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Section	A
Subject	hydraulic
structure	

1) Given data:-

$$\text{Height} = 0.42 \text{ m}$$

$$\text{Depth} = 0.4 \text{ m}$$

$$\text{width} = 1.6 \text{ m}$$

$$\text{length} = 30 \text{ m}$$

$$\text{Slope} = 1 \text{ in } 1000$$

$$\text{Manning's } \eta = 0.013$$

0.3 m neglected the

Velocity approach.

Required:-

Design of culvert: ?

Solution:-

$$H/D = \frac{0.42}{0.4}$$

$$= 1.05 \leq 1.6 \text{ m}$$

Free open channel.

2) Critical = depth:-

$$y_c = \frac{2}{3} H = \frac{2}{3} (0.1) = 0.06 \text{ m}$$

3) Critical = velocity:-

$V_c = \sqrt{g y_c}$ which come
from $Fr = \frac{V_c}{\sqrt{g y_c}}$

for critical flow

$$Fr = 1$$

So,

$$1 = \frac{V_c}{\sqrt{g y_c}}$$

put values

$$V_c = \sqrt{9.81 \times 0.06} \\ = 0.19 \text{ m/s}$$

4) Critical = slope:-

$$S_c = 0.00427$$

5) Discharge Q
 AS we know

$$Q = 2.92 Y_0 \left[\frac{1.2 Y_0}{1.2 + Y_0} \right]^{2/3}$$

Y_0	Q	Y_c
0.1	0.257	0.06
0.2	0.165	0.124
0.3	0.3	0.185

$$Y_c = \left(\frac{Q^2}{g} \right)^{1/3}$$

at the inlet over short
 reach

$$H = Y_0 + \frac{V^2}{2g} + \frac{K_e V^2}{2g} \quad \text{--- (1)}$$

K_e values

- 1) For square edge $K_e = 0.5$
- 2) Flat $= 0.25$
- 3) Rounded $= 0.25$

So we use $K = 0.5$
 for Rectangular box
 Culvert

Y_0	H	Q
0.1	0.119	0.057
0.2	0.2	0.165
0.3	0.3	0.3
	0.4	0.4

The above discharge
 is find through formula

$$Q = cd (1.2 \times 0.6) [2g (H - \frac{1}{2})]^{1/2}$$

$cd = 0.62$

$$Q = 2.08 (H - 0.57)^{1/2}$$

Ans⁽¹⁾ Load on bridge foundation due to scum & the working mechanism:-

Scum of sediments around bridge foundation by the stream is the most significant contributing factor for bridge failure.

The scum failure lead to scum occur with out proper warning & have led to facilities & economic loss over years.

Two Major Categories:-

i) Science driven:-

The Science driven research focuses on understanding the scum mechanism & aims to explain the cause of scum due to different factors.

ii) Engineering driven:-

Engineering driven focuses on estimation, monitoring & counter measures of bridge scum.