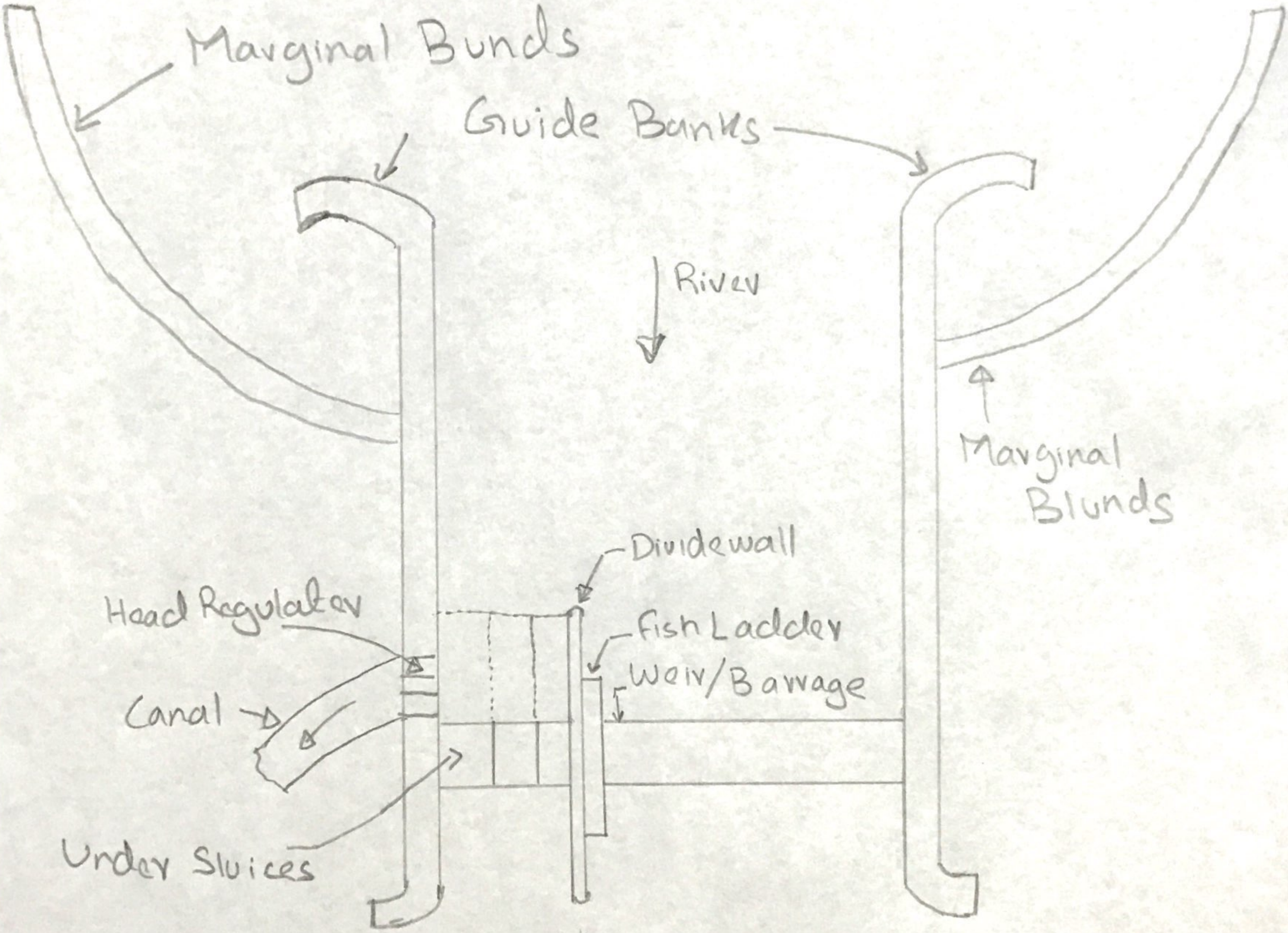
Lower Critical Velocity is defind as when the velocity at which the flow of water changes from laminar to tranistion is known as lower critical velocity.

→ Higher Critical Velocity :-
Higher critical velocity is defined as when the velocity at which the flow of water changes from transition to turbulant is known as Higher critical velocity.

Qno3
(a) Draw neat Sketch of barrage showing its diffrent componants.

Ans 3A

Sketch of barrage showing components



Qno 3

(b) How would you predict / Analyze maximum or, equilibrium scour depth based on experimental formula.

Ans:

If the contracted width (ie the bridge length, L) is less than the regime width W (Eq 9.9), the normal scour depth D_N, under the bridge is given by

$$D_N = R_s (W/L)^{0.61}$$

where R_s is the regime scour depth (Eq 9.10).

The maximum scour depth in a single span bridge (no piers) with a straight approach (case 1) is about 25% more than the normal scour given by Eq 10.18, whereas in the case of a multispan structure with a curved approach reach (case2) it is 100% more than the normal scour. If the constriction is predominated, the maximum scour depth is the maximum of case1 or case 2 or by the given value

$$D_{max} = R_3 (w/L)^{1.56}$$

Several formulae based on experimental results have been proposed to predict the maximum or Equilibrium scour depth (Y_s, bellow general bed level) around bridge piers. In general these assume the relationship

$$Y_s / b = \phi (Y_o / b', F_r, d/b')$$

where b' is the pier width, Y_o is the up stream flow depth, d is the sediment size and F_r is the flow froude number

Q no 4

A box Culvert is to be designed having inside dimensions 15ft * 15ft. The culvert is subjected to L.L of 1.5 kip/ft² and superimposed D.L of 300 lb/ft². Unit weight of soil is 100 lb/ft³. Angle of repose is 30°. Use 1:2:4 concrete and fy = 60 ksi steel. Design the box culvert.

Given Data:-

L.L = 1.5 kip/ft²

D.L = 300 lb/ft²

θ = 30°

Unit weight of soil = 100 lb/ft²

Dimensions = 15' x 15'

fy = 60 ksi steel

Concrete = 1:2:4 = M_{15}

D = 0.92m thickness

Solution:-

① load

Total load on Top = Self weight + L.L + DL

Self weight = 3 x 15 = 45 kN/m²

45 kN/m² = 0.939 Kip/ft²

W = 1.5 + 0.939 + 0.3

W = 2.739 Kip/ft²

② Coefficient of Earth pressure

$$K_a = \frac{1 - \sin\phi}{1 + \sin\phi}$$

$$= \frac{1 - \sin(30)}{1 + \sin(30)}$$

$K_a = 0.33$

③ Lateral pressure due to (Dead load + live load)

= Total vertical load x K_a

= (LL + DL) x K_a

= (1.5 + 0.3) x 0.33

= **0.594 Kip/ft²** OR

28.4 kN/m²

④ lateral pressure due to soil

= $K_a \times \gamma_{soil} \times h$

= $0.33 \times 0.1 \times 18$

= **0.594 kip/ft²**

OR

= **28.4 kN/m²**

⑤ lateral pressure at top due to L.L + DL = 0.594 kip/ft²

= **28.4 k/m²**

⑥ Lateral pressure at bottom:

= Lateral pressure due to (L.L + DL) + lateral pressure due to soil

= 0.594 + 0.594

= **1.188 kip/ft²** or

= **56.88 kN/m²**