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Subject : Hydralic Structure

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Question no 1

Part (a)

Differentiate between Culvert and Causeway.

Ans

Culvent

① An opening through an embankment for the conveyance of water by mean of pipe or an enclosed channel.

② A transverse channel under a road or railway for the draining of water.

③ The Component of a culvert are Comparatively Simpler and include Concrete box.

④ A culvert is an enveloping structure that Consist of two sides a roof and a floor

⑤ A Culvert is Constructed when water needs to be Conveyted through channel or tunnel.

=> Culvert prevent water logging, flood and errosion.

=> There are different type of Culvert

i) Pipe Single or Multiple
ii) Pipe Arch Single or Multiple
iii) Box culvert Single or Multiple
iv) Arch Culvert.

Causeway

① A causeway can be defined as a structure which has double function

a) It allows the normal days weather flow of river stream to pass through the culvert below the roadway.

b) The occasional flood pass both through the culverts and over roadway.

=> Because of have dual function causeway should be construct with great cave.

=> M causeway have failed because of a werong loccation or wrong design.

=> A road that is raised, so as to be above water, marshaland and Similer flow.

=> It is not same like bridge because it supports an roadway b/w piers.

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Question no 1

Part b (b)

Define Cross drainage work. Why it is neccessary ? Explain different types of cross drainage work in detail.

Ans:- => In waste water engg project or irrigation project, when the network of main cannals, branch cannals may have to cross the natural drainges.

=> Like river, streams, nallahs etc at different points with in the Command area of the project.

=> The crossing of the Cannals with such obstacle Cannot be avoided.

=> So Suitable structure must be Constructed at the crossing point for the easyflow of water of the cannal and drainge in the respective direction.

=> Def :- When ever Cannal meet natural drainge a cross drainge is provided.

=> It is a structure Carrying the discharge from a natural stream accross a cannal interpting the stream.

Necessity of cross Drainage work

=> Natural drainage may be present accross the cannal, So the cross drainage work meest be provided for running the irrigation System.

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⇒ At the crossing point the water of the Cannal and the drainage get intermixed. So for the smoothe running of the cannal and its design discharge the cross drainage work are required.

⇒ The Site Condition of the crossing point may be such that without any suitable structure the water of the Cannel and drainge can be diverted to their natural direction, So the cross drainge works must be provided to maintain their natural direction of flow.

⇒ Simply Cross drainge work is required to drain off the drainage water that supply of water didnot interrupted.

Types of Cross drainge work

i) Acqueduct
ii) Super passage
iii) Level crossing
iv) Inlet and outlet

i) Aqueduct:- ⇒The hydraulic structure in which the irrigation Canal is taken over the drainge i.e as river, stream etc is known as aqueduct.

⇒ In this case, the drainage water passes clearly below the Canal.

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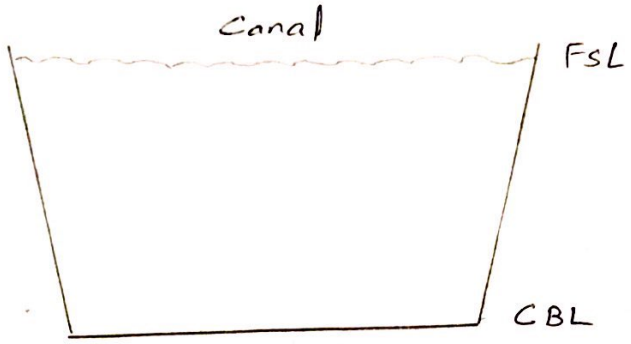

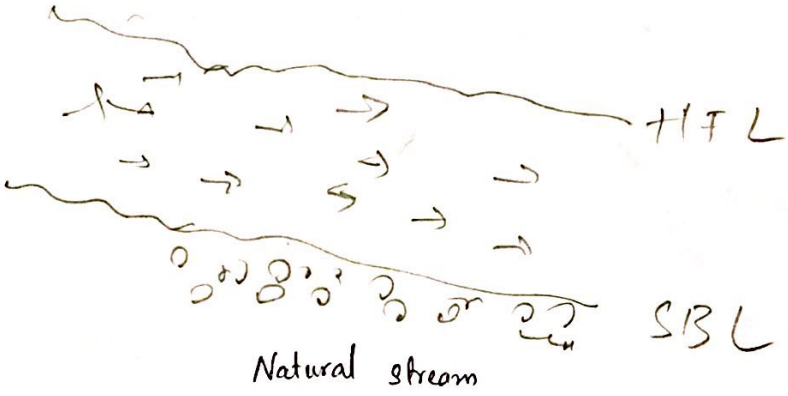

ii) Super passage :-

=> The hydraulic structure in which the drainage is take over the irrigation Canal is known as Super passage

=> The water of the Canal passes clearly below the drainage

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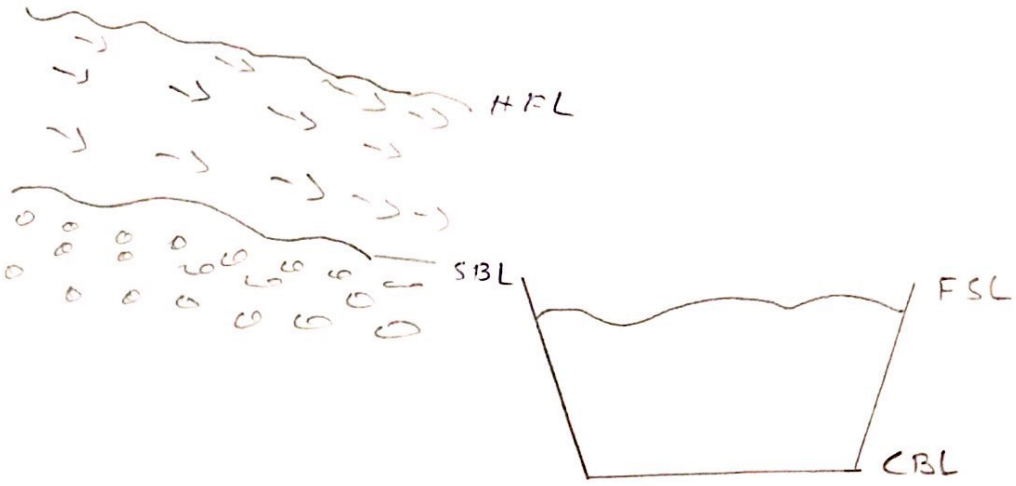

(3) Level Crossing:

=> When the bed level of Canal and the stream are approximately the same and quality of water in Canal and stream is not much different.

=> Water is disposed through Canal and stream in required quality => Level crossing consist of

i) Crest wall
ii) Stream regulator
iii) Canal regulator.

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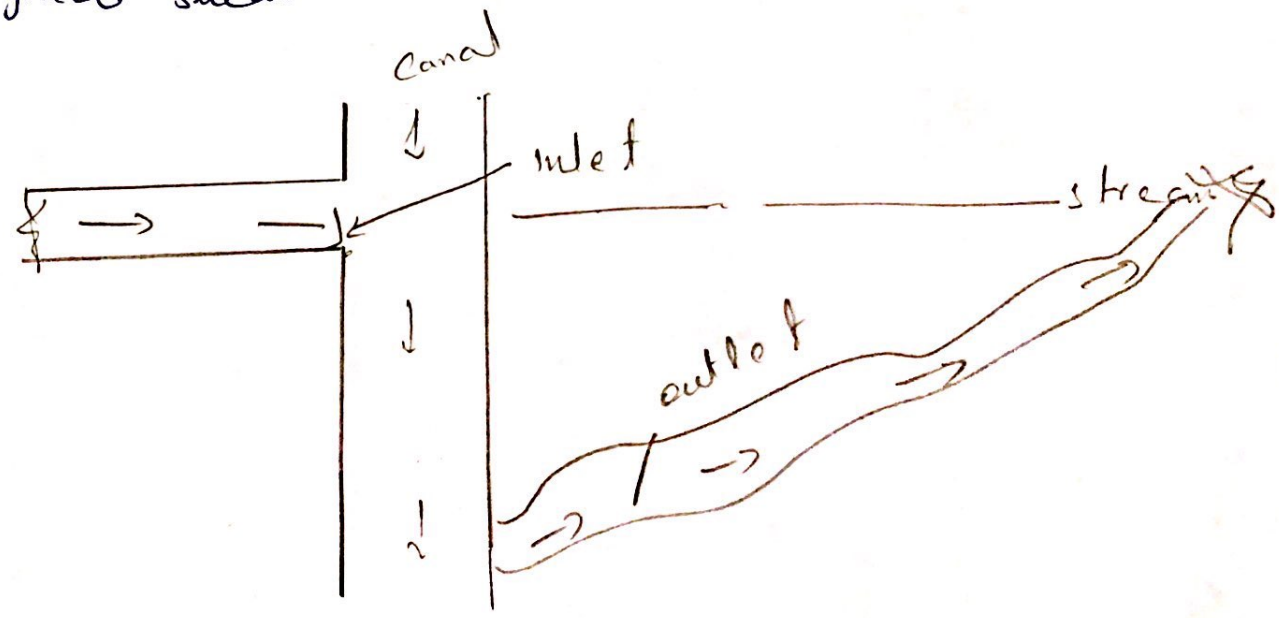
(4) Inlet and outlet

When irrigation canal or waste water project meet a small stream or drainage at same level drain is allowed to enter the canal inlet at same distance from this inlet point a part of water is allowed to drain as outlet which eventually meet the original shear.



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Question 2

Part a

Differentiate between weir and barrage.

Weir	Barrage
1) Weir is a solid obstruction put across the river to raise water level and divert the water into canal.	1) The function of barrage is similar to that weir but the heading up the water is effected by the gate alone.
2) If water is store for a small period of short supplies it is called storage weir.	2) Barrage are used to convert the tidal energy in electricity by forcing water through turbine by generator.
3) Weir is used to control the flow rates of river of high discharing.	3) No solid obstruction is put accross the river. The crest level in the barrage is kept at low land.
4) If water is store for small period of short supplies it is called storage weir	4) During the flood the gab are raised to clear off high floor level enabling the high flood to pass down stream with minimum affect.

Types of weir

Sloping weir
Vential drop weir
ogee weir
Labyrinth weir

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Qno 2

Part b

Reynold Number

=> It is the Ratio of inteia force to viscous force is Said to be Reynold Number (R_n)

=> The value of Critical Reynold number different different for different geometries and flow Condition.

=> For Circular pipe the value of Critical Reynold number is $R_a = 2300$

=> The value of the Reynold number points us to determine whether the flow is laminar or turbulent.

Types of flow Reynold's number

1) Laminar flow:

=> The flow is a pipe is laminar if the reynolds number is less than 2000.

=> If Reynold number, $RN < 2000$ the flow is Laminar flow

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⇒ Neither Laminar or Turbulent flow

The Reynold no in b/w 2000 and 2500 So the flow is called neither laminar aur turbulant flow.

Critical Velocity

⇒ The velocity at which the flow change from laminar to turbulance is known as critical velocity.

⇒ It is divide into two type

i) lower Critical velocity
ii higher Critical velocity

i) Lower Critical velocity

⇒ The velocity at which the flow enter from laminar to ~~turb~~ transition is called lower Critical velocity.

ii) Higher Critical Velocity:

A velocity at which flow changes from transition to turbulent as called higher Critical velocity.

——— X ——— X ———

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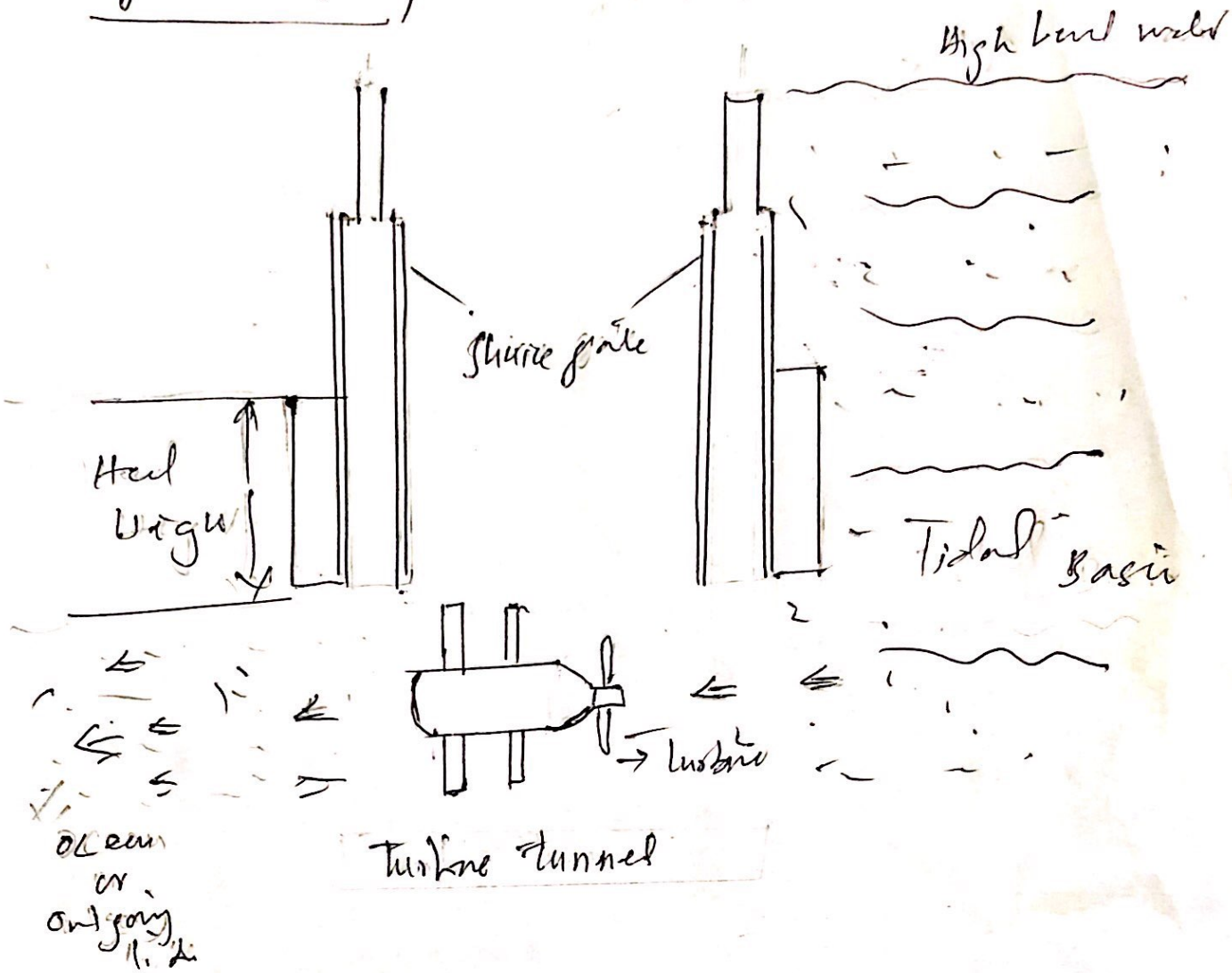
(10)

Q no. 3

(a)

⇒ Barrage and its components :-



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Q.no: 3 (14)

Part (b)

Scour Depth

If the width (D) is less than that the regime width (W) the normal scour depth (D) is given by

$$D_N = R_s \left(\frac{W}{L}\right)^{0.61}$$

: R_s is the regime scour depth

Maximum:

⇒ The maximum scour depth in a single-span bridge with a straight approach is about 25% more than the normal scour.

⇒ In the case of a multi-span structure the curved approach is 100% more than the normal scour.

⇒ Maximum scour depth is given

$$D_{max} = R_s \left(\frac{W}{L}\right)^{1.56}$$

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Qno 4

Given Data

L.L = 1.5 kip/ft²

D.L = 300 lb/ft²

θ = 30°

Unit weight of Soil = 100 lb/ft²

Dimension 15'x15'

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 + D.L

Self weight = 3x15 = 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

$$ka = \frac{1 - \sin\theta}{1 + \sin\theta}$$

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

Ka = 0.33

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(3) Lateral pressure due to (Dead load + Live load):

= total vertical load x ka

= (L.L + D.L) x ka

= (1.5 + 0.3) x 0.33

= 0.594 kip/ft²

or

= 28.4 kN/m²

(4) Lateral pressure due to Soil:

= ka x γsoil x h

0.33 x 0.1 x 18

= 0.594 kip/ft²

or

28.4 kN/m²

(5) Lateral pressure at top due to L.L + D.L = 0.594 kip/ft²

= 28.4 kN/m²

(6) Lateral pressure at Bottom

= Lateral pressure due to (LL + DL) + lateral pressure due to Soil.

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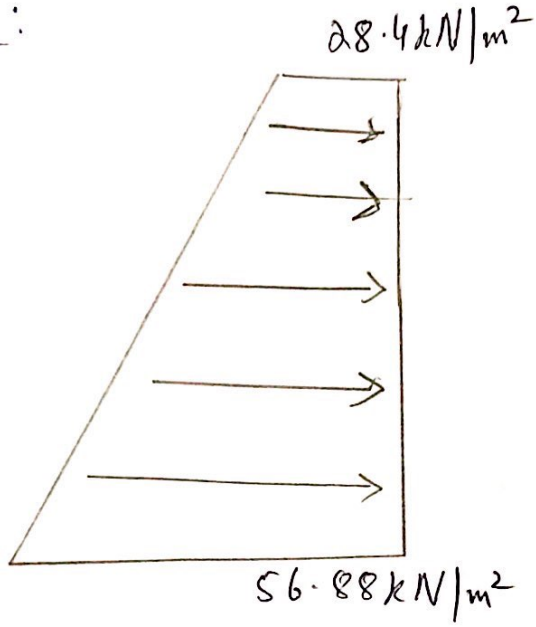
$= 0.594 + 0.594$

$= 1.188 \text{ kip}/\text{ft}^2$ or

$= \boxed{56.88 \text{ kN}/\text{m}^2}$

Diagram:



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