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CLASS : BE (C)

SECTION : A

ID # 7708

SUBJECT : HYDRAULIC STRUCTURE

LECTURER : ENGR. ADEED

Q1

a Differentiate between culvert and caveway.

Ans CULVERT

It is a way under roads or railway which is provided for the passage of ~~of~~ water from one side to the other. It can also be carry electric or other cables. The design of it is depend upon the extreme water surface elevation, and height of road and also some other factors. The total length of this culvert is 6m or less than 6m between the faces of abutments. The culvert have many types used in construction which are ~~road ways~~ pipe culvert, box culvert and arch etc.

CAUSEWAY

It is a track of road or railways on upper point ~~of~~ an embankment across a water or stream. It can be constructed of earth, masonary, wood or concrete. The causeways were more same as dykes and generally pierced to allow pass water while other modern causeway look much the same as bridges or viaducts.

Q1 PART.B

Ans CROSS DRAINAGE WORK

A cross drainage work is a crossing provided for a canal and natural drain to prevent them for mixing into each other and not to interrupt their flows.

NECESSITY:

ON THE BASES OF WATER QUALITY

When there is no cross drainage work so the main issue will be that the drainage water quality is change then the canal water quality which suffer as their water quality will intermix with each other which will badly affect the water quality.

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On The Basis Of Amount Of Water

As we know that the canal flow cannot slow means that it has peak flow or the amount of canal is change than natural drain when their will no cross drainage work provide then it will mixed with each other due to which discharge of canal will also mixed with natural drain which causes a hydraulic failure of their structure.

Types Of Cross Drainage Work

Type-I Irrigation Canal Passes Over The Drainage

It involves the following

i) **AQUEDUCT**

It is the hydraulic structure in which the irrigation canal is taken over the drainage and the suitable bed level of canal is higher than the extreme flood level of drainage.

ii SIPHON AQUEDUCT

It is the hydraulic structure of irrigation canal over drainage and in which the canal bed level is lower through which the drainage cannot easily pass through it.

TYPE-II DRAINAGE PASSES OVER THE IRRIGATION CANAL

i) SUPER PASSAGE

It is the hydraulic structure in which the drainage passes over ~~canal~~ canal. In this passage of structure suitable when the bed level of the drainage is higher than extreme flood level of irrigation canal. The water can passes clearly.

ii) SIPHON SUPER PASSAGE

The hydraulic structure in which the drainage passes over canal. In this passage of structure suitability when the bed level of drainage is below extreme flood level of canal and the ~~canal~~ canal water cannot pass through it clearly.

TYPE III DRAINAGE AND CANAL INTERSECT EACH OTHER AT SAME LEVEL

i) LEVEL CROSSINGS

In this hydraulic structure when the bed of canal and drainage stream are same and their quality and quantity is not much different then they are allowed to mix with each other and passes through a canal regulator and stream regulator.

ii INLET AND OUTLET

When the canal meets small stream or drain at same level. drain is allowed to inlet and at some point apart from distance the drain is allowed to outlet through stone pitching.

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Q2 Question 2 (a)

Ans

	WEIR	BARRAGE
1)	A low dam built across a river to raise the level of water stream or regulate its flow	An artifical barrier accross a river are estuary to prevent flooding and irrigation or navigation or to generate electricity by tidal power
2)	Weir has high crest	Barrage has few crest
3)	In weir shutter impart length has height of 2m	In barrages gates over entire length and greater height
4)	In weir shutter dropped to poss flood	In barrage gates are raised higher clear of high flood to pass flood.
5)	Raished crest causing sitting upstream	Less sitting upstream due to low crest

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Question 2 (b)

Ans REYNOLD NUMBER

The ratio of initial forces to the viscous forces within a fluid which is subjected to relative movement due to different fluid velocitys.

LIMIT OF REYNOLD'S NUMBER

FOR LAMINAR FLOW

For the laminar flow the Reynold's number is less then 2000

$$Re < 2000$$

FOR TURBULENT FLOW

For the turbulant flow the Reynold's number is greater than 4000.

$$Re > 4000.$$

FOR TRANSITON FLOW

For the transitional flow reynolds's number is between 2000 to 4000

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$2000 \leq Re \leq 4000$

LOWER CRITICAL VELOCITY

The ~~veloci~~ critical velocity at which the laminar flow stops or the laminar flows enter to the transitional flow at that point velocity is known as lower critical velocity.

HIGHER CRITICAL VELOCITY

The velocity at which the transitional flow enter the turbulant flow or the turbulant flow starts is called higher critical velocity.

QUESTION-NO-3. PART (A)

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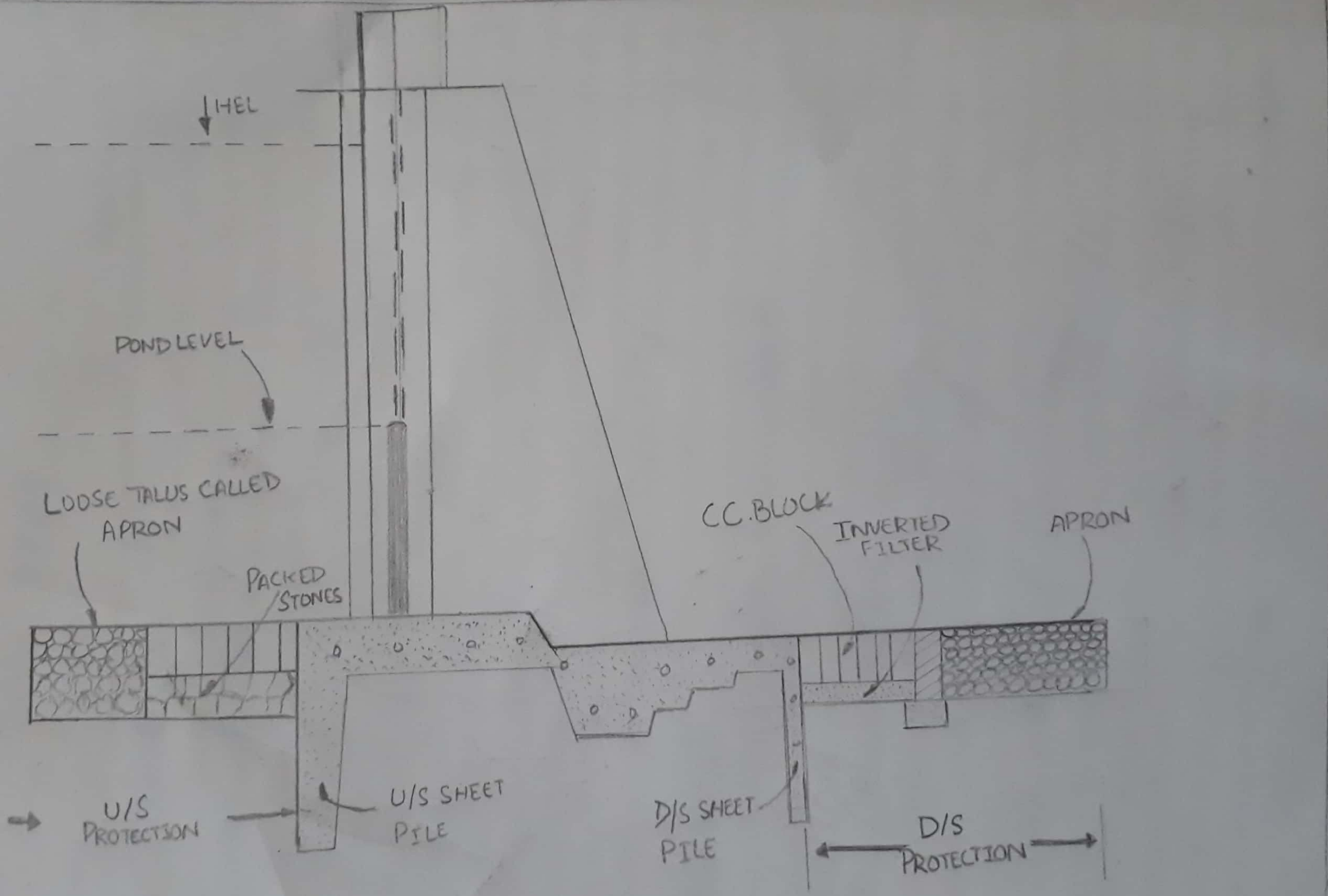

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Question 3 (b)

Ans **EXPLANATION**

After many experimental results have proposed to predict the 'maximum' or equilibrium scour depth. In general these assume the relationship through the formula:

$$y_s/b' = \phi(y_o/b', F_r, d/b')$$

where b' is the pier width
y_o is the upstream flow depth
d is the sediment size
F_r is the Froude number

Later on Laursen's (1962) experimental results underestimate the scour depths, compared to many Indian experiments (Inglis 1949) which suggest the formula

$$y_s/b' = 4.2(y_o/b')^{0.78} F_r^{0.52}$$

The indian field data suggest that the scour depth should take twice regime scour depth.

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In the case of live beds (a stream with bedload transport) the formula

$$y_s/y_0 = (B/b')^{5/7} - 1$$

predicts the maximum equilibrium scour depth. In relatively deep flow a first-order estimate of (clear) local scour (around pier) may be obtained by

$$y_s = 2.3 k_\alpha b'$$

where k_α = angularity coefficient which is a function of the pier alignment, i.e angle of attack of approach flow.

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Question : 4

GIVEN DATA

$L.L = 1.5\ kip/ft^2 = 1500\ lb/ft^2$
$D.L = 300\ lb/ft^2$
$\gamma = 100\ lb/ft^3$
$\theta = 30^\circ$
$f_y = 60ksi$
Use of concrete = 1:2:4

Thickness = 0.92m = 3ft
Inside dimension = 15ft x 15ft

REQUIRED

Design a box culvert = ?

SOLUTION:

1) LOAD CALCULATION

Total load carry on top slab = self weight of slab + L.L + D.L

Self weight of slab $= 3 \times 150$
$= 450\ lb/ft^2$

$w = 450 + 1500 + 300 = 2250\ lb/ft^2$

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2) COEFFICIENT OF EARTH PRESSURE.

$$Ka = \frac{1 - \sin d}{1 + \sin d}$$

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

$$Ka = 0.33$$

3) LATERAL PRESSURE DUE TO (D.L+L.L)

= Total vertical load (L.L+D.L) x ka

$= (1500+300) \times 0.33$

$= 594 \text{ lb/ft}^2$

4) Lateral Pressure due to Soil

$= ka \times \gamma h$

$= 0.33 \times 100 \times 18$

$= 594 \text{ lb/ft}^2$

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5) LATERAL PRESSURE

i) TOP

= lateral pressure due to (D.L + L.L)

= 594 lb/ft^2

ii Bottom

= lateral pressure due to (D.L + L.L) + lateral pressure due to soil

= 594 + 594

= 1188 lb/ft^2 Ans