FinaL

Name	Tauseef Ali
I.D	7701
Section	B
instructor	Eng- Adeed.
Data	24/6/2020
Subjected	hydraulic structure.

Q1 part (a)

Culvert:

A Culvert is a structure constructed under road ways or rail ways to provide cross drainage or take electrical or other cable from one side to other.

OR

Culvert is a small bridge having length of 6m or less then 6m

Culvert is parament drainage.

Cause way:

Cause way is a road paved dip which allows the floods to pass over it. It may or may not have opening or vent to allow low water to flow.

cause way can be constructed of earth masonry, wood or concrete.

A Cause way is a track, road or railway on the upper point of an embankment across a low or wet place or piece of water.

Culvert:

Culvert work as bridge to pass on it.

It is normally use for natural flow of water for controlling it

Culvert having a shaple of tunnel carring a stream of water under a road or Railway

Causeway:

* It is supported mostly by earth or stone.
* Not it is not a bridge because it support a roadway between piers.

A causeway is built on an ambankment

Type of culvert

- Arch culvert -
- Slab culvert -
- Box Culvert.
- Pipe culvert.

Type of causeway

* flush Causeway
* low level causeway.
* high level causeway.

① 1 part(B)

Q1 part (B)

i) Cross drainage works:-

Cross drain age work is a suitable structure must be constructed at crossing point for the easy flow of water of the canal and drainage in the respective direction. is known as cross drain age work.

Necessary:-

- It is required to dispose of the drainge water so that the canal supply water remain uninterrupted.
- The water of canal and the drainage get inter mixed at the crossing point. The canal drainge work are required for the design discharge of soomth running.
- The water of canal and drainage can not be diviated to their natural direction so the cross drainage must be required to mantaine their natural direction of flow.

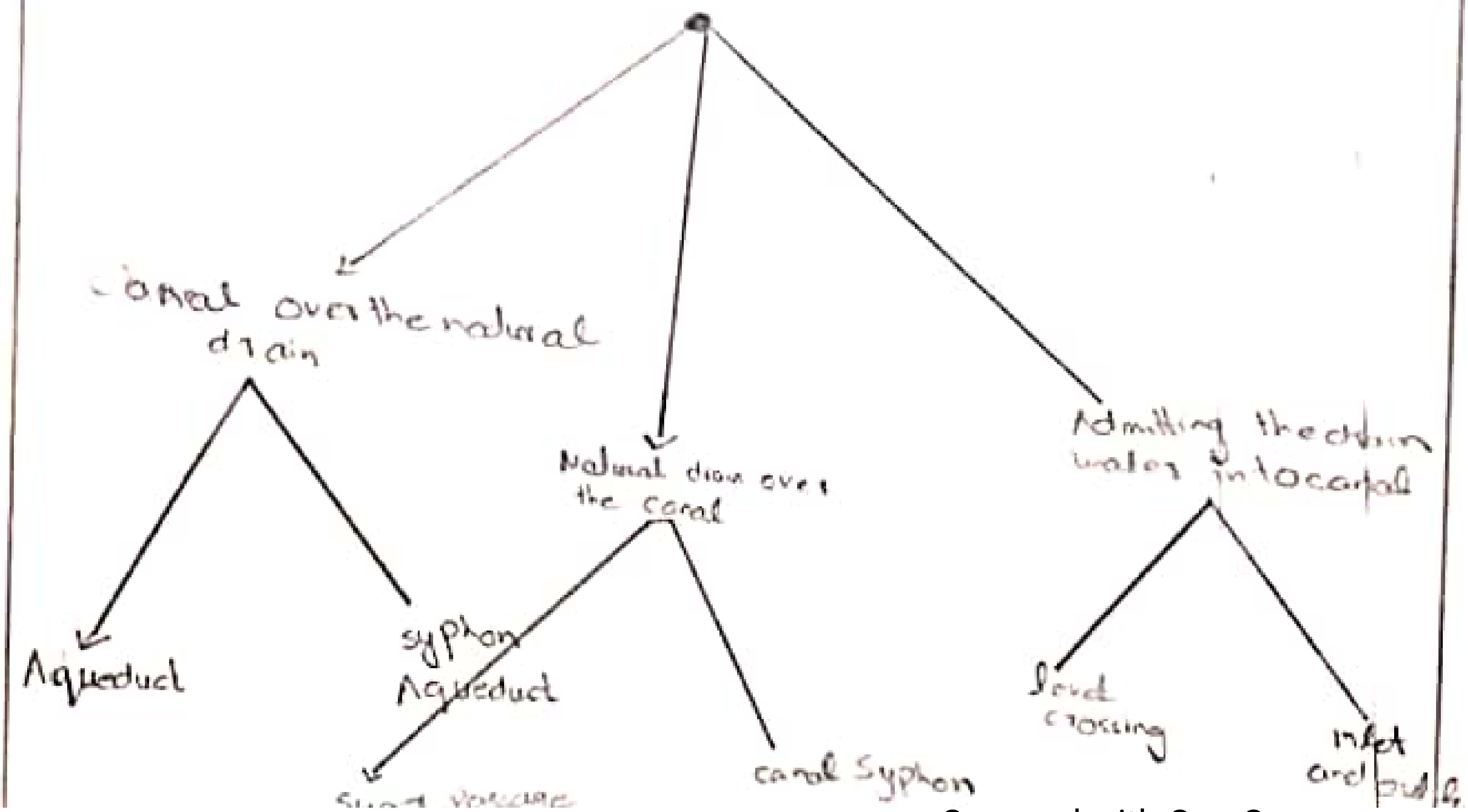
Sunt passage

Type of cross drainag

Type I (irrigation) canal passes over the drainage
- ⓐ Aqueduct.
- ⓑ Siphon Aqueduct.

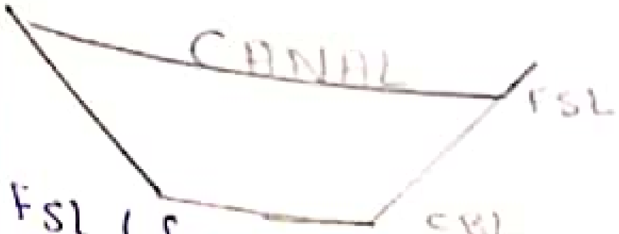
Type ② (drainage pass over the irrigation cha
- ⓐ Super passage.
- ⓑ Siphon super passage.

Type ③ (Drainage and canal intersection each other of the Some levell
- ⓐ level Crossing.
- ⓑ in let & out let.

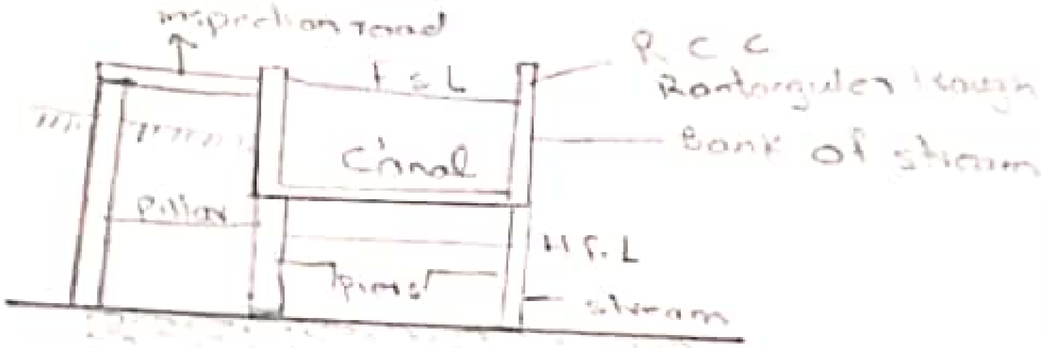


Type 1 Irrigation canal passes over the Drainage.

- Aqueduct: hydraulic structure in which the irrigation canal is taken over the drainage.
- high flood level of drainage should remain lower then the level of the Cb anal bed.

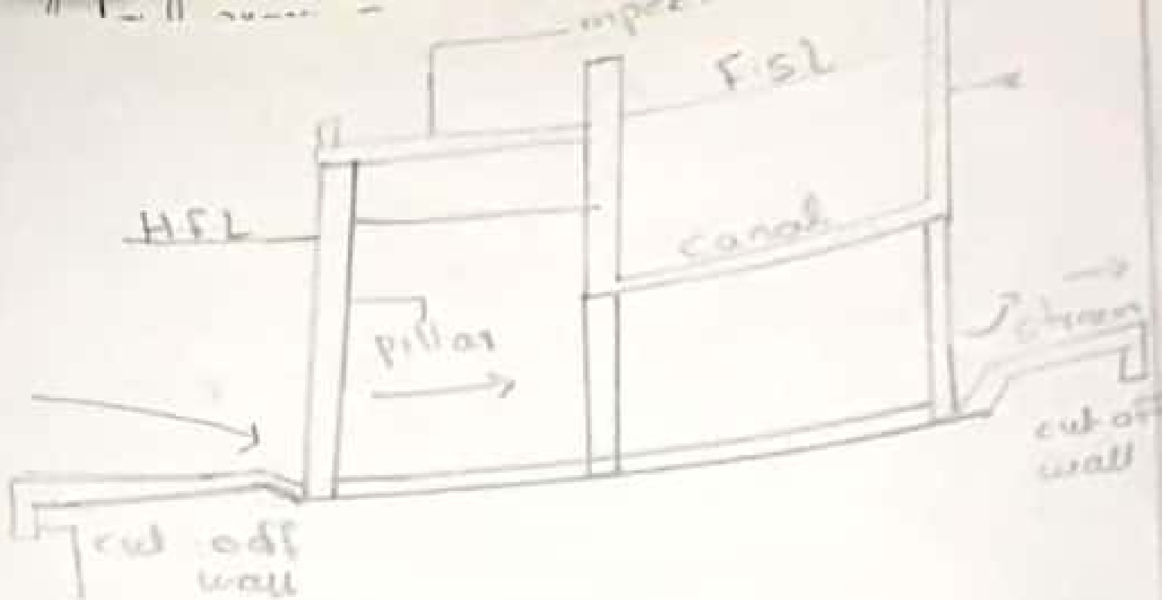


FSL (full supply level)
CBL (canal bed level)
HFL (high flood level).
SBL (stream bed level).



Siphon Aqueduct

A structure where the chanal is taken over the drainage but the drainage water cannot easily pass below the canal.
It is constructed where the water surface level of the drain at HFL is higher than then the canal bed.



Type ②

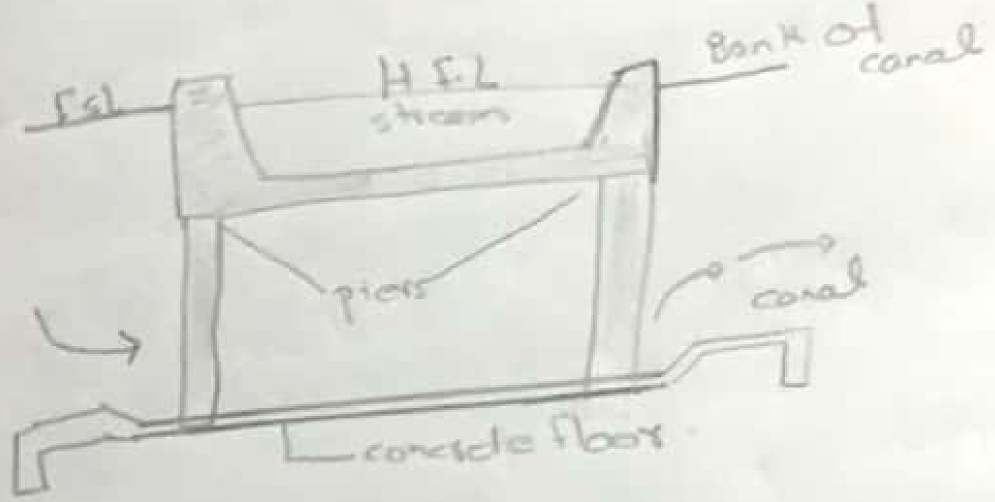
Super passage.

The structure in which the drainage canal is taken over the irrigation canal is knows as super passage.

- A super passage is reverse of Aqueduct constructed where the the bed of drain is well above the canal F.S.L.

Siphon super passage

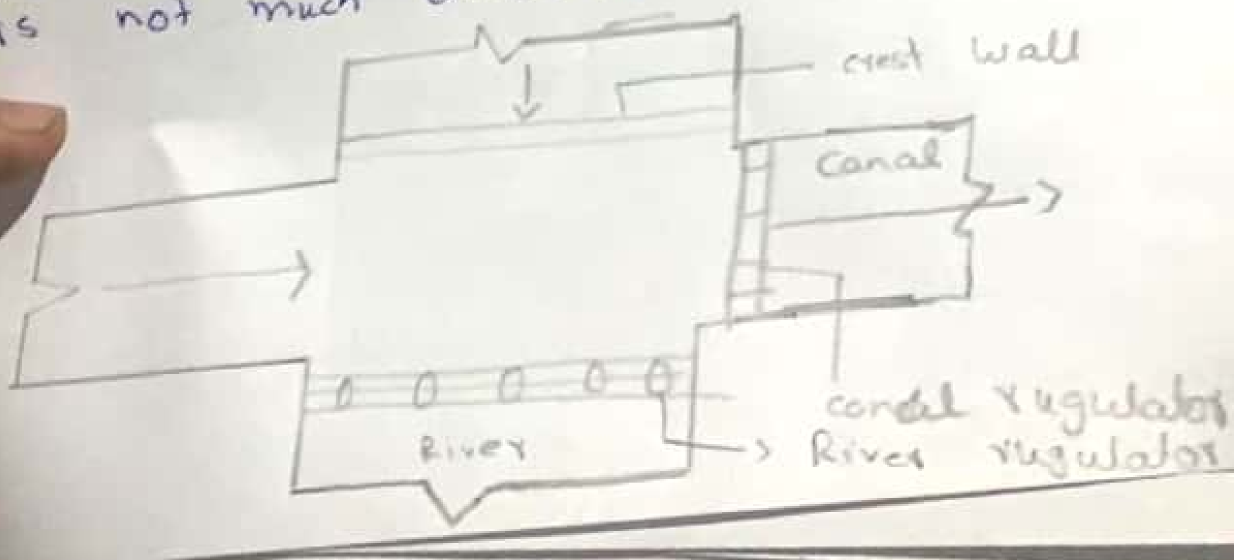
A structure in which the drainage is taken over the irrigation canal but the canal water passes below the drainage under siphonic action. constructed where full supply level is higher than bed of the drain



Type #3

level crossing

when the bed level of canal and the stream are approximeltly the same and the Quantity of water in canal and stream is not much different.



Q #2 part (A)

Weir:

A low dam built accross a river to raise the level of water upstream

OR

Weir are commonly used to control the flow rate of river during period of high discharge.

Sluice gate is used to increase or decrease the volume of water going out

Barrage:

A barrage is type of low head diversion dam which consist of numbre of large gate that can be opened or closed the control amount of water passing throught.

Barrage are classified into three type.

- upstream sheet piles.
- intermediate sheet piles.
- Down stream sheet piles.

Weir	Barrages
low cost	high cost
low control on flow	Relatively high control on flow and water levels by operation of gate
gate over entire length	shutter is part length.
gate are of greater height	shutter are of smaller height.
control on rivaflow	no control on river flow
longer construction period	shorter construction period
costly structure	Relatively cheaper structure.

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Q No #2 part (b)

Reynolds no: It is a ratio of inertial force to viscous force is called Reynold number.

OR

The product of density time length divided by viscosity co-efficient.

$$Re = \frac{\rho u D}{\mu} = \frac{u D}{\nu}$$

ρ = density

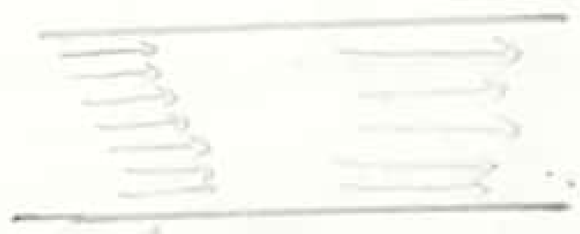
u = flow speed.

D = Diameter.

μ = dynamic viscosity.

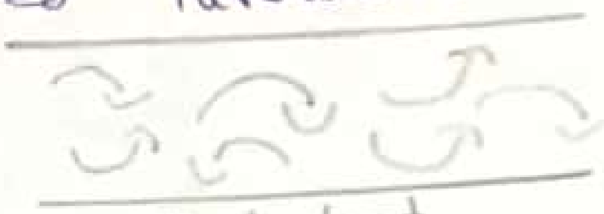
ν = Kinemetic viscosity.

laminar: The flow in pipe is laminar if the reynold numbre is less than 2000



laminar.

* Turbulent: greater then 4000 then the flow is called Turbulent flow.



Turbulent

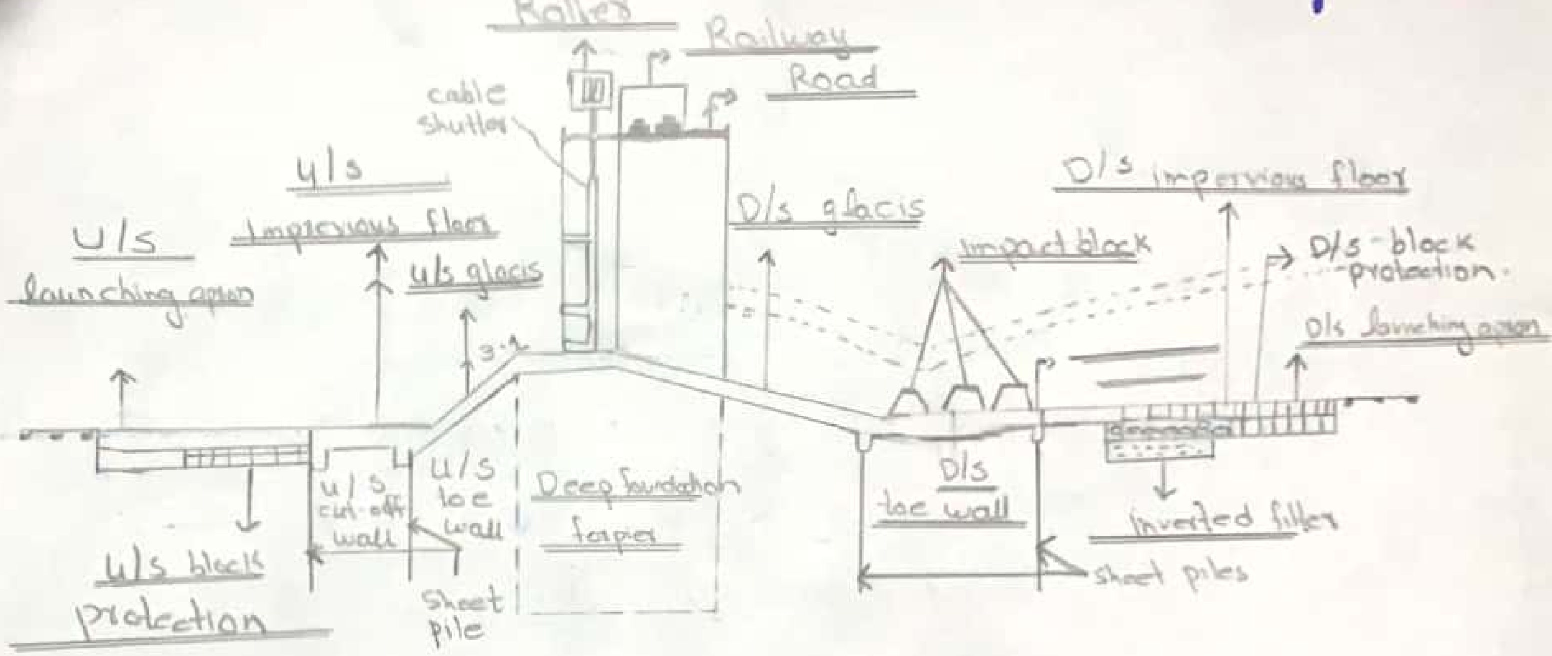
* Neither laminar nor turbulent flow.
when the Reynolds numbre is between 2000, and 4000 the flow is neither laminar or nor turbulent flow

* lower critical velocity.
The velocity at which the flow change from laminer to transition is called lower critical velocity.

* higher critical velocity.
The velocity at which the flow change from transition to turbulent is called higher critical velocity.

Q3 # part A

Q3 part (A)



Component part of barrage

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Q3 part (B)

Several formulae based on experimental result have been proposed to predict 'maximum' or equilibrum scour depth (y_s, below general bed level) around bridge piers. in general these assume the relationship:

$$y_s/b' = \phi(y_0/b', F_r, d/b')$$

Where

b' = is the pier width
y_0 = is the upper stream flow depth.
d = is the sediment size
F_r = is the flow froude numbre.

→ laursen's 1962) experimental resulld underestimate the scour depth, compared to many india experiment (Inglis 1949) which suggested the formula

$$y_s/y_0 = 4.2(y_0/b')^{0.78} F_r^{0.52}.$$

The indian field data also suggested that the scour depth should be taken as twice regime scour depth.

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

$$y_s/y_0 = (B/b') - 1$$

predicts the maximum equilibrum scour depth

In a relation deep flow a first order estimate of local scour may be obtained by

$y_s = 2.3\, K_a b'$

where K is angularity co-efficent which is the funcation of the pier alignment.

The live bed may contribute to an appreciable reduce level scour distinctly layer and cover layer of thickness less than the local scour depend the overall scouring phenomena is different.

The scour depth in the lowering layer, it is given by.

$H = \eta\,(y_2 - y)$.

y_1 & y_2 are uniform flow depth over a flat bed of grain roughness corresponding to the up stream surface particles (d_1) and under lying surface fined particles (d_2) respectively.

Co-efficent of non riffle forming sediments.

$\eta = 2.8$ for design purpose.

— The total scour depth may lead to to a gross under estimate if the lower layer is of fine material.

Q4

Given data

L.L = 1500 lb/ft²
D.L = 300 lb/ft²
thickness = 3 ft

$\theta = 30^\circ$

unit of wt concrete = 100 lb/ft

Fy = 60 Ksi

Section = 15'x15'

for 1:2:4 Rcc concrete = 156 lb/ft

Solution:

- Self wt of slab:

Thickness x unit wt of concrete

3×156 lb/ft

$= \boxed{468 \text{ lb/ft}^2}$

- Total load = (L.L + D.L + Self wt)

$= 1500 + 300 + 468$

$= \boxed{2268 \text{ lb/ft}^2}$

- co-efficient of earth pressure

$$\frac{1 - \sin\theta}{1 + \sin\theta} = \frac{1 - \sin 30}{1 + \sin 30} = 0.33$$

lateral pressure.

① vertical pressure at Top

$(L.L + D.L)\, K_a$

$(1500 + 300)\, 0.33$

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

② pressure of soil

$K_a \times h \times$ unit wt of soil

$= 0.33 \times 100 \times$ ~~15 ...~~ $(15 * 3)$

$= \boxed{6\ \text{~~93 lb/ft~~}^2}$ 594 lbft.

pressure at top $= \boxed{594}$

pressure at bottom = top + Pressure of soil

$= 594 + 594$

$1188\ lb/ft^2.$