Question 1:-

(a)

Culvert	Causeway
→ Culvert is of a tunnel shape carrying a stream of water under a road or railway.	→ A Causeway is of course a raised, it is built as an embankment.
→ It work as a bridge to pass on it.	→ It is supported mostly by earth or stone.
→ It is normally uses for natural flow of water for controlling it	→ It is not a brigde because it support a roadway between Piers.

Question 1

(b) Cross Drainage work:.

A structure which carry the discharge from a natural stream across a canal intercepting the stream is known as cross Drainage work.

Necessary:.

It is required to dispose of the drainage water so that the canal supply water remain uninterrupted.
At the crossing point, the water of the canal and the drainage works must be provided if get intermixed. So for smooth running of the canal with its design discharge the cross drainage works are required.

Types of cross drainage work

Type 1 (Irrigation canal passes over the drainge)

(a) Aqueduct.
(b) Siphon Aqueduct.

Type 2 (Drainage passes over the Irrigation canal)

(a) Super Passage
(b) Siphon Super Passage

Type 3 (Drainge and canal intersection each other same level)

(a) Level Crossing
(b) Inlet and outlet.

Aqueduct:-

It carries an Irrigation Canal over a drain.

Siphon Aqueduct:-

It carries an Irrigation Canal over a drain and flow of water occur under siphonic action.

Super Passage:-

It carries a drain over an Irrigation Canal.

Siphon Super Passage:-

The hydraulic structure in which the drainage is taken over Irrigation canal, but the Canal water passes below the drain under siphon action.

Level Crossing:-

This structure makes at possible to dispose off drain water softly at same level as that of a canal.

Inlet and Outlet:-

When possible drain water is taken in the canal to be discharged afterward into a drain at suitable location.

Question No 2:-

(a)

Weir:-	Barrage
→ High set crest	→ Low set crest
→ Ponding is done against the raised crest or partly against crest and partly by shutter.	→ Ponding is done by mean of gates.
→ Shutter is of small height, 2m.	→ Gates of greater height
→ No control of river in low floods	→ Perfect control on river flow.
→ Excessive afflux in high flood.	→ High flood can be passed with minimum afflux.
→ Relatively cheper structure	→ Costly structure.

Question 2

(b)

Reynolds Number:-

Reynold number is a ratio of intertreal forces and viscous forces in a fluid flow.

It is used to differenate between types of flow in pipes

Mathmatically $R_e = \frac{\rho V d}{\mu}$

ρ = density
V = velocity
d = characteristic diameter
μ = dynamic viscocity

Laminar flow:-

The flow in a pipe will be laminar if the Reynold number is less than 2100.

Turbulent flow:-

If the reynold number is grater than 4000 then the flow will be Turbulent

Neither Liminar nor Turbulent flow:-

When the Reynold number lies between 2000 and 2800 the flow is transition flow,

Lower critical Velocity:

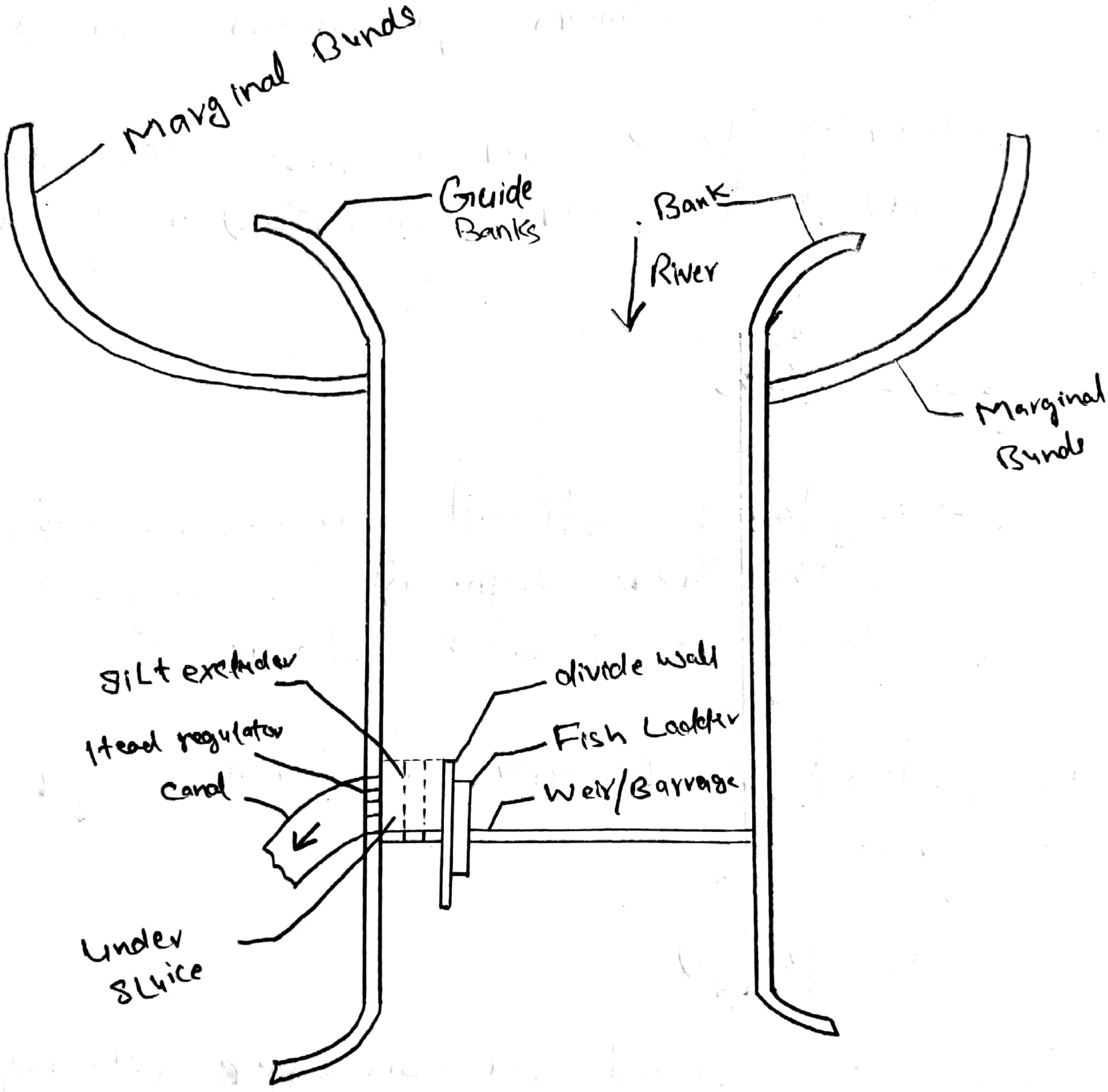
The velocity at which flow changes from Laminar to transition is called Lower critical velocity.

Higher critical velocity:

The velocity at which flow changes from transition to turbulent is called higher critical velocity.

Question 3:-

(a) Barrage and its Component.



Question 3:

(b) Scour depth around bridge:

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

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

b' = Pier width.

y_0 = upstream flow depth.

d = sediment size.

F_r = Froude Number.

Laursen's (1962) experimental results underestimate the scour depths, compared to many indian experiments (Inglis 1949) which suggest the formula (approach flow is normal to the bridge piers).

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

The Indian field data also suggest that the scour depth should be taken as twice the regime scour depth.

In 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

$$y_s = 2.3 K_a b'$$

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

The stepped scour depth in covering layer H is given by.

$$H = \eta (y_2 - y_1)$$

$\eta = 2.6$ coefficient for non-ripple-forming sediment.

y_2, y_1 = uniform flow depth.

Question 4

Given data:-

L.L = 1500 lb/ft²

D.L = 300 lb/ft²

Section Dimension = 15' × 15'

Thickness = 3 ft

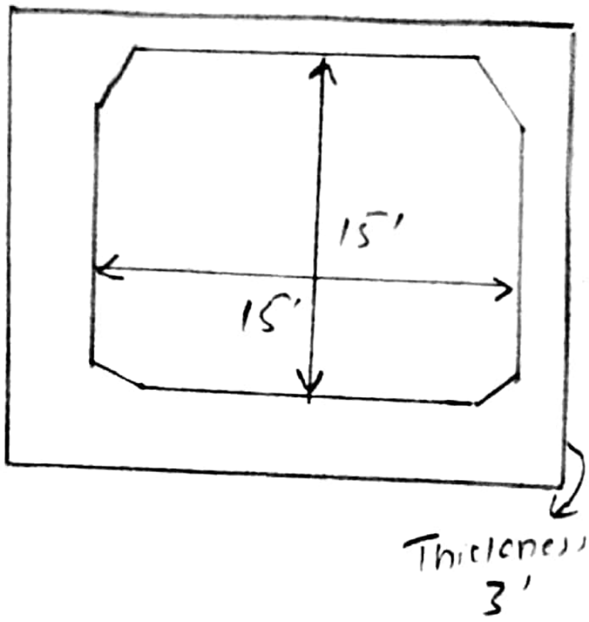
Unit weigh = 3 ft

Unit weight of Soil = 100 lb/ft³

$\phi = 30°$

Unit weight of Concrete = 156 lb/ft³

$f_y = 60$ ksi



Solution:-

Self wt of slab

thickness × unit wt of RCC Concrete

$= 3 \times 156$ lb/ft²

$= 468$ lb/ft²

Total load:-

L.L + D.L + Self wt

$= 1500 + 300 + 468$

$= 2268$ lb/ft²

Co-efficient of earth Pressure

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

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

$= 0.33$

⇒ Lateral Pressure

Vertical pressure at top

(L.L + D.L) Ka

(1500 + 300) 0.33

594 lb/ft²

Pressure of soil

Ka × h × unit wt. of soil

0.33 × (15' + 3') × 100

= 594 lb/ft²

⇒ Later Pressure at to = 594 lb/ft²

pres at bottem

top + pressure of soil

= 594 + 594

= 1188 lb/ft²