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Write the major causes of riverbank failures in Bangladesh.

→ Geological factor: The low laying delta lands of Bangladesh offer little resistance to the hydraulic forces of its rivers during high flow period.

→ Sedimentation in the River beds: our rivers carry more than 1 billion tons of sediment every year and are responsible for the prevalence of flooding which eventually leads to riverbank failure.

→ Groundwater seepage also causes riverbank failure.

→ mature Stage of River: When rivers enter the mature stage (Ganges, Brahmaputra, Meghna) they become meander or braided. These oscillations cause massive riverbank failure.

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The flow in (m^3/s) of a stream at a section in nine consecutive years are given below.
100, 110, 90, 75, 115, 120, 105, 95, 125.
Calculate the 80% dependable flow of the stream.

Sol^n:

Flow(m^3/s)	Rank(m)	Probability, $P=\frac{m}{1+n}$
125	1	0.1
120	2	0.2
115	3	0.3
110	4	0.4
110	5	0.5
100	6	0.6
95	7	0.7
90	8	0.8
75	9	0.9

$n = 9$

$\therefore$ 80% dependable flow = $90 m^3/sec$. Ans

Write four names of the policies, plans, or acts related to water resources management of Bangladesh.

→ Bangladesh Water Act 2013
→ Bangladesh water Rules 2018
→ National water Management Plan (NWMP)
→ Flood Action Plan (FAP)
→ Integrated Coastal Zone Management Plan

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Calculate the drainage discharge in m^3/s to dispose the runoff generated from a catchment of 4 ha after having a 40mm/hr rain using the rational formula. Assume runoff coefficient of 0.5

Soln: discharge, $Q = CiA$

$$= 0.5 \times \frac{40 \times 10^{-3} m}{3600 sec} \times 4 \times 10^{4} m^2$$

$$= 0.22 m^3/sec$$

Write three principles or components of Integrated Water Resources Management.

Soln:

→ Stormwater management

→ Wastewater treatment

→ Water supply

→ Conservation of existing water sources

Draw the qualitative stress-strain diagram of mild steel showing all its components.

See my RCC note

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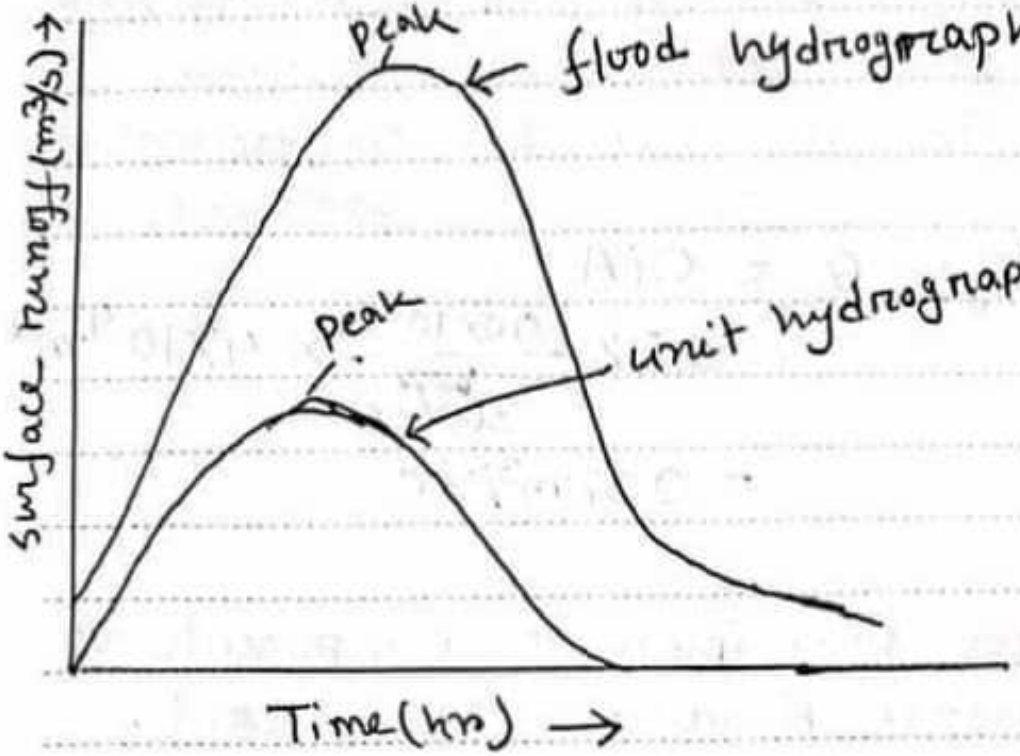
Draw a typical flood hydrograph and a unit hydrograph for rivers of Bangladesh.



water requirement of a crop is 5mm/day and the growing period of the crop is 100 days. Calculate the total water requirement of the crop for an area of 2 ha considering water application and conveyance efficiency of 75% and 50%, respectively.

Soln: Total water requirement = $\frac{\frac{5}{1000} \times 100 \times 2 \times 10^4}{0.75 \times 0.50}$ m

$\simeq 26666.67 \, m^3$ water

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Write the names of the test to be perform to obtain the gradation or texture of fine grained soils?

→ Sieve Analysis

→ Hydrometer analysis

Write three basic governing equations applicable for open channel flow as well as pipe flow.

→ ~~Continuity~~ Continuity equation ($A_1V_1 = A_2V_2$ = constant)

→ Bernoulli's equation

$$\left(\frac{p}{\rho g} + \frac{v^2}{2g} + h = \text{constant}\right)$$

$\frac{p}{\rho g}$ ↙ Pressure head

$\frac{v^2}{2g}$ ↘ velocity head

h ↘ Potential head

→ Momentum equation,

Force = ~~Rate~~ rate of change of momentum

$F = \rho Q(V_2 - V_1)$

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Draw qualitative gradation curves for a well-graded and a gap-graded aggregate sample

See my Engineering Materials note.

~~# Draw qualitative~~

During a soil test, SPT value was found to be 20, explain its meaning. As a site engineer, at what stage will you stop the SPT test?

SPT N value 20 means, the number of blows required for 30cm(12inch) penetration is 20.

I will stop the SPT test if →

(i) 50 blows are required for ~~300mm(12in)~~ any 150mm(6in) increament.

(ii) 100 blows are obtained for 300mm(12in) penetration.

(iii) 10 successive blows produce no advancement.

Date :
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Write four major problems of using ground water as a source of water supply in Bangladesh.

→ Drying up of wells
→ groundwater becoming saline due to evaporat
→ reduction of water in streams & lakes
→ land subsidence
→ decreasing ground water level

Write the expressing unit of the following parameters : (i) salinity (ii) Turbidity (iii) Hardnes (iv) TDS

Soln

(i) Salinity — µmhos/cm
(ii) Turbidity — NTU
(iii) Hardness — mg/L
(iv) TDS — mg/L

In a sieve analysis, 5% of the sample pas through 0.075mm sieve and 25% passes through 4.75mm sieve ; Determine the % of coarse and fine aggregates as well as silt and clay materials.

Ans: coarse aggregate = (100-25) % = 75%

Fine aggregate = (25-5) % = 20%

Silt & clay = 5%

What is rating curve ? Write the equation of a typical rating curve

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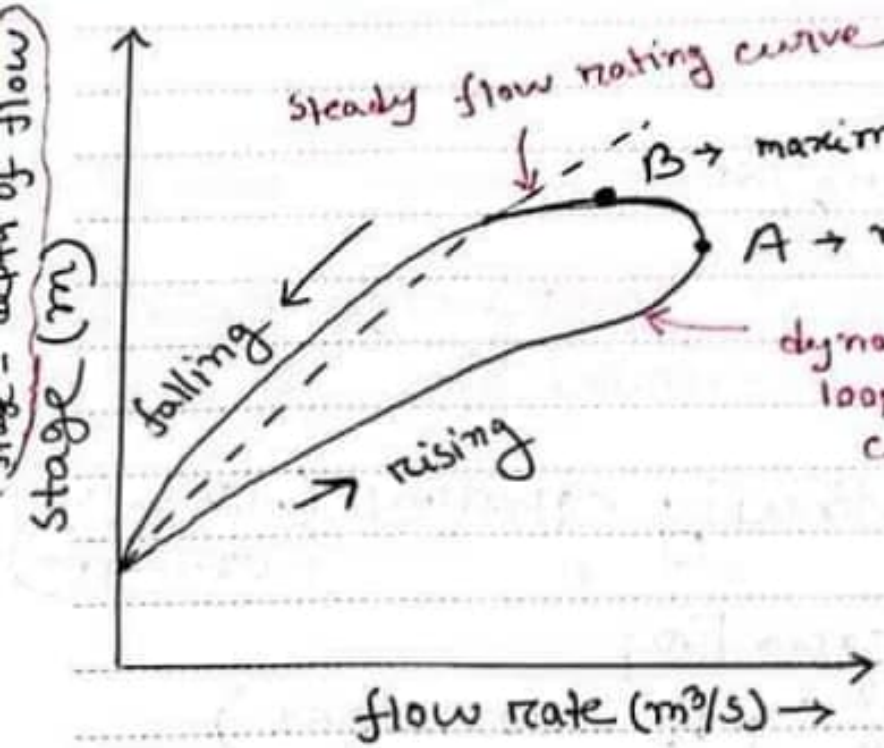
~~# Draw a typical flood hydrograph and a usual hydrograph for rivers of Bangladesh~~



Rating curve equation, $Q = C(h+a)^n$

Q = flow rate
a = stage as zero flow
h = stage height
C, n = constants

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* The areas enclosed by the contours in a lake are as follows:

Contour (m)	270	275	280	285	290
Area (m^2)	2050	8400	16300	24600	31500

calculate the volume of water between the contours 270m & 290m using the Prismoidal formula.

Soln: Contour interval, d = 275 - 270 = 5m

Volume by prismoidal formula

$$= \frac{5}{3}[2050 + 31500 + 4(8400 + 24600) + 2(16300)]$$

$$= 330250 m^3$$

* Simpson 1/3 এর Prismoidal (সমান) formula

* Write the following abbreviated terms:

(a) ~~FFWC~~ -

FFWC - Flood Forecasting & Warning Centre

SPARRSO - Bangladesh Space Research & Remote Sensing Organization.

RRI - River Research Institute.

STP - Sewage Treatment Plant

BRT - Bus Rapid Transit

IPCC - Intergovernmental Panel on Climate Change.

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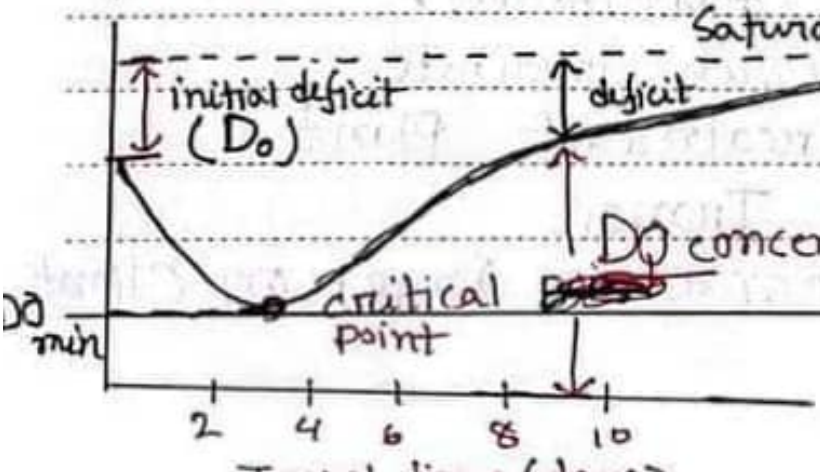
* Write down the clear covers of the following structural elements considering BNBC 2020
(1) Beam (2) column (3) Footing (4) Retaining wall

Element	Clear cover
Beam	1.5"
Column	1.5" (above grade beam)
	3" (below GB)
Footing	3"
Retaining wall	2.5"

* Write down six laboratory tests to assess the quality of bituminous materials.
⇒ see my Transportation note.

* Draw contours with arbitrary values for a pond and a hill.
⇒ see my Surveying Note.

* Draw qualitative Dissolved oxygen variation curve in a flowing water body from a particular source of pollution.



WARPO

Tech-70

Non-Tech-20

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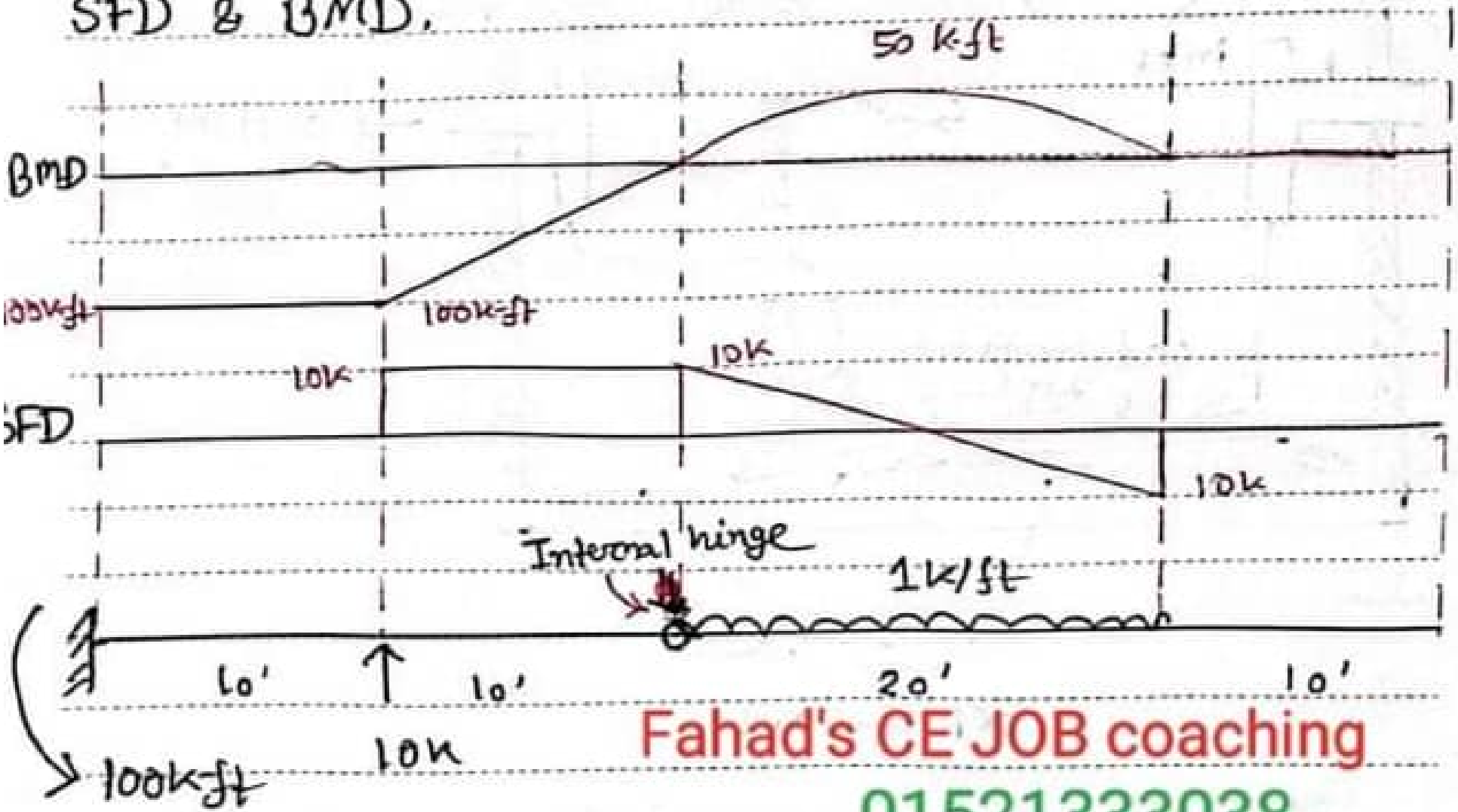
* Find the loads of the beam section using the following SFD & BMD.



For Design,
$\varphi = 0.9$

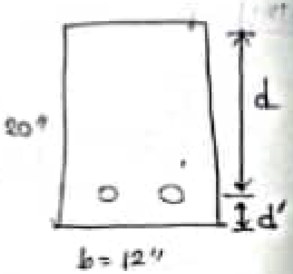
Moment = Ultimate Moment
$= M_u$

WASA-2017, NGO Forum-2022

A rectangular beam of section 12" X 20" carries a moment 180 K-ft. Find out the reinforcement required to resist the moment and either failure occurs by cracking of concrete or yield of steel. Consider $f'_c = 3$ Ksi, $f_y = 60$ Ksi and $d' = 3$ in.

Soln: $A_s = ?$ $\quad M_u = 180$ K-ft

Failure occurs by concrete cracking or steel yeilding?



$d = h - d'$

$= 20" - 3 = 17$ inch

$d' =$ c.cover

$$a = \frac{A_s f_y}{0.85 f'_c b}$$

$$= \frac{A_s \times 60}{0.85 \times 3 \times 12}$$

$\therefore a = 1.96 A_s$ ——— (i)

$M_u = \varphi . M_n$

$\Rightarrow M_u = \varphi . A_s f_y \left(d - \frac{a}{2}\right)$

$\Rightarrow 180 \times 12 = 0.9 \times A_s \times 60 \left(17 - \frac{1.96 A_s}{2}\right)$

$\Rightarrow A_s = 2.80$ in² (Ans)

Now, $\rho = \frac{A_s}{bd} = \frac{2.80}{12 \times 17} = 0.0137$

$$\rho_{max} = 0.85 \beta_1 \frac{f'_c}{f_y} \frac{0.003}{0.003 + 0.005}$$

$$= 0.85 \times 0.85 \times \frac{3}{60} \times \left(\frac{0.003}{0.003 + 0.005}\right)$$

$= 0.0135$

$\rho > \rho_{max}$ (Not ok)

So, Beam will fail by cracking of concrete

(Ans)

[WASA-2017]

A rectangular beam of section 12" x 20" carries a moment of 180 K-ft. Find out the reinforcement required to resist the moment and check either failure occurs by cracking of concrete or yielding of steel. Consider $f_c' = 3$ ksi, $f_y = 60$ ksi and $d' = 3$ in.

Solution: Given, $b = 12''$, $h = 20''$, $d' = 3$ in $\therefore d = (20-3) = 17''$

$f_c' = 3$ ksi, $f_y = 60$ ksi, $M = 180$ K-ft

We know,

$$M_u = \phi M_n = \phi A_s f_y \left(d - \frac{a}{2}\right) \quad \text{Here, } a = \frac{A_s f_y}{0.85 f_c' b}$$

$$\Rightarrow 180 \times 12 = 0.9 \times A_s \times 60 \times \left(17 - \frac{1.96 A_s}{2}\right) \Rightarrow a = \frac{A_s \times 60}{0.85 \times 3 \times 12} = 1.96 A_s$$

$$\Rightarrow 52.92 A_s^2 - 918 A_s + 2160 = 0$$

$$\therefore A_s = 2.81 \text{ in}^2$$

Now, $\rho = \frac{A_s}{bd} = \frac{2.81}{12 \times 17} = 0.014$

and, $\rho_b = 0.85 \beta_1 \times \frac{f_c'}{f_y} \times \frac{\varepsilon_u}{\varepsilon_u + \varepsilon_y} = 0.85 \times 0.85 \times \frac{3}{60} \times \frac{0.003}{0.003 + \frac{60}{29 \times 10^3}} = 0.02$

Since, $\rho < \rho_b$ it is under reinforce beam (tension steel yields at failure)

(Ans.)