QUESTION # 01

PART A Answer :-

## CULVERT :-

Culvert is define As : it is a structure that can allows water to flow under a road, trail and railroad or similar obstruction from one side to other side. Typically embedded. So as to surrounded by soil a culvert may be made from reinforced concrete or pipe ..

## ⇒ CAUSWAY :-

It is a track, road or railway on the upper point of an embankment across a low or wet place of water. It is constructed of earth, masonry wood or concrete. ONCE of the earlist known wooden causways is the sweet track it the somerset levels.

=> Difference between Them :-

causway

is road that is raised, as to above water, marshland etc while culvert is transverse channel under a road or railway for the draining of water.

⇒ NEXT Question # 01.
PART B

CROSS DRAINAGE WORKS :-

Irrigation structures constructed for carrying the canal water safely over or under the drainage water called cross Drainage works.

⇒ It is a structure carrying the discharge from the nature stream across a canal intercepting the stream. Canal comes across obstruction like rivers, natural drains.

# => NECESSITY of cross Drainage Works

it require to dispose of the drainage water so that the canal supply remains uninterrupted. A cross drainage work is also called as drainage crossing.
The canal at a cross is Generally been taken either over or below the drainage.

=> Types 1

structures falling under this type:-

=> AQUEDUCT

=> syphon Aqueduct:-

1 Aqueduct:- The canal bed level is above the discharge bed level so canal is to be constructed above drainage.

A canal trough is to be constructed

In which canal water flow from upstream to downstream. This canal trough is to be rested on number of piers.

The drianed water flow through their piers upstream to down stream. The canal water level is referred as fully level (FSL) and drainge water level is refeed as high flood level (HPL) The High flood level is below the canal bed level. IT is similar to bridge instead of roadway or railway.

Syphon Aqueduct :-

Canal water is carrier above the drainge but the high flood level (HFL) of drainge is above the canal th trough. The drainge water flows

Under syphonic action and there is no pressure in the natural drain. The construction of the syphon structure is such that the flooring drainge the construction of the syphon aqueduct structure is such that the flooring of drain is depressed downwards by constructing a vertical drop below to discharge high flow drain through the depressed concrete floor. It is more often constructed and better than sample aqueduct through costlier.

Types of #

=> Super passage :-

=> Canal Syphon :-

## Super passage :-

It carries drainge above canal at the canal bed is below drainge bed level. The drainge through is to be constructed at road level and drainge water flow through this from upstream to downstream and the canal water flow through the piers which are constructed below the drainge through as supports.

The full supply through the level canal is below the drainge through the structure. the water in canal flow gravity and possess the atmospheric pressure. This is simply reverse of aqueduct structure.

CANAL Syphon :-

Drainage is carried over canal similar to a super passage but the full supply level of canal is above the drainage trough. so the canal water flows under syphonic action and their is no presence of atmospheric pressure in canal.

when compared, super passage is more often prepared than canal syphon b/c in a canal syphon, big disadvantage is that the canal water is under drainage through so many defective minerls or sediment deposited cannot be removed with ease like in a case of syphon aqueduct.

Type # 03:

=> Drainage and canal intersection each other of the same level.

IN The case of drainge water is to mixed with canal water level cost of construction is less that but still clearence and maintance of canal water becomes really difficult.

So the structure falling under this stratgy are constructed with outmost care.

=> Level crossing:-

When the bed level of canal is equal to the drainge bed level. Then crossing is to constructed.

It consist of following steps:

=> construction of wier to stop drainge water behind it.

=> construction of canal regulator across a canal.

=> construction of head regulator across a Drainge.

Question Part B Q2

=> Define Reynod' number? limit of Renolyd?
Also define lower & higher velocity

Ans:-

Reynold's Number :-

it is defined as:- The product of density times length divided by viscosity coefficient.

=> Also this is the proportional to the ratio of initial forces and viscous forces in a fluid flow.

=> Limit for LAMINAR & Turbulent:-

LAMINAR :-

If the Number is less than 2100 than the flow in the pipe is laminar.

Turbulent :-

If the reynold number is greater than 4000 then it will turbulent

=> Neither laminar nor turbulent flows

When the reynolds Number is between 2000 and 2800 Then the flow is neither laminar nor turbulent.

=> Lower Critical Velocity :- The velocity at which flow changes from laminar to transition called Lower critical Velocity.

=> Higher Critical Velocity :- The velocity which flow changes from transition to turbulent is called Higher critical Velocity

Question 02 :-

PART A.

Difference between WEIR & BARRAGE

| WEIR | BARRAGE |
|---|---|
| => Low cost | => High cost |
| => low control on flow | => Relatively high control and water level by operations of Gates. |
| => Afflux created is high due to relatively high weir crests. | => Usually a road can be conveniently and economically combined with a Barrage where necessary. |
| => Chances of silting on the upstream is more | => Silting may be controlled by Judicial operation gates. |
| => No provision for transport communication across the river. | => Due to low crest of weirs the afflux during high floods is low. Since the Gates may be lifted up fully above the High |

Q4 No # 3 Part b

Ans:-

If the contracted width the bridge length L is less than the regime width the normal scour depth is then given by equation.

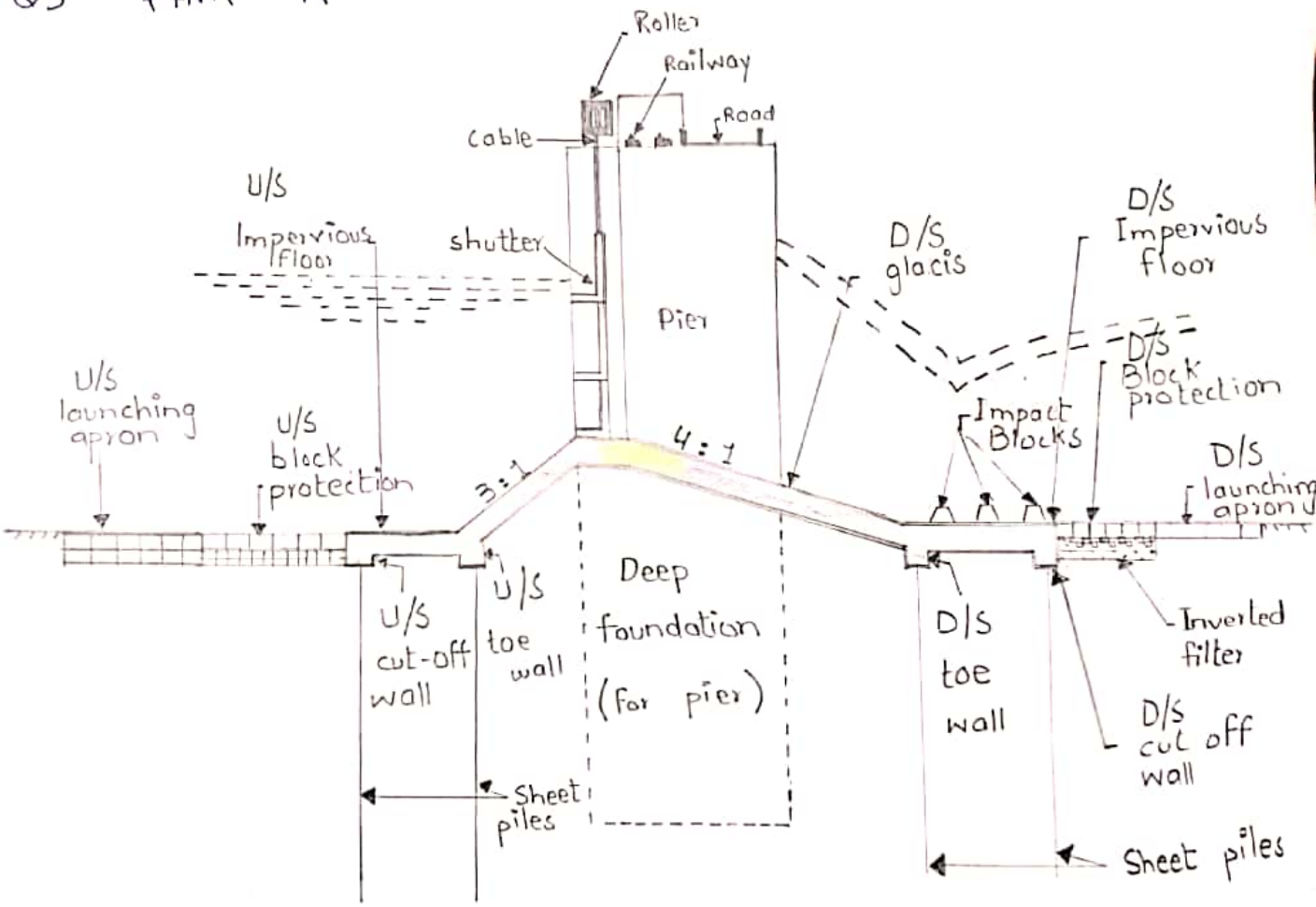
$Dn = Rs (W/L)^{0.61}$

where R is the regime scour depth

=> The maximum scour depth for single span bridge is 25% more than the normal depth if the bridge is multi span than the scour will be 100% more than the normal scour.

If the contraction is predominant the maximum scour depth is maximum from case 1 and case 2 and is given by $Dmax = Rs (W/L)^{1.56}$

Q3 PART A.




Component parts of barrage

Question # 4

Given Data

⇒ Inside dimension = 15 ft × 15 ft

L.L = 1.5 k/ft² = 1500 lb/ft²

D.L = 300 lb/ft²

⇒ Unit weight soil = 100 lb/ft³

⇒ Angle of repose = 30°

Use concrete of 1:2:4 ratio

$f_y$ = 60 ksi

thickness = 0.92 m = 3 ft

⇒ Required :

Design 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 × 150

= 450 lb/ft²

w = 450 + 1500 + 300 = 2250 lb/ft²

2: Co-efficient of Earth Pressure:-

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

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

Ka = 0.33

3) Lateral pressure due to (D.L+L.L) lb

= Total Vertical load = (L.L+D.L) × ka

= (1500+300) × (0.33)

= 594 lb/ft²

4 lateral pressure due to soil

= ka × γb

= 0.33 × 100 × 18

= 594 lb/ft²

5 Lateral pressure

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

= 594 lb/ft²

Bottom:

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

= 594 + 594

= 1188 lb/ft² Ans.