

ନିମ୍ନ Civil Bank Solution

Bashudhara

Bank Solution



BASHUDHARA

Exercise Book

Write Your Mission

Name :

Institute : ଶ୍ରୀକାମା (ମାଟିଆ)

Class : Roll :

Subjects : Section :

1. বাহাদুর কৃষি গ্রন্থ - 2016

2. বাহাদুর কৃষি গ্রন্থ - 2016

3. অন্নী গ্রন্থ সিমেন্ট - 2009 (AUST)

4. কনজ গ্রন্থ সিমেন্ট - 2009 (AUST)

5. অফিসার (-ডিভিশন) ২০/০৯/১৮ ১০.০০-১২.০০

ডিভিশন: অফিসার (Civil) ২০/০৯/১৮ ৯.০০-১০.০০

6. বাহাদুর গ্রন্থ এডি সিমেন্ট ২২/০৯/১৮

সেক্টর ইন্ডাস্ট্রিয়াল লেন্ড, অলিম্পিক রোড
চিলাভুঙ্গা, ঢাকা।

4. 200 Questions and answers on
Practical Engineering works Pdf

2. www.enotes.com

3. www.civil.com

মো. ২৫৫১১১
কাজী মোস্তাফিজ
কাজী মিলি মল্লিক

1. What is the consideration in selecting the orientation of wing walls in the design of bridge abutments.

Ans:- There are three common arrangements of wing walls in bridge abutments based on Dr. Edmund C Hambly (1979).

(i) Wing walls parallel to abutments:

This is the simplest and shortest time to build but it is not the most economical design. This design has the advantage that it has least disturbance to existing slope embankment.

(ii) Wing walls at an angle to abutments:-

This is the most economical design among the three points in terms of material cost.

(iii) Wing walls perpendicular to abutments:-

Though it is not the most economical design, the wing walls provide a continuous alignment with bridge decks which provide supports to parapets.

Q.2 Why tensile test of soil is required?

Ans: 4
same

Two common examples: (soil reinforcement)

(i) ~~Mixing~~ Mixing a soil amendment such as lime into weak clayey soil and re-compacting to improve soil-bearing capacity (often done under the road in highway construction)

(ii) Installing plastic or composite webbing layers (called geo-grid material) alternating with compacted soil to produce a stronger sloped soil structure

Q.3 Describe soil reinforcement? Describe two soil reinforcement process.

Soil reinforcement :-

Soil reinforcement is defined as a technique to improve the engineering characteristics of soil. In this way, using natural fibers to reinforce soil is an old and ancient idea.

Use of coir fibers for sustainable development

In the context of sustainable develop.

ment which is a balancing act between the fulfillment of human need and protection the natural environment, the use of natural fibers such as coir in geotechnical applications is desirable.

Reinforcing the soil with coir fiber/coir geotextiles is a cost effective solution to the ground/soil improvement problems. The effects of fiber parameters on the strength, stiffness and compressibility behavior of soil were studied in detail.

- (i) Results showed that inclusion of fibers increases strength, stiffness, reduces the compressibility and swell potential. It
- (ii) is also observed that additions of fibers reduces the seepage velocity of plain soil considerably and thus increasing the piping resistance.

~~(iii) Soil nailing~~
Soil nailing is one of the extensively used techniques for stabilizing vertical cuts

A few case studies and analytical results which have been published as described below.

(i) In one of the studies, a vertical cut supporting a masonry retaining wall in a hilly terrain (total height 13m) was stabilized using this technique.

(ii) Calculations showed that the vertical cut was just marginally safe in the existing condition, hence soil nailing was used for improvement of stability.

4. What are main reasons for pull-out tests — for soil nailing?

(a) To check and verify the bond strength between soil and group adopted during the design of soil nails. This is main objective of conducting soil nail pull out test

(b) To determine the bond strength

5.10.2020

between soil and grout for future design purpose.

(iii) To check if there is any slippage or creep occurrence.

(iv) To check the elastic and plastic deformations of test nails.

05. Advantages and disadvantages of plastic over timber fenders?

Plastic fenders	Timber fenders
(i) Low in strength.	(i) High in strength.
(ii) Higher resistance to abrasion.	(ii) Lower resistance to abrasion.
(iii) Resistant to chemical and biological attacks	(iii) No resistant to chemical and biological attacks
(iv) Moderate energy absorption capacity	(iv) Low energy absorption capacity
(v) More environmental friendly.	(v) Less environmental friendly.
(vi) Resistant to rotting	(vi) No resistant to rotting

**** Note:** To achieve optimum quality the materials should be mixed first in dry condition and then in wet condition.

1000
Page

6. Describe concreting operations.

6/10-16

steps in concrete operations / batching

The process of measuring different concrete materials such as cement, CA, sand and water for the making of concrete is known as the batching. Batching can be done in two ways → (i) Volume batching (ii) weight batching

^{of concrete} # In volume batching the measurements are taken by volume and on the other hand the measurements are taken by weight in weight batching.

Mixing :- In this process, all the materials are thoroughly mixed in required proportion until the paste shows uniform color and consistency. Hand mixing and machine mixing are the different methods of mixing.

7. # Calculate the dimension of a settling tank if discharge is $45 \text{ m}^3/\text{s}$, overflow rate is 0.5 m/hr . Detention period is 3 hr . BB, AD
 Solⁿ:

$$\text{Detention time, } T = \frac{\text{SWD}}{\text{SOR}} \quad \left| \quad \text{Area} = \frac{\text{Dis charge}}{\text{SOR}}\right.$$

$$\Rightarrow \text{SWD} = T \times \text{SOR}$$

$$= 3 \times 0.5$$

$$= 1.5 \text{ m}$$

$$= \frac{45}{0.5}$$

$$= 90 \text{ m}^2$$

For Circular tank

$$\frac{\pi}{4} D^2 = 90$$

$$\Rightarrow D = 10.7 \text{ m}$$

For rectangular tank

$$\text{let } \Rightarrow L = 4B$$

$$L \times B = 90$$

$$\Rightarrow 4B^2 = 90$$

$$\Rightarrow B = 4.75 \text{ m}$$

$$L = 19 \text{ m}$$

Dimension may be

10.75 m with depth 1.5 m

$$\text{or } \boxed{19 \times 4.75 \times 1.5}$$

8.

A road embankment 10 m wide at foundation level with side slope as $2:1$ and with an avg height of 5 m is computed with an avg gradient 1 in 40 from contour 220 m to contour 280 m . Find the volume of earthwork? BB, AD

Solⁿ:

Difference betⁿ the level of both ends of the road = contour 280 - contour 220
= 60m

Gradient along the length is 1 in 40

So, length of the road is = $\frac{60}{\frac{1}{40}} = 2400m$

Again, area of cross section = $(b+sh)h$
= $(10 + 2 \times 5) \times 5 = 100m^2$

∴ Volume of earthwork = 2400×100
= $240000 m^3$

8
Ques
Ans
In a village 5000 litres of water is required everyday 25% chlorine is mixed in bleaching powder. If 0.05 mg/L chlorine is required to clean water where 0.1 mg/L is available. What is bleaching power required daily? BB, AD

Solⁿ:

Dosage = additional required + available Cl_2
= $0.05 + 0.1 = 0.15 mg/L$

$$\therefore \text{Total } \text{Cl}_2 \text{ required} = 5000 \times 0.15 = 750 \text{ mg}$$

$$\therefore \text{Bleaching powder required} = \frac{100}{25} \times 750 = 3000 \text{ mg}$$

Q.9 # Taking 920 gm and determine f.M.
 The f.M of one type soil is 2.28 and the
 f.M of another type of soil is 2.74. Combined
 f.M 2.48. Determine the amount of soil in
 two types. **S.B, AB - 2011**

Solⁿ

$$f_c = \frac{f_1 - f_{com}}{f_{com} - f_2}$$

$$f_1 = 2.74 \quad (i)$$

$$f_2 = 2.28 \quad (ii)$$

$$f_{com} = 2.48$$

$$= \frac{2.74 - 2.48}{2.48 - 2.28} = 1.3$$

$$R: 1 = 1.3 : 1 \quad \text{H.}$$

$$\text{sum of proportion} = 1.3 + 1 = 2.3$$

$$M_1 = \frac{1.3}{2.3} \times 920 = 520 \text{ gm}$$

$$M_2 = \frac{1}{2.3} \times 920 = 400 \text{ gm}$$

~~XXX~~ 3.4.16 Transportation:

When the mixing is done properly the freshly mixed concrete is then transported to the construction site, this process is known as transportation.

After that, the concrete is correctly placed on the frameworks.

Concrete can be transported to the site location in two ways:

- (i) Manual transportation.
- (ii) Mechanical.

Compaction:

Compaction is a process in which the air bubbles are eliminated from the freshly concrete. It is required to increase the ultimate strength of concrete by enhancing the bond with reinforcement.

Curing:

Curing is the process in which the concrete keeps its moisture for a certain time period to complete the hydration process. Curing should be done properly.

to increase the strength of concrete.

Required curing:

Ordinary sulphate resistant cement - 8 days
 low heat cement - 14 days.

Bangladesh Krishi Bank, AE (Civil)
 2018, AUST

1. *Final note* For a trapezoidal channel, side slope 2:1 bottom width (3m), discharge (9.3 m³/s) and depth of flow (1.5m) are given. find out if the flow is sub-critical or super critical.

Solution:

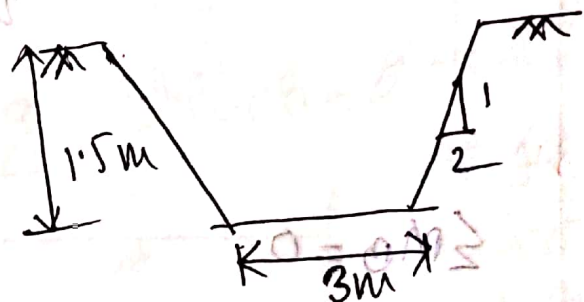
$$Fr = \frac{V}{\sqrt{gD}} \quad \text{--- (1)}$$

$$D = \frac{A}{B} = \frac{9}{9} = 1 \text{ m}$$

$$Q = AV \Rightarrow V = \frac{Q}{A} = \frac{9.3}{9} = 1.03 \text{ m/s}$$

$$Fr = \frac{V}{\sqrt{gD}} = \frac{1.03}{\sqrt{9.81 \times 1}} = 0.33 < 1$$

∴ flow is sub-critical flow.



$$Q = 9.3 \text{ m}^3/\text{s}$$

$$h = 1.5 \text{ m}$$

$$A_2 = (b + sh)h$$

$$= (3 + 2 \times 1.5) \times 1.5$$

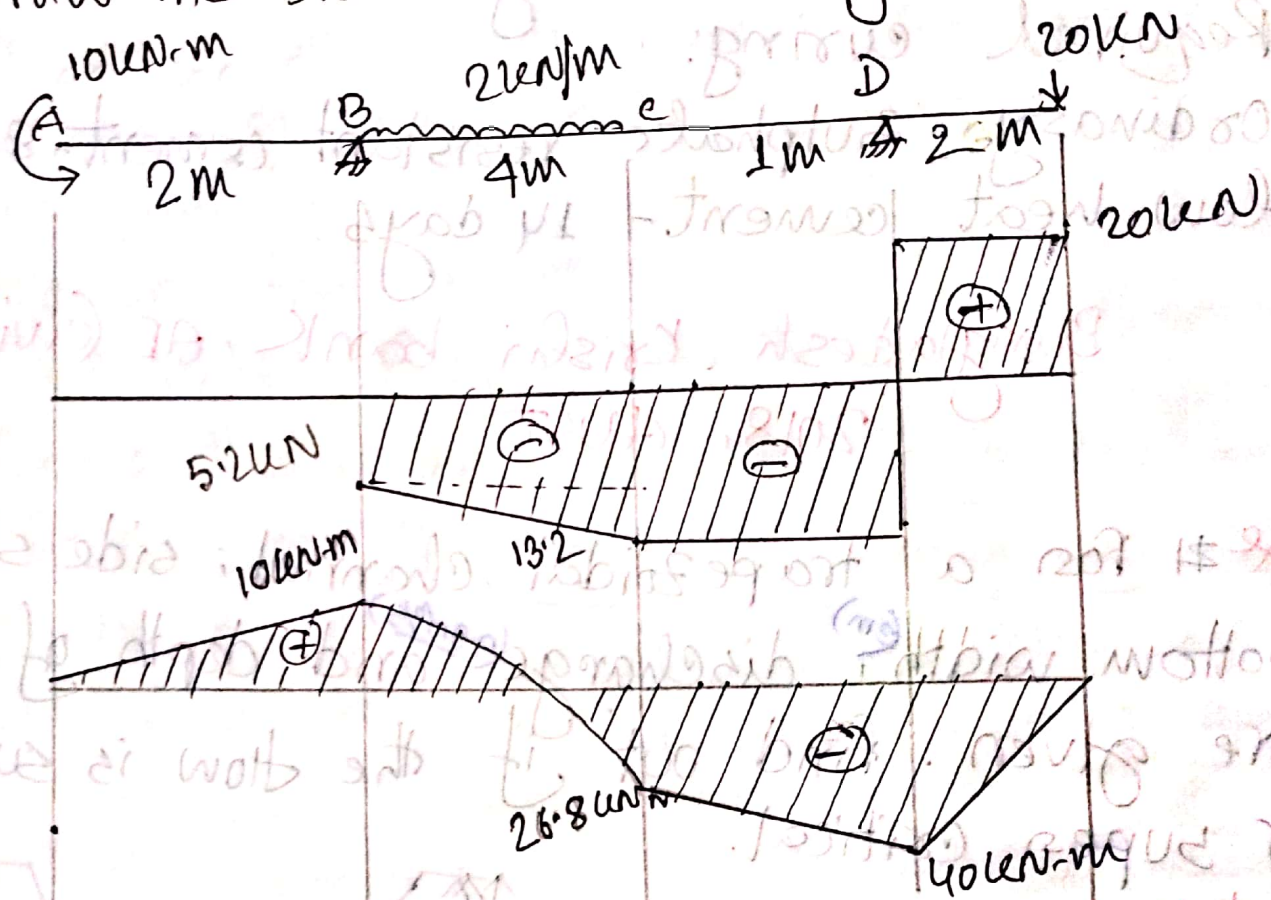
$$= 9 \text{ m}^2$$

$$B = b + 2sh$$

$$= 3 + 2 \times 2 \times 1.5$$

$$= 9 \text{ m}$$

2. Draw the SFD and Bending moment D
 010-18
 10kN·m
 20kN
 2kN/m
 2m
 4m
 1m
 2m
 D



$$\sum M_B = 0$$

$$4 \times 2 \times 2 + 20 \times 8 - R_D \times 5 - 10 = 0$$

$$\Rightarrow 5R_D = 166$$

$$R_D = 33.2 \text{ kN}$$

$$\sum R_y = 0$$

$$R_B + R_D - 8 - 20 = 0$$

$$\Rightarrow R_B + 33.2 - 28 = 0$$

$$\Rightarrow R_B = -5.2 \text{ kN}$$

$$\text{head loss} = \frac{fLV^2}{2gD}$$

$$V = \frac{\mu}{\rho} = \frac{\text{dynamic viscosity}}{\text{density}} = \text{kinematic viscosity}$$

3. Oil flows in a pipe. pipe dia and length are given. Viscosity and density of oil are given. find out frictional losses and also drop in pressure. BKB-2018

Solution:

$$h_f = \frac{fLV^2}{2gD}$$

$$= \frac{0.20 \times 15 \times 10^3 \times 1^2}{2 \times 9.81 \times 1}$$

$$= 15.29 \text{ m of water}$$

$$\mu = \frac{\Delta h_f d^2}{32LV}$$

Δh_f = pressure difference.

Given,

Pipe dia, $D = 1 \text{ m}$

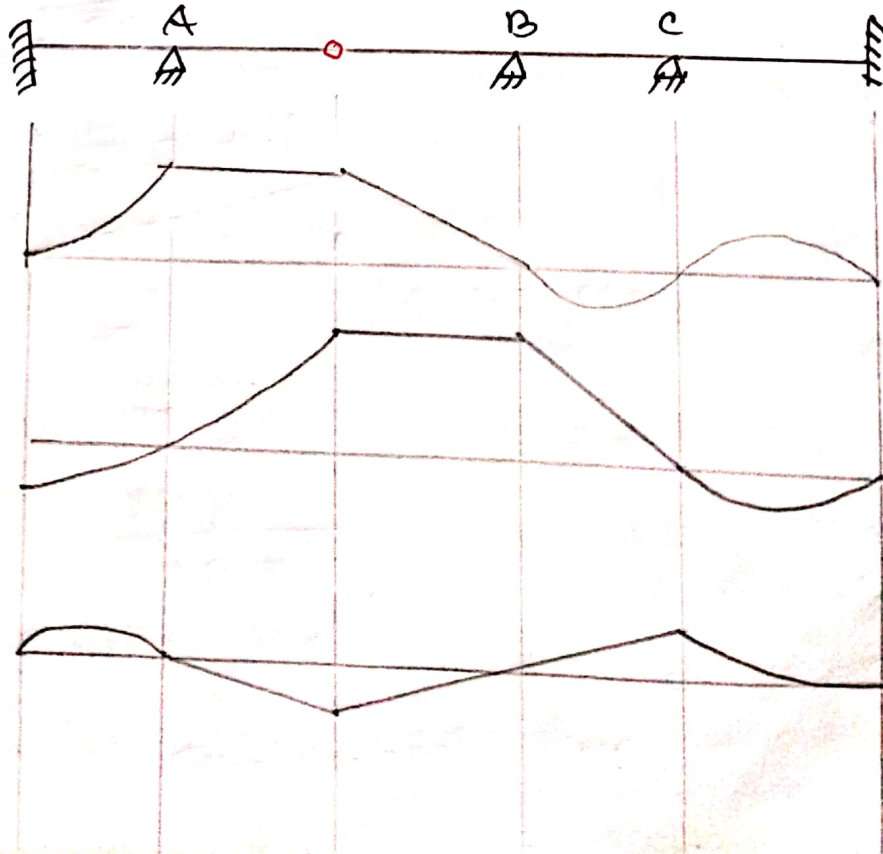
$L = 15 \text{ km} = 15 \times 10^3 \text{ m}$

$V = 1 \text{ m/s}$

$f = 0.20$

Viscosity

4. Draw IL for following structure.



IL for shear A, B, C

BKB-18
Defen - Dysha
corol

V
M
theta

5. #1 What is pre-consolidation pressure? Describe the method to determine it with diagrams.

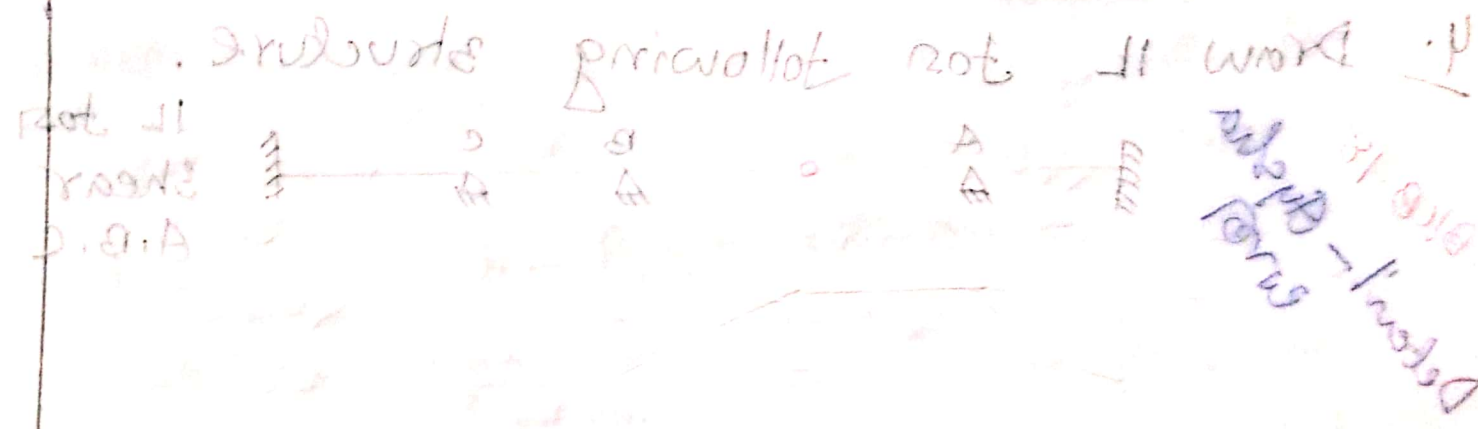
$\Delta = 0.01$
 Pipe dia. $D = 12$
 $L = 12$
 $\sigma = 12 \times 10^6$
 $V = 1$
 $\gamma = 0.50$
 difference

$$W = \frac{\gamma L V}{\sigma}$$

$$= \frac{0.50 \times 12 \times 10^6}{12 \times 10^6}$$

$$= 0.50$$

$\Delta = 0.01$
 $W = 0.50$
 difference



6 # Define: Non-newtonian fluid, unit hydrograph, draw various cracks in a simply supported beams.

- (iv) Age of concrete at casting
- (v) Age of curing
- (vi) Proportions of mixing
- (vii) Presence of void

(7) # What are factors affecting workability of concrete mix? State the reasons for cracking.

BKD
-2018

Factors affecting workability of concrete mix.

- (i) Cement content of concrete.
- (ii) Water content in concrete
- (iii) Mix proportions of concrete
- (iv) Size of aggregates
- (v) Shape of aggregates
- (vi) Grading of aggregate
- (vii) Surface texture of aggregates.

(viii) Use of admixture in concrete.

(ix) Age of curing.

(x) Proportions of mixing method.

(xi) Presence of void.

It states the reasons for cracking -

(A) Factors affecting workability of concrete are listed below # (F)

- (i) Cement content of concrete.
- (ii) Water content in concrete.
- (iii) Mix proportions of concrete.
- (iv) Size of aggregates.
- (v) Shape of aggregates.
- (vi) Grading of aggregates.
- (vii) Surface texture of aggregates.

8. # b and d are given. Grade M15 concrete, mild steel reinforcement used. Effective length of beam is given. Find out the area of steel using WSD method. Also determine the size and spacing of lateral ties.

Soln

$$M_c = \frac{1}{2} f_c k b d^2$$

$$= \frac{1}{2} \times 2185.5 \times .78 \times 12 \times 16^2$$

$$= 2.5 \times 10^6 \text{ psi}$$

$$M_c = M_s = A_s f_s d$$

$$\Rightarrow 2.5 \times 10^6 = A_s \times 24000 \times .78 \times 16$$

$$\Rightarrow A_s = 8.65 \text{ in}^2$$

9 #9 bars

Determination tie
 Spacing, = $d_{tie} \times 48 = \frac{9}{8} \times 48 = 18''$
 Spacing = $d_{main} \times 16 = 18''$
 least dimension of beam = $16''$
 Spacing = $16''$, tie size #3

$$f_c' = 15 \times 145.5$$

$$= 2185.5 \text{ psi}$$

$$f_y = 60000 \text{ psi}$$

$$b = 12''$$

$$d = 16''$$

$$M =$$

$$n = \frac{f_s}{f_c} \times 24000$$

$$= \frac{983.47}{2185.5}$$

$$= 248$$

$$n = \frac{29 \times 10^6}{57000 \sqrt{2185.5}}$$

$$= 11$$

$$k = \frac{n}{n + r}$$

$$= 0.68$$

$$j = 1 - k/3$$

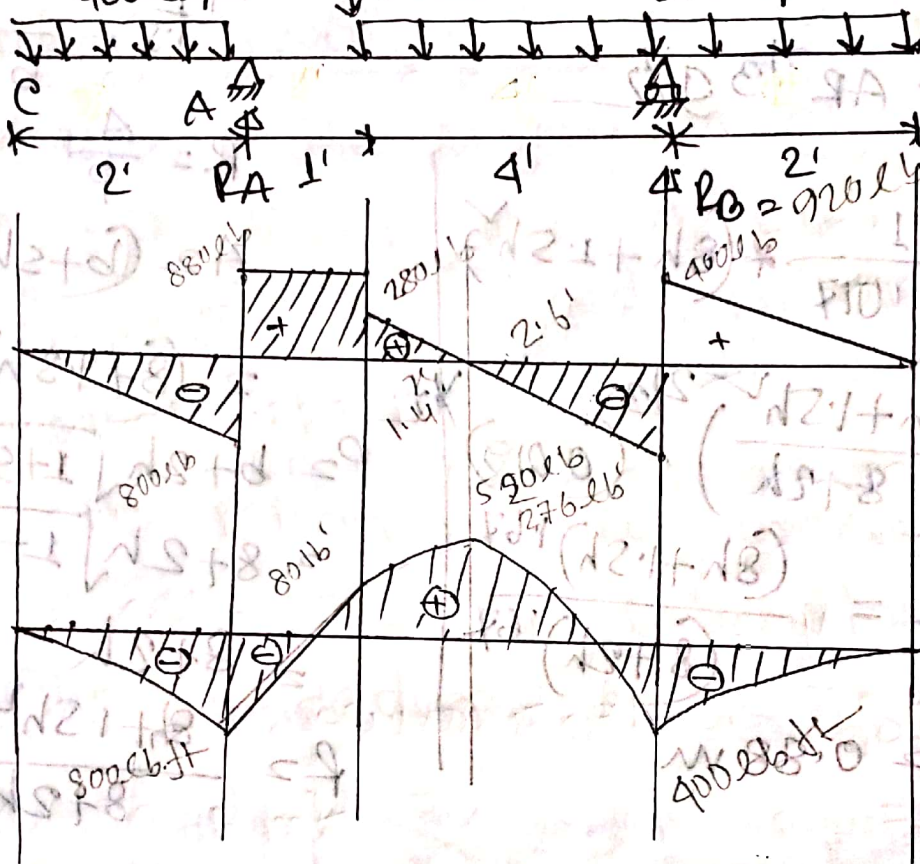
$$= .78$$

2. Agrani Bank Limited AUST, 2017

MCQ → English (10) + Math (10) + Technical = 80.
Written: 120.

1. Draw SFD and BMD of the following beam

AGILE 2017



$$\sum M_A = 0$$

$$-400 \times 2 \times 1 + 600 \times 1 + 200 \times 4 \left(1 + \frac{4}{2}\right) + 200 \times 2 \left(5 + \frac{2}{2}\right) - R_B \times 5 = 0$$

$$\Rightarrow -800 + 600 + 2400 + 2400 - 5R_B = 0$$

$$\Rightarrow R_B = 920 \text{ lb}$$

$$\sum F_y = 0$$

$$R_A + R_B - 800 - 600 - 1200 = 0$$

$$\Rightarrow R_A = 1680 \text{ lb}$$

3. # Define pre-consolidation pressure. How will calculate this pressure. Write with pressure diagram.

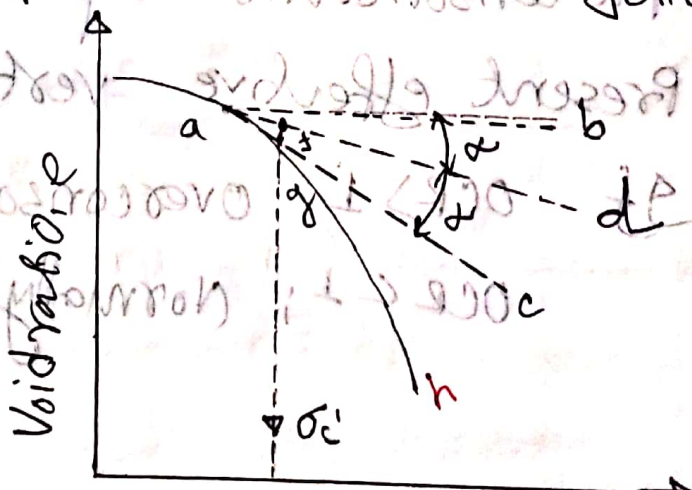
Anal Note

Preconsolidation pressure: Pre-consolidation pressure is the maximum effective vertical overburden stress that a particular soil sample has sustained in the past.

Calculation of pressure:

15th em
Dat-27th page

To determine the preconsolidation pressure σ'_c from the laboratory $e-\log \sigma'$ plot. The procedure is as follows.



- (i) By visual observation, establish point a, at which the $e-\log \sigma'$ plot has a minimum radius of curvature.
- (ii) Draw a horizontal line ab.

- (b) Draw the line ac tangent at a
- (d) Draw the line ad, which is the bisector of the angle bac
- (e) Project the straight-line portion gh of the $e-\log \sigma'$ plot back to intersect line ad at f. The abscissa of point f is the pre-consolidation pressure σ_c' .

The over consolidation (OCR) of a soil

$$OCR = \frac{\sigma_c'}{\sigma'}$$

σ_c' = pre consolidation pressure of a specimen

σ' = Present effective vertical pressure.

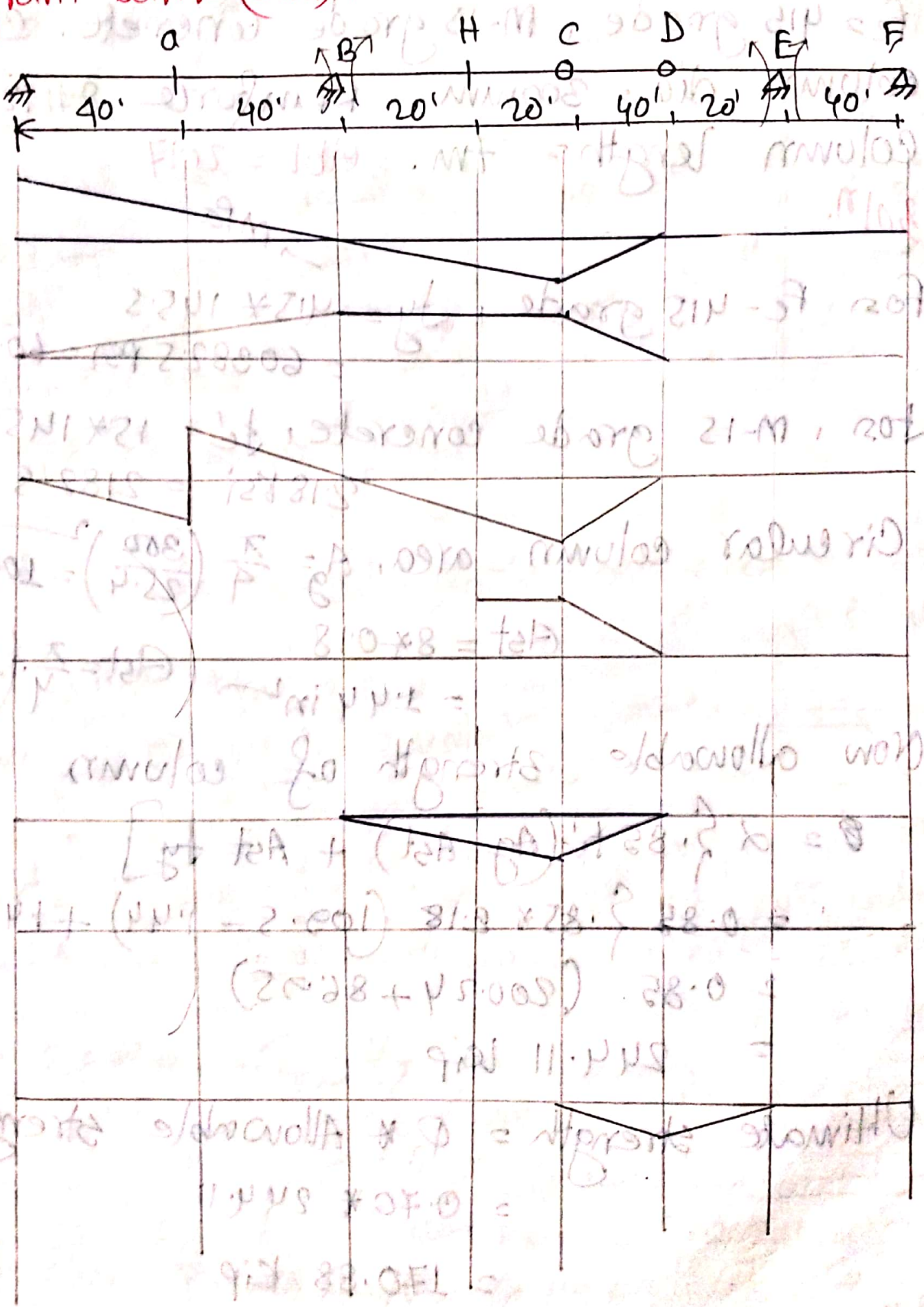
If $OCR > 1$, overconsolidated soil

$OCR < 1$; Normally consolidated.

(Note: $\log \sigma'$ scale)

- (i) of which the e-log σ' plot has a minimum
- (ii) Draw a horizontal line at

4. Draw ILD of (i) R_A & R_B (ii) $V_a + V_H$ (iii) $M_B + M_E$
 Agrami bank (Civil), 2017



5. Determine the column strength. Given data
 $f_c = 415$ grade, M-15 grade concrete. Circular
 column dia = 300mm. Reinforce 8#12mm
 Column length = 7m. $\phi = 0.7$
 3017.

For Fe-415 grade, $f_y = 415 \times 145.5$
 $= 60382.5 \text{ psi} = 60.38 \text{ ksi}$

For M-15 grade concrete, $f_c' = 15 \times 145.5$
 $= 2182.5 \text{ psi} = 2.18 \text{ ksi}$

Circular column area, $A_g = \frac{\pi}{4} \left(\frac{300}{25.4} \right)^2 = 109.5 \text{ in}^2$

$A_{st} = 8 \times 0.18$
 $= 1.44 \text{ in}^2$ $A_{st} = \frac{\pi}{4} \left(\frac{12}{25.4} \right)^2$

Now allowable strength of column

$$\begin{aligned} \phi &= \phi \left[0.85 f_c' (A_g - A_{st}) + A_{st} f_y \right] \\ &= 0.85 \left[0.85 \times 2.18 (109.5 - 1.44) + 1.44 \times 60.38 \right] \\ &= 0.85 (200.24 + 86.95) \\ &= 244.11 \text{ kip} \end{aligned}$$

Ultimate strength = $\phi \times$ Allowable strength
 $= 0.70 \times 244.11$
 $= 170.88 \text{ kip}$

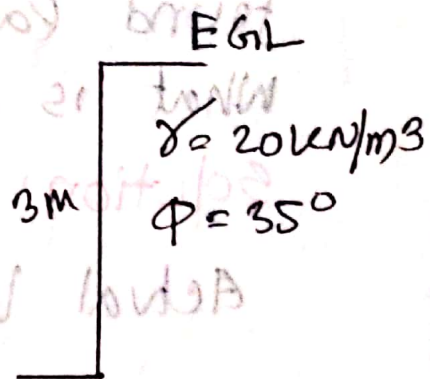
$$\text{Pressure} = \frac{\Delta \sigma}{A} = \sigma/m^2$$

6. # Determine the active pressure and passive pressure. Given data are shown below.

Solⁿ: We know,

$$k_a = \frac{1 - \sin \phi}{1 + \sin \phi} = \frac{1 - \sin 35^\circ}{1 + \sin 35^\circ} = 0.27$$

$$k_p = \frac{1 + \sin \phi}{1 - \sin \phi} = \frac{1 + \sin 35^\circ}{1 - \sin 35^\circ} = 3.65$$

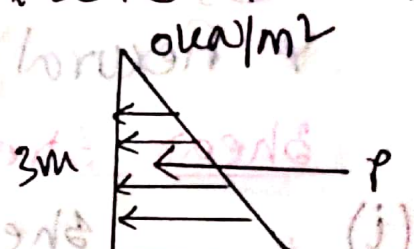


Active pressure:

At $z = 0m$ $\sigma_{a1}' = 0$

At $z = 3m$ $\sigma_{a2}' = k_a \gamma z = 0.27 \times 20 \times 3 = 16.2 \text{ kN/m}^2$

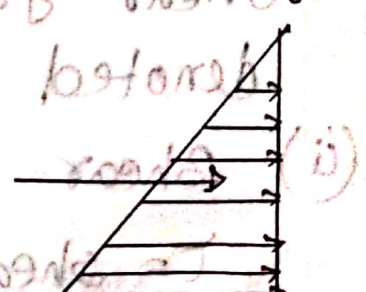
$\therefore \sigma_a = \sigma_{a1}' + \sigma_{a2}'$
 $= 0 + 16.2 = 16.2 \text{ kN/m}^2$



Passive pressure:

At $z = 0$ $\sigma_{p1}' = 0$

At $z = 3m$ $\sigma_{p2}' = k_p \gamma H$
 $= 3.65 \times 20 \times 3$
 $= 219 \text{ kN/m}^2$



Passive pressure

$P = \frac{1}{2} \times 219 \times 3$
 $= 328.5 \text{ kN/m}$

$\bar{z} = \frac{1}{3} \times 3$
 $= 1m$

$P = \frac{F}{A} = \frac{N}{m^2}$
 $\Rightarrow F = PA$
 $= \frac{N}{m^2}$

$\frac{N}{m^2} = \frac{N}{m^2}$
 $\Rightarrow F = \frac{N}{m^2} \times m = \frac{N}{m}$

7. # A road is measured by a 20m chain & length is found to be 500m. It is found later that, the chain is 4cm long. What is the actual length.


Solution:

$$\text{Actual length} = \frac{L'}{L} \times ML$$

$$= \frac{20.04}{20} \times 500 = \boxed{501 \text{ M}}$$

8. Difference between shear stress, Normal & Flexural stress

Shear stress:

(i)  shear stress in beam defined as the stress that occurs due to internal shearing of the beam that results from the shear force subjected to the beam. It is denoted τ

(ii) Shear stress equation, $\tau = \frac{VQ}{Ib}$

τ = shear stress (N/m^2)

V = total shear (N)

Q = first moment of area (m^3)

I = moment of inertia

t = material thickness

Normal Stress:

(i) Normal stress is defined as a result of the load applied perpendicular to a member. It is denoted by σ .

(ii)
$$\sigma = \frac{P}{A} = \frac{\text{axial force}}{\text{cross sectional area}}$$

Flexural stress:

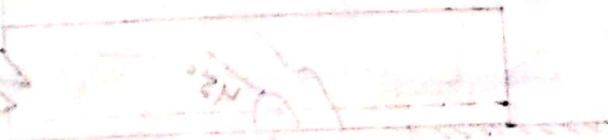
(i) The stress caused by the bending moment are known as flexural stress or bending stress. It is denoted by σ_b .

(ii)
$$\sigma_b = \frac{mc}{I}$$

M = Calculated bending moment

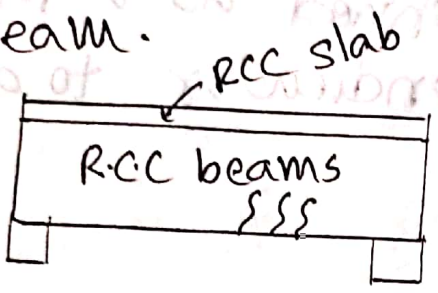
c = vertical distance away from the N.A.

I = Moment of inertia around the N.A.

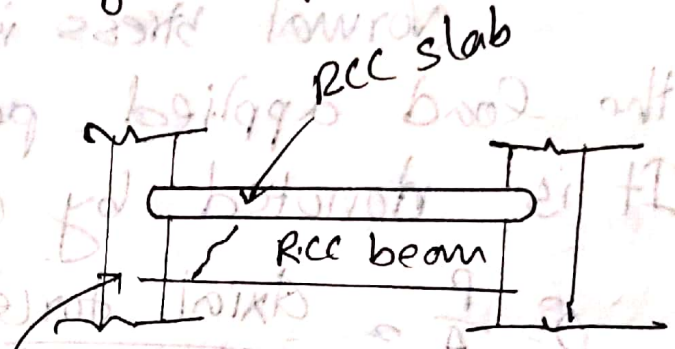


09

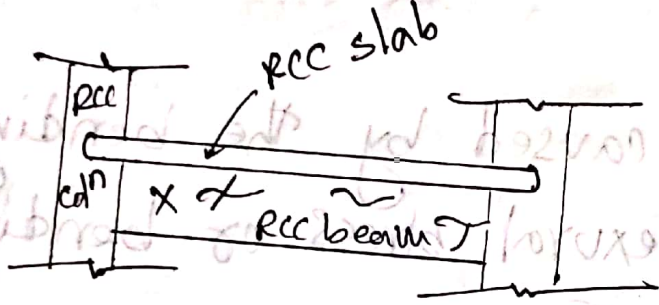
Draw different types of cracks in Beam.



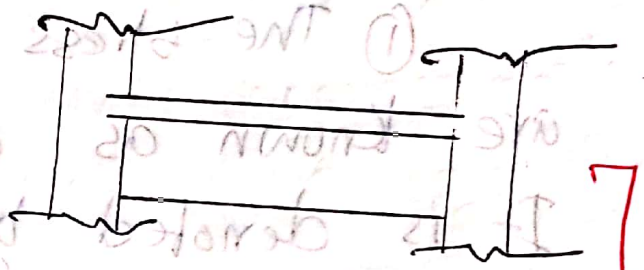
flexural cracks



Corrosion cracks



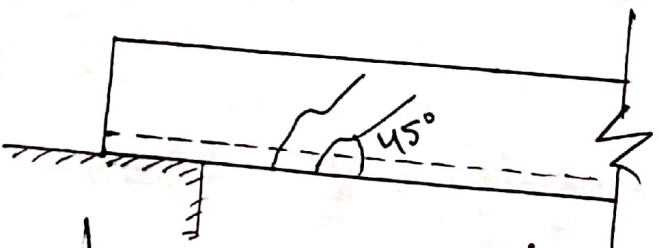
shrinkage cracks



(a) Diagonal Tension failure: | shear crack / Diagonal crack

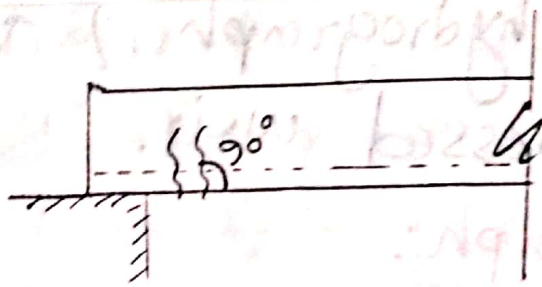
In this type of failure, diagonal cracks are appear in the beam which is inclined at about 45° to the horizontal.

→ location: near to support.



(b) flexural shear failure: [flexural crack / bending crack]

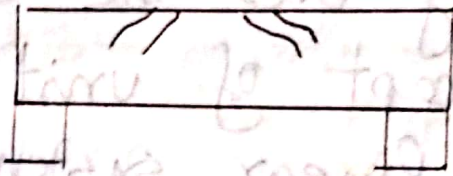
In this type of failure, cracks appear normally at an angle 90° to the horizontal.



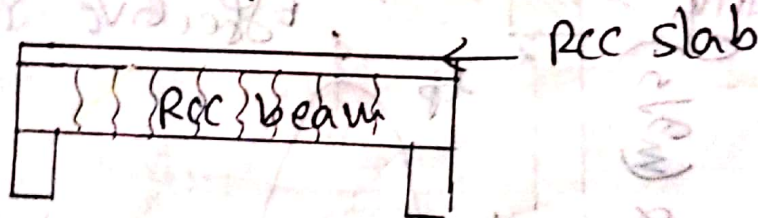
Location: At tensile zone.

(c) Diagonal compression failure:

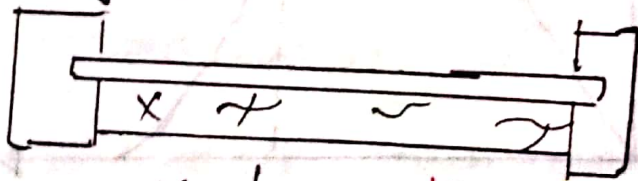
In this type of failure takes place by crushing of concrete in compression zone.



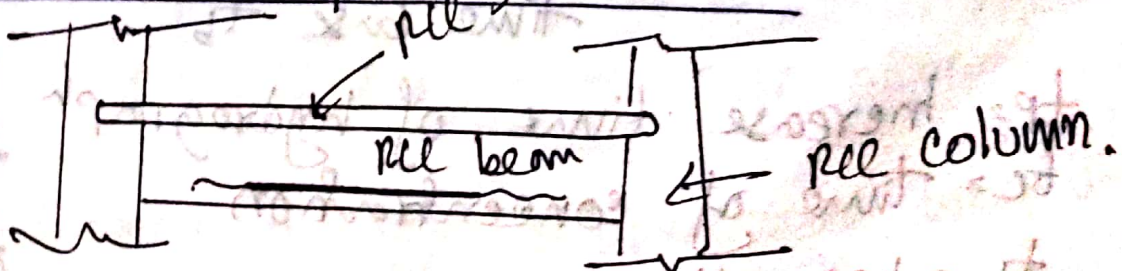
(d) Torsion crack (total length)



(e) Shrinkage crack [Anywhere in beam]



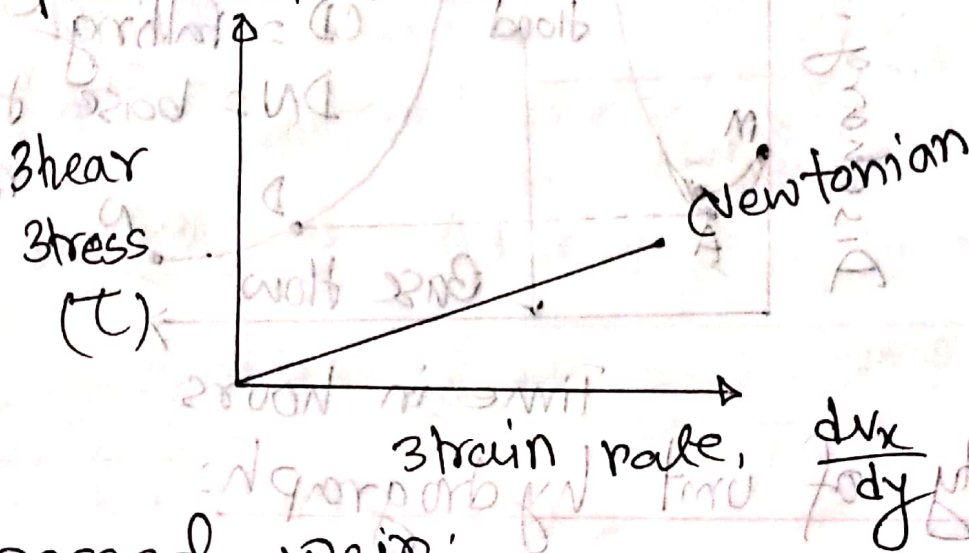
(f) Bond crack / corrosion crack



Newtonian Fluid :-

The fluids which obey Newton's law of viscosity are known as Newtonian fluids.

Examples: Air, kerosene etc.



Suppressed weir:

A standard suppressed rectangular weir has a horizontal crest that crosses the full channel width.

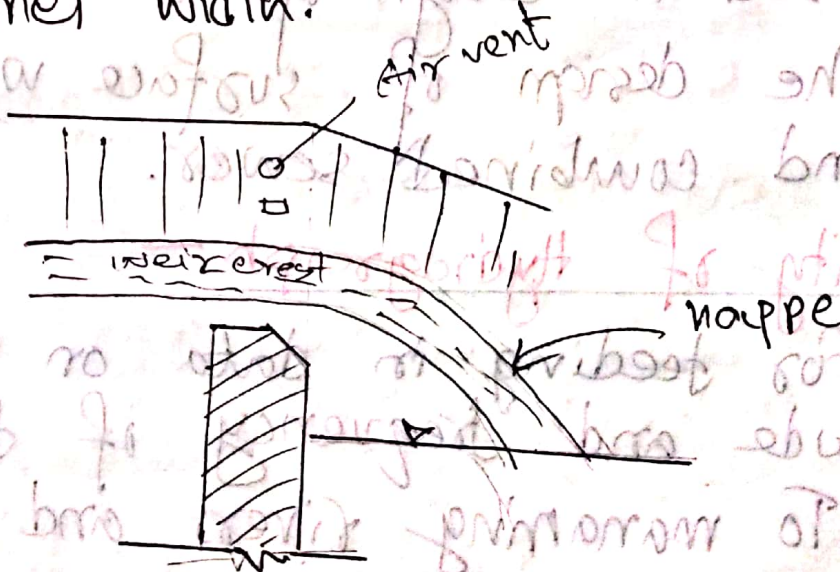


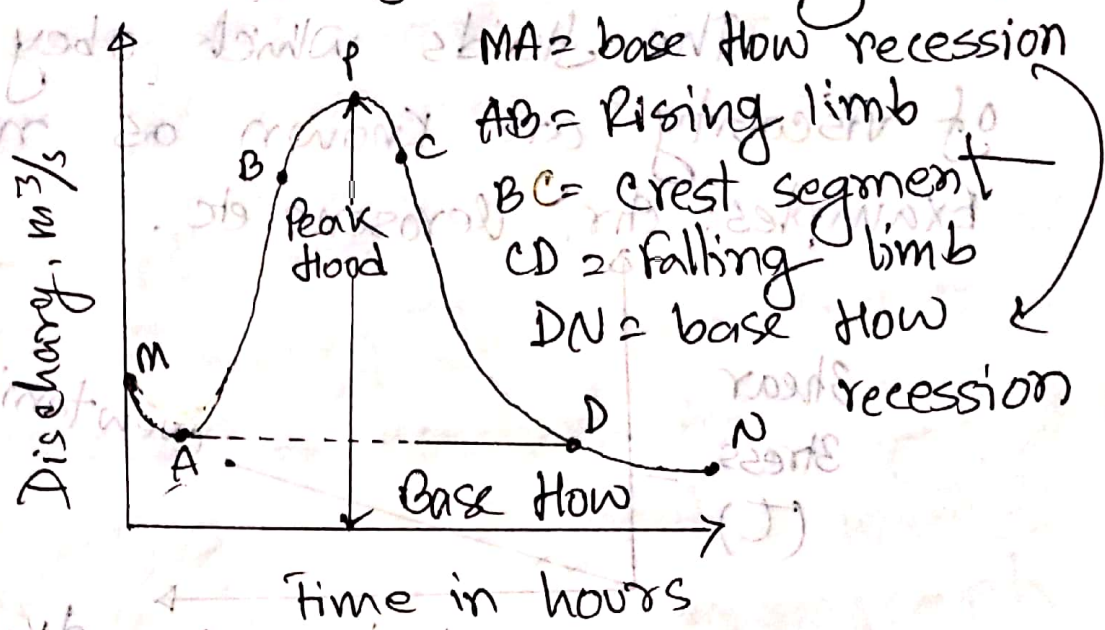
Fig: Section through suppressed weir with air vent in wall

Extra - Google

Extra \Rightarrow B.P.D.B.

Draw a typical Hydrograph, showing different points -

29/2/20
28/2/20



Necessity of unit hydrograph:

- a) For calculation of water reaching a particular outfall.
- b) Used in design of sewerage
- c) The design of surface water sewerage and combined sewer.

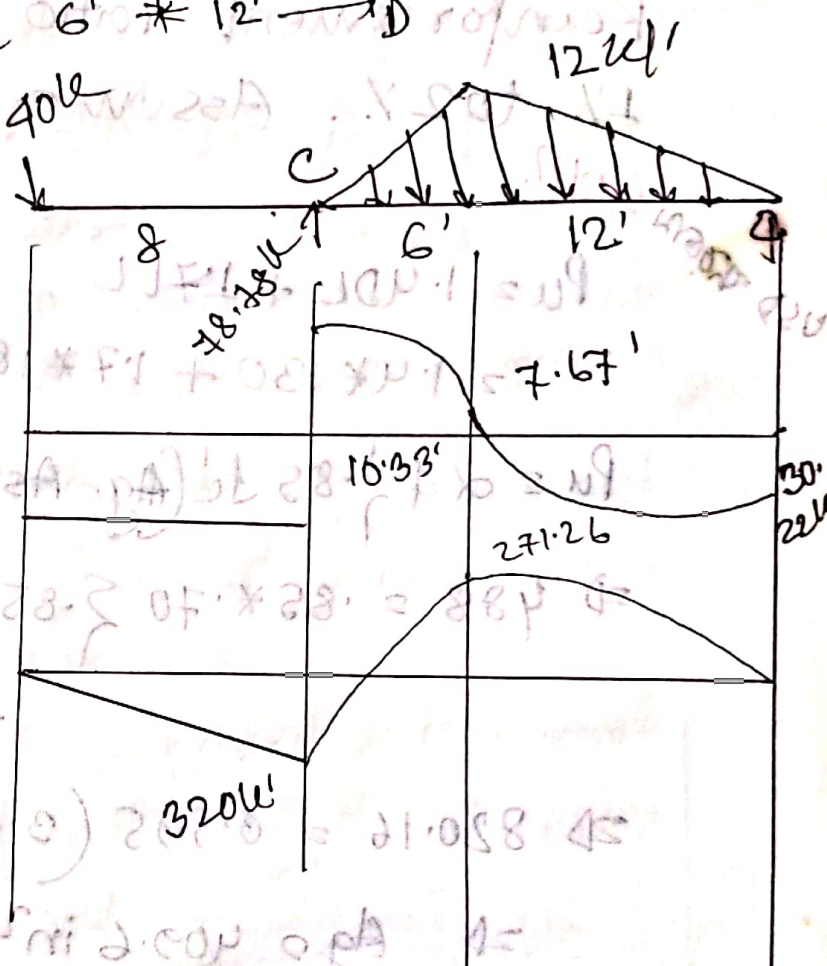
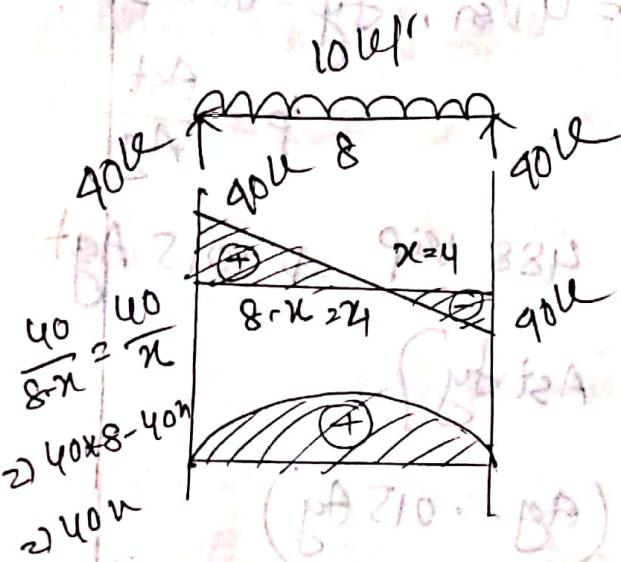
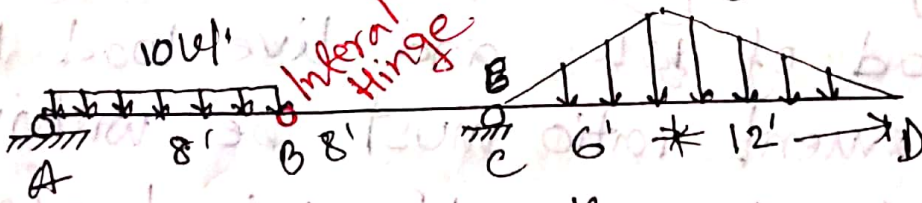
Extra Google

Necessity of Hydrograph -

- (i) For feeding in data on the potential magnitude and frequency of floods
- (ii) To manning rivers and drainage basins.

Janata Bank (Civil), 2016

1. Draw the SFD and BMD of the following structure



$$\sum M_A = 0$$

$$8 \times R_B - 10 \times 8 \times 4 = 0$$

$$\Rightarrow R_B = 40 \text{ k}$$

$$R_A + R_B = 80 \Rightarrow 0$$

$$\Rightarrow R_A = 40 \text{ k}$$

$$\sum M_C = 0$$

$$-40 \times 8 + \left(\frac{1}{2} \times 6 \times 12\right) \times \left(\frac{2}{3} \times 6\right) + \frac{1}{2} \times (12 \times 12) \times \left(6 + \frac{1}{3} \times 12\right) + R_D \times 18 = 0$$

$$\Rightarrow R_D = 30.22 \text{ k}$$

$$\sum R_y = 0$$

$$R_A + R_D - 40 - \frac{1}{2} \times 12 \times 18 = 0$$

$$\Rightarrow R_C = 117.78 \text{ k}$$

21600m
of 7500k

2105 (iv) Area of steel

02. #1 Design a square tied column to support dead load of 130k and live load 180k. Reinforcement ratio must be within 1% to 2%. Assume $f_c' = 4 \text{ ksi}$, $f_y = 60 \text{ ksi}$.

Soln.

$$p = \frac{A_{st}}{A_g}$$

$$P_u = 1.4DL + 1.7LL$$

$$F_u = 1.4 \times 130 + 1.7 \times 180 = 488 \text{ kip} \Rightarrow 0.015 A_g$$

$$P_u = \phi \left[0.85 f_c' (A_g - A_{st}) + A_{st} f_y \right]$$

$$\Rightarrow 488 = 0.85 \times 0.70 \left[0.85 \times 4 (A_g - 0.015 A_g) + 60 \times 0.015 A_g \right]$$

$$\Rightarrow 820.16 = 0.595 (3.364 A_g)$$

$$\Rightarrow A_g = 409.6 \text{ in}^2$$

$$\therefore A_{st} = 6.14 \text{ in}^2$$

WSD method

$$P_u = DL + LL$$

$$P_{all} = \phi A_g (0.25 f_c' + P_s f_s)$$

3. #1 Determine the number of bolts to transmit a dead load of 25 kips and a live load force 75 kips through two 18x8x1 connected to gusset plate (1/2" thick). All materials are A36 steel. The bolts are dia 1/2", A36 steel in a bearing type connection with threads excluded from shear plane. Use three lines bolts across the web of the channel and consider $f_y = 30$ ksi, Apply ASD method.

Soln.

No. of bolts:-

$$\text{Area of each bolt, } A_b = \frac{\pi}{4} \times \left(\frac{1}{2}\right)^2 = 0.196 \text{ in}^2$$

$$f_y = 30 \text{ ksi}, P = 25 + 75 = 100 \text{ kip}$$

$$\text{No. of bolt} = \frac{100}{30 \times 0.196 \times 2} \quad \left[\text{Double shear} \right] = 8.5 \approx 9 \text{ bolts}$$

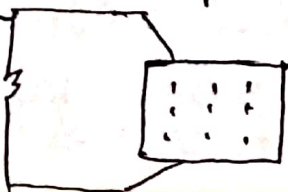
Check bearing capacity of angle and gusset plate

$$\text{Allowable bc } f_p = 1.2 f_u = 1.2 \times 58 = 69.6 \text{ ksi}$$

$$\left[\because f_u = 58 \text{ ksi to } f_y = 30 \text{ ksi} \right]$$

$$R_p(\text{angle}) = f_p \times d \times t \times \text{No. of bolt} \times \text{no. of bearing surface} \\ = 69.6 \times \frac{1}{2} \times 1 \times 9 \times 2 = 626.4 \text{ k} > 100 \text{ k}$$

$$R_p(\text{gusset plate}) = d \times t \times f_p \times \text{No. of bolt} \\ = \frac{1}{2} \times 1 \times 69.6 \times 9 = 313.2 \text{ k} > 100$$



4. Define Virgin consolidation curve. Which one do you prefer as a soil engineer betn laboratory consolidation curve and virgin consolidation curve. Explain with necessary diagram and examples.

Virgin Consolidation Curve:

[The compression index, as determine from the laboratory $e-\log p$ curve, will be somewhat different from that encountered in the field. The primary reason is that the soil remolds to some degree during the field exploration. The nature of variation of the $e-\log p$ in the field for normally consolidated clay, is shown in below figure. It is generally referred as virgin compression curve.]



BM 4th
40 page

Google:

A soil that has been deposited from suspension and consolidated to some stress, clearly the maximum stress to which the soil has ever been subjected, is said to be normally consolidated and the associated relationship is termed as virgin consolidation curve.

Laboratory consolidation curve is preferred by engineers because effective stress σ'_v starts from initial condition.

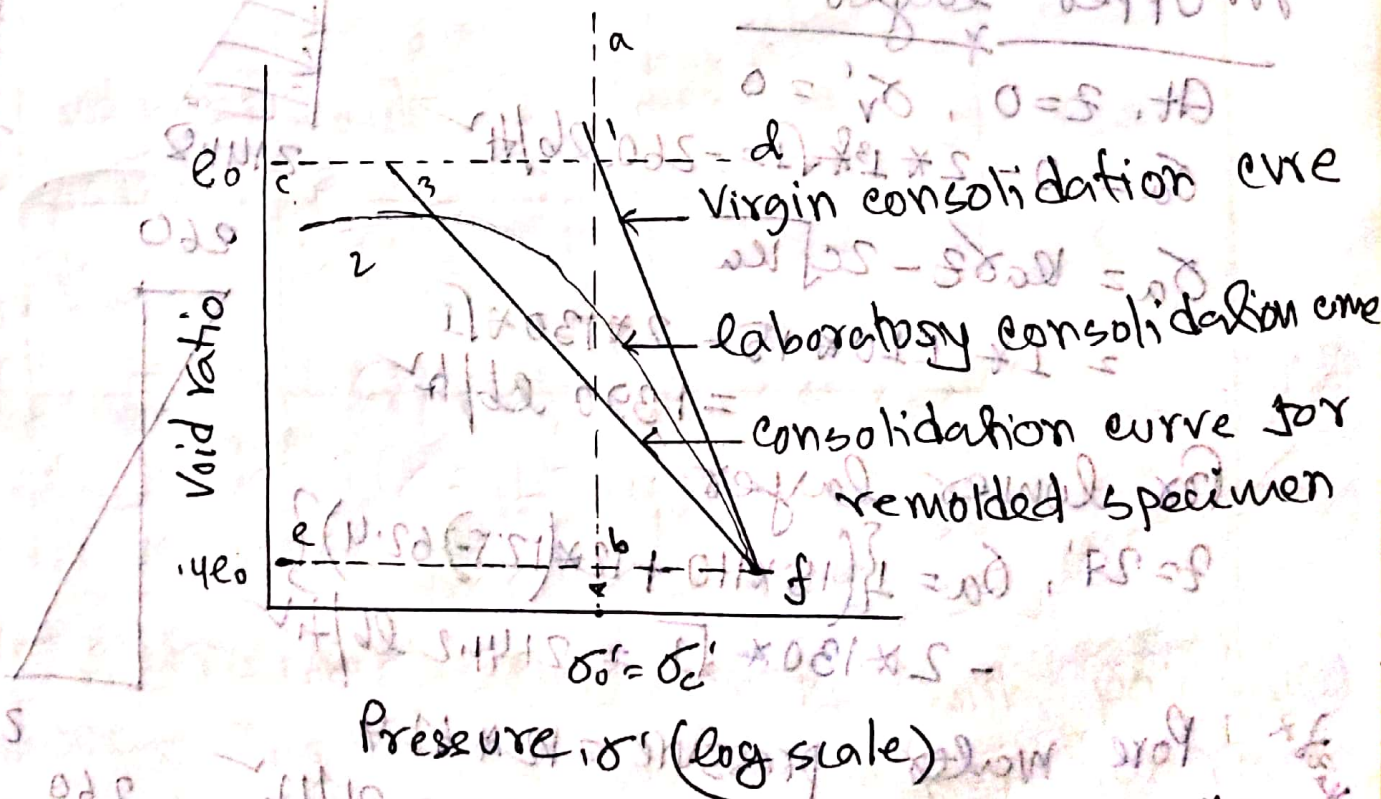


Fig: Consolidation characteristics of normally consolidated clay of low to medium sensitivity.

5.
 $Q=0$

A retaining wall has support is soil above its base level and the water table is 12' below the ground level. The backfill material is pure clay, having $\gamma = 110 \text{ lb/ft}^3$ and $\gamma_{sat} = 125 \text{ lb/ft}^3$ of the value of cohesion $c = 130 \text{ lb/ft}^2$. Determine the stress at different location and draw the pressure diagram.

Solⁿ:

$$K_a = \frac{1 - \sin \phi}{1 + \sin \phi} = 1$$

for upper layer

At $z=0$, $\sigma_v' = 0$

$$\sigma_a = 0 - 2 \times 130 \times \sqrt{1} = -260 \text{ lb/ft}^2$$

$$\sigma_a = K_a \gamma z - 2c \sqrt{K_a}$$

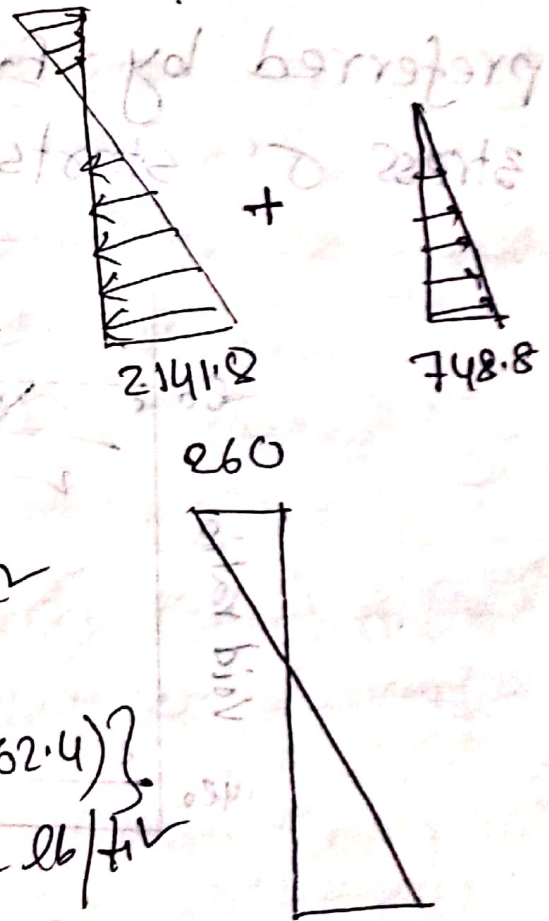
$$= 1 \times 110 \times 15 - 2 \times 130 \times \sqrt{1} = 1390 \text{ lb/ft}^2$$

for lower layer

$$z = 27', \sigma_a = \left\{ (15 \times 110 + 12 \times (125 - 62.4)) \right\} - 2 \times 130 \times \sqrt{1} = 2141.2 \text{ lb/ft}^2$$

Pore water pressure = 12×62.4

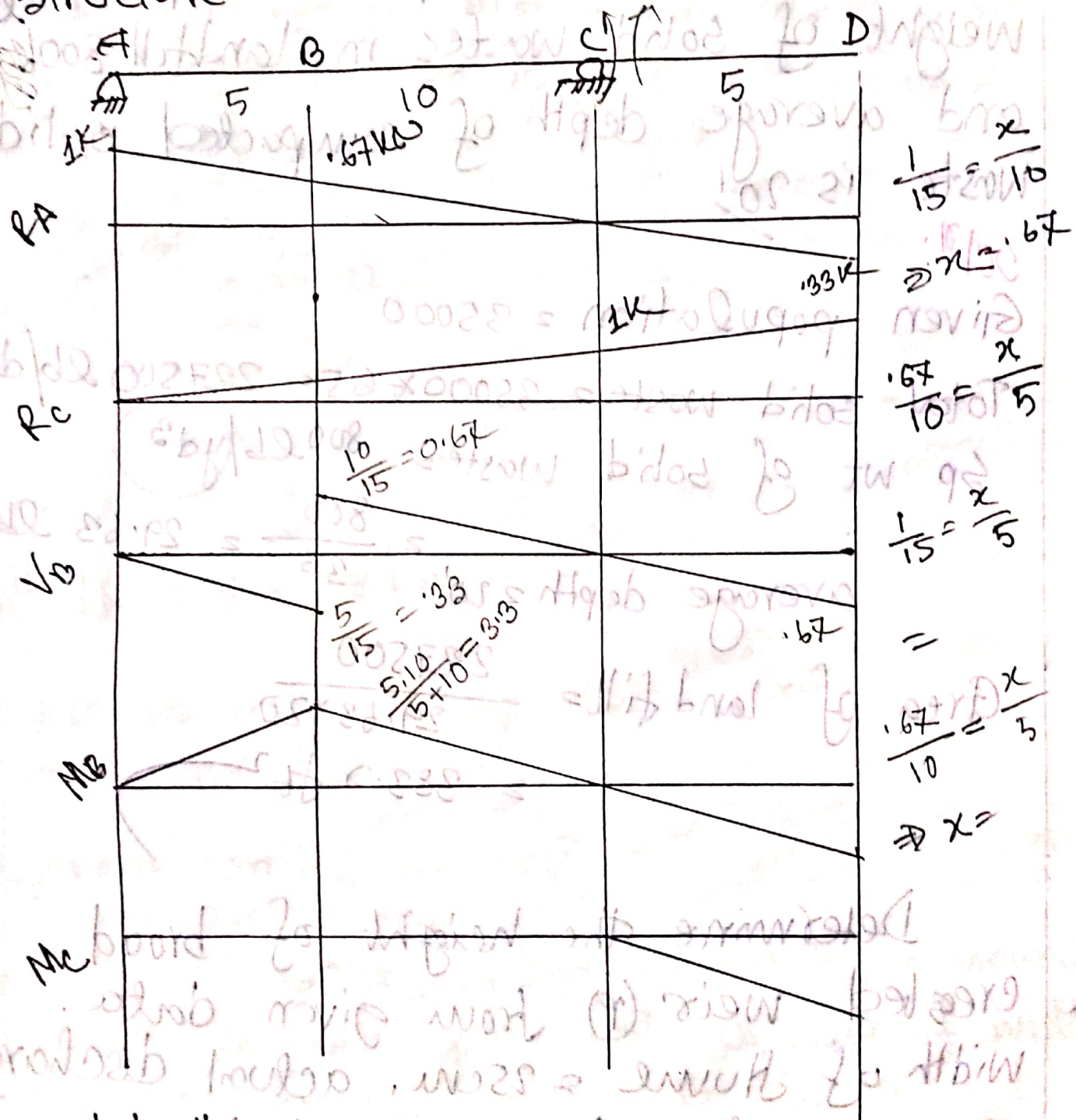
$$= 748.8 \text{ lb/ft}^2$$



$$\frac{260}{15} = \frac{2890}{x}$$

$$\Rightarrow 2.36 = x$$

6. Draw RA, Rc, Vb, Mb, Mc of the following structure. Janata bank, 2016



7. Let there is a community with population of 35000. The solid waste generation rate is 6.5 lb/cap/day. There is a necessity to design a land fill for the community.

Estimate the required land field area. Consider that, the compacted specific weight of solid wastes in landfill $800 \frac{\text{lb}}{\text{yd}^3}$ and average depth of compacted solid waste is $20'$

Solⁿ:

Given population = 35000

Total solid waste = $35000 \times 6.5 = 227500 \text{ lb/day}$

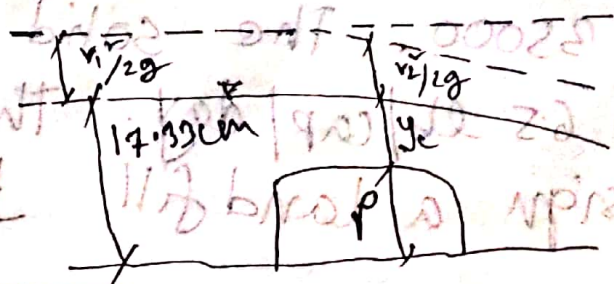
Sp wt of solid waste = $800 \frac{\text{lb}}{\text{yd}^3}$

average depth = $20' = \frac{800}{33} = 29.63 \frac{\text{lb}}{\text{ft}^3}$

$$\text{Area of landfill} = \frac{227500}{29.63 \times 20} = 383.9 \text{ ft}^2$$

Q.8
Exam

Determine the height of broad crested weir (p) from given data. Width of flume = 25cm, actual discharge = 7020.5 cm³/s. Ignore head loss.



Soln:

$$V_1 = \frac{Q}{y_1 B} = \frac{7020.5}{17.93 \times 25} = 16.2 \text{ cm/s}$$

$$b = 25 \text{ cm}$$
$$Q = 7020.5 \text{ cm}^3/\text{s}$$

$$y_c = \sqrt[3]{\frac{Q^2}{g B^2}}$$
$$= \sqrt[3]{\frac{7020.5^2}{9.81 \times 25^2}}$$
$$= 20.09 \times 4.31$$

$$V_c = \frac{Q}{B y_c}$$
$$= \frac{7020.5}{25 \times 4.31}$$
$$= 65.16 \text{ cm/s}$$

$$P + y_c + \frac{V_c^2}{2g} = y_1 + \frac{V_1^2}{2g}$$

$$\Rightarrow P = y_1 + \frac{V_1^2}{2g} - y_c - \frac{V_c^2}{2g}$$

$$= 17.93 + \frac{16.2^2}{2 \times 9.81} - 4.3 - \frac{65.16^2}{2 \times 9.81}$$

$$= 10.99 \text{ cm}$$

Q Focus writing → **Janata Bank** - 2016

Q Write a letter to the editor of a news paper complaining against driving of motor cars in streets. **Janata Bank**.

Q Focus writing in English.

Write an essay discussing ways to improve transport system in Dhaka city.

04. # If the radius of a curve is 300' and width 20', $f = 0.14$, $v = 90$ mph. calculate superelevation. BB AD-2011

$$e + \frac{v^2}{25gR} = \frac{v^2}{25gR} + e + f$$

$$e - e = \frac{v^2}{25gR} - \frac{v^2}{25gR} + f - f$$

$$0 = \frac{v^2}{25gR} - \frac{v^2}{25gR} + f - f$$

$$0 = \frac{90^2}{25 \times 32.2 \times 300} - \frac{90^2}{25 \times 32.2 \times 300} + f - f$$

$$0 = \frac{8100}{241500} - \frac{8100}{241500} + f - f$$

$$0 = 0.0335 - 0.0335 + f - f$$

$$0 = 0 + f - f$$

$$0 = f - f$$

$$0 = 0.14 - 0.14$$

$$0 = 0$$

improve transport system in Dhaka only
 Write an essay discussing ways to
 improve waiting in English.
 goes in streets. Jamaat Bank
 lobby concerned against driving of motor
 bike a letter to the editor of a newspaper
 Jamaat Bank. Goid
 forms waiting → Jamaat Bank

Janaka bank
2016

14.00

14.14

#1 The corner of a building situated next to inner side of a two-lane level horizontal curve with a radius of 50m on a rural highway. Each lane is 3.0m with 2.0m shoulder. The corner is 0.8m away from shoulder. Is it safe to drive at a speed of 90 kmph on this curve? If not how would you remedy the problem? Assume perception reaction time 2.5 sec and deceleration = 3.3 m/sec²

soln!

$$R = 50m, v = 90 \text{ kmph} = 42.93 \text{ m/s}$$

$$t = 2.5 \text{ sec}, a = 3.3 \text{ m/s}^2$$

$$\text{Radius of inside lane} \Rightarrow R = 50 - \frac{3}{2} = 48.50m$$

$$HSO = \frac{3}{2} + 2 + 0.8 = 4.30m$$

$$\text{We know, } HSO = R \left[1 - \cos \left(28.65 \times \frac{SSD}{R} \right) \right]$$

$$SSD = vt + \frac{v^2}{2a} = 42.93 \times 2.5 + \frac{(42.93)^2}{2 \times 3.3} = 386.56m$$

from ① - The building should be located at a distance

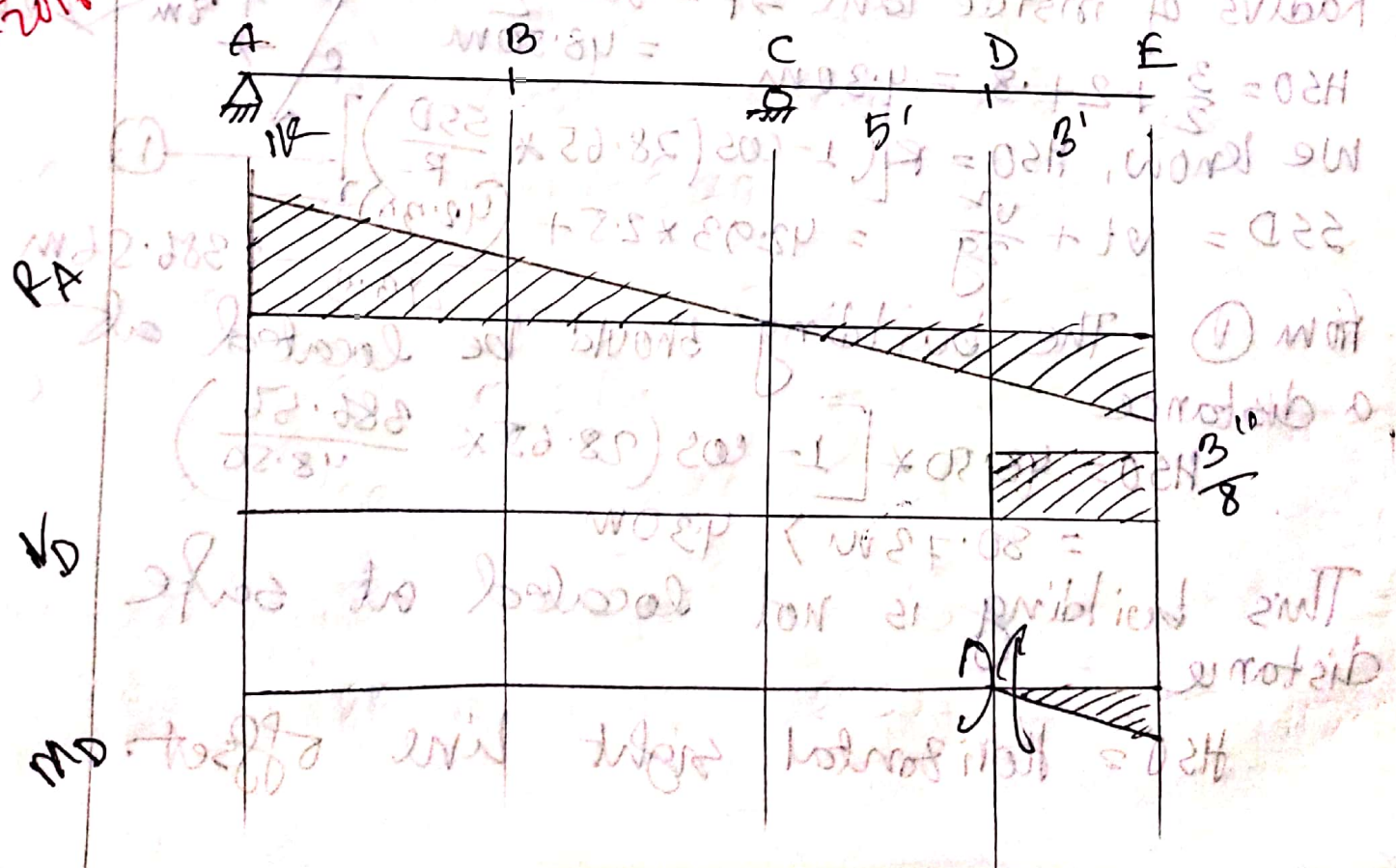
$$HSO = 48.50 \times \left[1 - \cos \left(28.65 \times \frac{386.56}{48.50} \right) \right] = 80.73m > 4.30m$$

This building is not located at safe distance.

HSO = Horizontal sight line offset.

Draw influence lines for shear at D (V_D)
 Bending moment at D (M_D) and support
 reaction A (R_A) in the figure below.

Janata
 2011



The following consecutive staff readings were taken using Dumpy level: 0.705, 1.655, 1.890, 3.015 and 1.655. The first reading was taken on a benchmark whose RL is 150.605 m. Calculate the reduced levels of the stations by the rise and fall method. *January-2016*

Soln: Rise and fall method

Back Reading	Int Reading (IS)	For Reading (FS)	Rise	Fall	R.L
0.705	-	-	-	-	150.605
	1.655	-	-	0.95	149.655
	1.890	-	0.765	-	150.42
	3.015	-	-	2.125	148.295
		1.655	1.36	-	149.65

$$\sum BS - \sum FS = 0.705 - 1.655 = -0.95$$

$$\sum Rise - \sum Fall = 0.765 + 1.36 - (0.95 + 2.125) = 0.95$$

$$\text{Last RL} - \text{1st RL} = 149.65 - 150.605 = -0.95$$

For clear Conception

Problem: 01

The following consecutive readings were taken with a levelling instrument at intervals of 20m.
~~2.375, 1.70, 0.615, 3.450, 2.835, 2.070, 1.835~~
~~1.985, 0.435, 1.630, 2.255 and 3.630~~
 The instrument was shifted after the fourth and eighth readings. The last reading was taken on BM of RL = 110.200m. Find the RL of all points.

Dumpy levels means fall of levels.

Station point	Change	BS	IS	FS	Rise (+)	Fall (-)	RL Remark
1	0	2.375	-	-			112.620
2	20	1.70	1.70		.675		113.265
3	40	0.615	0.615		1.115		114.38
4	60	2.835		3.450	2.835	2.835	111.545
5	80		2.070		.765		112.31
6	100		1.835		.235		112.545
7	120	0.435	1.630	1.985	.85		113.395
8	140		1.630			1.195	112.2
9	160		2.255			.625	111.575
10	180			3.630		1.975	110.200

$$\sum BS - \sum FS = 5.645 - 8.065 = -2.42$$

$$\sum Rise - \sum Fall = 3.610 - 6.030 = -2.42$$

$$\& \text{ last RL} - \text{1st RL} = 110.20 - 112.620 = -2.42$$

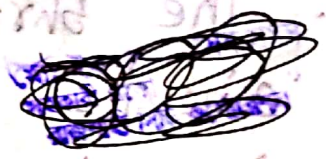
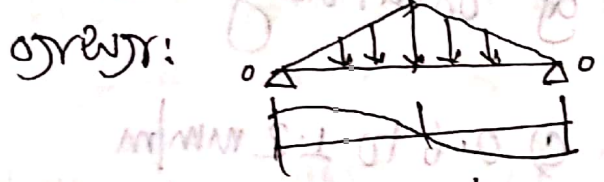
1. The ratio of lateral strain to the linear strain is called

a) Modulus of elasticity c) Modulus of rigidity
 b) bulk modulus ~~d) Poisson's ratio~~

R.S Khunmi - 57 page

2. The shear force at a centre of a simply supported beam with a gradually varying load from zero at both ends to w per meter at the centre, is

~~(a) zero~~ (b) $wL/4$ (c) $w/2$ (d) $\frac{wL}{2}$



3. The bending moment at a section tends to bend or deflect the beam and internal stresses resist its bending. The resistance offered by the internal stresses to the bending is called

a) Compressive stress c) Elastic modulus
 b) Shear stress ~~d) bending stress~~

4. The compressive strength of perforated bricks should not be less than.

a) 4 MN/m^2 b) 5 MN/m^2 c) 6 MN/m^2 ~~d) 7 MN/m^2~~

R.S Khunmi - Page 256 (72 Nos)

5. The time factor corresponding to 25% degree of consolidation is given by

- a) $\frac{\pi}{8}$ b) $\frac{\pi}{16}$ c) $\frac{\pi}{32}$ ~~d) $\frac{\pi}{64}$~~

R.S Khosmi - 445P
214 Nos

6. The lateral earth pressure exerted by the soil when the retaining wall moves into the soil is known as

- a) Earth pressure at rest ~~c) passive earth P~~
b) Active earth pressure d) total earth pressure

R.S Khosmi
445P
214 Nos

7. The shrinkage of ordinary concrete is about

- a) 0.1 to 0.3 mm/m c) 0.6 to 1.2 mm/m
~~b) 0.3 to 0.6 mm/m~~ d) 1.2 to 2.1 mm/m

8. The resistance of an aggregate to wear is known as

- a) shear value ~~c) abrasion value~~
b) crushing value d) impact value

9. For simply supported slab spanning in one direction, the ratio of span to overall depth should not exceed

- a) 15 ~~c) 30~~
b) 20 d) 50

10. An angle measured clockwise from the preceding survey line to the following survey line is called

- ~~a) Direct angle~~ c) Horizontal Angle
- b) Vertical angle d) deflection

11) The crushing strength of stone depends upon

- a) texture c) workability
- b) Specific gravity d) both a and c

12) For RCC construction, the maximum size of coarse aggregate is limited to

- a) 10mm b) 15mm c) 20mm ~~d) 25mm~~

53. The ratio of unconfined ^{compressive} strength of undisturbed soil to the unconfined compressive strength of soil in a remolded state, is called

- ~~a) sensitivity~~ c) relative density
- b) thixotropy d) bulk density

~~54~~ The maximum water content of a saturated soil at which a reduction in its moisture does not cause a decrease in volume of the soil is called —

- a) liquid limit b) plastic limit c) elastic limit
- ~~d) shrinkage limit.~~

55. The maximum depth of foundation for building on clays is
- a) 0.2 to 0.4m b) 0.4 to 0.6m
 c) 0.6 to 0.9m ~~d) 0.9 to 1.6m~~
56. For highly loaded columns, the concrete mix used is of proportion.
- ~~a) 1:1:2~~ b) 1:1.5:3 c) 1:2:4 d) 1:3:6
57. The major loss due to prestressed is caused by
- a) Creep of concrete c) shrinkage of concrete
 b) Relaxation steel ~~d) all of these.~~
58. In residential building, the average value of stair width is
- a) 600mm b) 700mm c) 800mm ~~d) 900mm~~
59. The longitudinal shearing stress acting on the surface betn the steel and concrete are called
- ~~a) bond stress~~ c) compressive stress
 b) Tensile stress d) none of these
60. The correct relation between TOD, BOD and COD
- a) $TOD > BOD > COD$ c) $COD > BOD > TOD$
~~b) $TOD > COD > BOD$~~ d) $BOD > COD > TOD$

61. Which of the foundation is used for weaker soil -
- a) column footing c) raft footing
 b) grillage footing ~~d) all of these.~~
62. High percentage of tricalcium silicate and low percentage of dicalcium silicate in cement results in
- a) Rapid hardening c) high heat generation
 b) high early strength ~~d) All of these~~
63. The compressive strength of sand is
- a) 40 MN/m² ~~c) 65 MN/m²~~
 b) 55 MN/m² d) 80 MN/m²
64. A compaction factor of 0.88 indicates that the workability of concrete mix is
- a) very low b) low ~~c) medium~~ d) high.
65. For reinforcing bar in compression, the average bond stress can be increased.
- a) 10% ~~b) 25%~~ c) 50% d) 75%
- 66) When the diameter of reinforcing bar is ϕ the anchorage value of the hook alone is equal to
- a) 2 ϕ ~~b) 16 ϕ~~
 b) 8 ϕ d) 32 ϕ

67. A good quality cement should have higher percentage of
- a) silica
 - b) free lime
 - c) di-calcium silicate
 - d) ~~Tri-calcium~~ silicate
68. The neutral axis in a T-beam section falls
- a) within the flange
 - b) outside the flange
 - c) either a or b
 - d) ~~None~~ of these.
69. The collimation method for obtaining the reduced levels of points does not provide a check on.
- a) fore sights
 - b) back sights
 - c) change points
 - d) intermediate "
70. When a slab is continuous over several spans, negative (hogging) bending moment is indicated over the
- a) end supports
 - b) ~~intermediate~~ supports
 - c) both a and b
 - d) none of these.
71. When the water table is close to the ground surface, the bearing capacity of soil reduced to
- a) one-~~half~~ fourth
 - b) one-~~fourth~~ half
 - c) two-third
 - d) ~~three-fourth~~

Janaka Bank - 2016

72. The length of reinforced concrete pile is taken as 2/3 the length embedded in firm stratum.
a) one-half c) two-third
b) one-third d) three-fourth.
73. With the moisture content of 5 to 10% by weight the bulking of sand is increased by
a) 20% b) 30% c) 40% ~~d) 50%~~
74. The factor of safety due to overturning of the retaining wall is generally taken as
~~a) 2~~ b) 4 c) 6 d) 8
75. The diagonal tension in a pre-stressed member will be _____ shear stress.
(a) equal to ~~b) less than~~ c) more than d) none of these
76. For the purpose of the design of reinforced concrete footings, pressure distribution assumed to be
a) linear c) hyperbolic
b) parabolic d) None of these
77. The allowable bearing stress for rolled steel beam is
a) 128 N/mm² c) 189 N/mm²
b) 156 N/mm² d) 228 N/mm²
78. When a body is subjected to three mutually perpendicular stresses of equal intensity, the ratio of direct stress to the corresponding volumetric strain is called - bulk modulus

78. In a prismatic compass, the zero of the graduated ring is located at
 a) North end ~~b) south end~~ c) east end d) west end
79. PERT Analysis is based on —
 a) Optimistic b) pessimistic
 c) Most likely method ~~d) all of these.~~
80. The difference betⁿ total float and free float is called
 a) duration c) critical activity
~~b) Interfering float~~ d) none of these.
81. The minimum depth of foundation for a load bearing wall of a building is restricted to
 a) 600mm b) 700mm c) 800mm ~~d) 900mm~~
82. The distance between C.G. of the compression flange and C.G. of tension flange of a plate girder is known as.
 a) overall depth c) clear depth
~~b) effective depth~~ d) economical depth.
83. In a plate girder the vertical stiffeners are provided when the ratio of clear depth to the thickness of web exceeds
 a) 50 b) 65 c) 75 d) 85

84. The most economical section of a trapezoidal channel is one which has hydraulic mean depth equal to
a) $\frac{1}{2}$ (depth) b) $\frac{1}{2}$ (breadth) c) $\frac{1}{2}$ (sloping) d) $\frac{1}{2}$ (depth + breadth)

85. A rectangular beam of length l supported at its two ends carries a central point load W . The maximum deflection occurs
a) at the ends b) at the center c) at $\frac{1}{2}$ from the ends d) none of these.

86. A soil sample has a specific gravity of 2.60 and void ratio 0.78. The water content % required to fully saturate the soil at that void ratio will be
a) 20 b) 30 c) 50 d) 70

87. In the pre cast reinforced concrete piles, the thickness of concrete covering the main bars shall not be less than.
a) 40mm b) 55mm c) 75mm d) 100mm

88. A square beam and a circular beam have the same length, same allowable stress and the same bending moment. The ratio

of weights of the square beam to the circular beam is

- a) 1 b) 1.5 ~~c) 1/112~~ d) 1/1.82

90. In a thick cylindrical shell subjected to an internal pressure (P), the max^m radial stress at the inner surface of the shell is

- a) zero ~~b) $-P$ (compressive)~~ c) P tensile d) $2P$ (tensile)

BADC (01-51), Bangla + English + Math

+ GK + ICT = 31, 1BA

52-80 ⇒ Civil + ME + EEE = 28.51

52. A gas which obeys kinetic theory perfectly is known as

- a) Monoatomic gas c) Diatomic
b) Real gas ~~b) perfect gas~~ d) Pure gas

53. The centre of gravity of a right circular solid cone is at a distance of _____ from its base

- a) $h/2$ d) $h/6$
~~b) $h/4$~~
c) $h/3$

54. The centre of gravity of T section 200mm x 150mm x 50mm from its bottom is
 a) 50mm b) 75mm ~~c) 87.5mm~~ d) 125mm
55. If the resultant of two equal forces has the same magnitude as either of the forces, then the angle —
 a) 30° b) 60° c) 90° ~~d) 120°~~
56. Reynold's number is the ratio of inertia force to
 a) pressure force b) elastic c) gravity force ~~d) viscous~~
57. The unit of angular acceleration is — ~~rad/s~~
58. If the length of the cable is doubled, its capacity C will become —
~~a) Doubled~~ b) Half c) One-fourth d) one-third
59. What quantity of charge must be delivered by a battery with a potential Difference of 110V
 a) .6c ~~b) 6c~~ c) 60c d) 600c

Explanation $\Rightarrow Q = \frac{W}{V} = \frac{660}{110} = 6c$

60. In case of short circuit _____ current will flow in the circuit.
 (A) Zero (B) Very low (C) Normal (D) Infinite

Ans: **Ques:** At the short circuit point, the voltage difference is very low (about zero) so then put the value in $I = \frac{P}{V}$, so if we put $V=0$, then current will be infinite.

61. A simply supported beam of span L carries a concentrated load w at its mid span. The maximum bending moment m is $\frac{wL^2}{4}$

62. The unit of moment of inertia of an area is mm^4

63. Which of following is vector quantity
 Ans: All the above.

64. The method of measuring distance by pacing is chiefly used in
 (A) Reconnaissance survey (B) Primary surveys
 (C) Location surveys (D) All of these

65. The height of a water column equivalent to a pressure of 0.15 MPa is

- a) 15.3m b) 25.3m c) 35.3m d) 45.3m

or by:

$$P = \rho H W$$

$$= 0.15 \times 10^6 / 9810 = 15.3 \text{ m}$$

66. A line joining the apex of a triangle to some fixed point on the opposite side is called a

- a) check line b) tie line c) base line d) none of these

67. To prevent segregation, the maximum height for placing concrete is

- a) 100cm b) 15m c) 150cm d) 200cm e) 250cm

68. When the concrete mix is too wet, it causes on the top

- a) segregation b) low density c) excess laitance d) All of these.

69. An angle between the inclined line of sight and the horizontal is called

- a) Direct angle
~~b) Vertical angle~~
 c) Horizontal angle
 d) deflection angle

70. The horizontal angle between the true meridian and a survey line is called
- a) Magnetic bearing c) dip
~~b) Azimuth~~ d) magnetic declination
71. A line joining some points on the main survey line, is called a
- a) check line ~~b) tie line~~ c) base line d) None
72. A line normal to the plumb line at all points is known as
- a) horizontal line ~~c) level line collimation~~
 b) vertical line d) line of collimation
73. A fixed point of reference of known elevation is called —
- a) change point ~~c) bench mark~~
 b) station point d) datum
74. For a longitudinal reinforcing bar in a column, concrete cover not less than —
 not less than the = 40 mm.
- ⇒ Diameter of such bar should be provided

75. Bernoulli's equation is adopted to
- a) Venturi meter c) Pitot tube d) None
 b) orifice ~~d) All of these~~
76. The cycle generally used for gas turbines is —
- a) Otto cycle b) Dual cycle c) Carnot cycle
~~d) Rankine cycle.~~ ~~e) Brayton cycle~~
77. If you double the absolute temperature of an object, it will radiate heat 16 times faster. $I = kT^4$
78. If all the variables of a stream are independent of time it is said to be
- a) constant flow b) closed flow ~~c) steady flow~~
 d) Unsteady flow
79. An isentropic process is always — Reversible and adiabatic
80. The process and or systems that do not involve heat are called — Adiabatic processes.

महानगर प्रश्न (निर्देश), 2016

41. In the stiffness method of analysis, the basic unknowns are —
a) displacements b) forces c) displacement and forces d) None of these.
42. The most commonly used admixtures which prolongs the setting and hardening time is ^{above}
a) gypsum b) CaCl_2 c) Sodium silicate d) All of the above
43. Effective length of a compression member effectively held in position and restrained in Direction at both ends is
(a) L b) $0.85L$ c) $2L$ d) $0.67L$ ~~None of these~~
44. Number of unknown forces in a space truss member is
a) three b) two c) one d) None of the above.
Answer: Two force member and max^m 3 unknown in space truss.
45. The most suitable equipment for compacting clay soil is
a) Smooth wheeled roller b) Pneumatic type roller c) ~~sheep foot roller~~ d) vibrator.

46. The ratio of lateral strain to linear strain is called.

- Janata 17
- (a) Modulus of elasticity (c) bulk modulus
(b) Modulus of rigidity (d) Poisson's ratio

47. When a body is subjected to the mutually perpendicular stress, of equal intensity, the ratio of direct stress to the corresponding volumetric strain is called

- Janata 17
- a) Young's modulus (c) bulk modulus
b) Modulus of rigidity (d) Poisson's ratio

48. The energy stored in a body when strained in elastic limit is known as

- a) resilience (b) proof resilience (c) strain energy
d) impact energy.

49. The shear force at the centre of a simply supported beam with a gradually varying load from zero at both ends w per meter at the centre.

- Janata 2017
- (a) zero (b) $wl/4$ (c) $wl/2$ (d) $wl/2$

50. The bending moment at a section tends to bend or deflect the beam and the internal stresses are $\&$ resist its bending

The resistance offered by the internal stresses to the bending is called

- a) compressive stress ~~c) bending stress~~
b) shear stress d) elastic modulus

51 A square beam and a circular beam have the same length — — — — —
a) 1 b) 1.5 ~~c) 1/12~~ d) 1/1.82

52 A rectangular beam of length supported at its two ends carries a central point load w the max^m deflection occurs.
a) At the ends ~~c) at the centre~~
b) at $1/3$ th from the both ends d) none of these.

53 In a thick cylindrical shell subjected to a internal pressure (P) , the max^m radial stress at the inner surface of the shell is
a) zero b) P (tensile) ~~c) $-P$ (compression)~~ d) $2P$ (tensile)

54 Euler's formula holds good only for
a) short column ~~b) long column~~ c) both short and long column d) all of the above.

55 When a body, floating in a liquid, is given small displacement, it starts oscillating about a point known as
a) Centre of pressure b) Centre of gravity c) centre of buoyancy ~~d) meta center.~~

56. Bernoulli's equation is applied to
a) venturimeter b) orifice c) pitot tube ~~d) All~~

57. The total energy line lies over the hydraulic gradient line by an amount equal to the

- a) Pressure head c) Pressure + velocity head
~~b) velocity head~~ d)

58) The most economical section of a trapezoidal channel is one which has hydraulic mean depth equal to

- a) $\frac{1}{2}$ (depth) b) $\frac{1}{2}$ (breadth) c) $\frac{1}{2}$ (Sloping side)
d) $\frac{1}{2}$ (depth + breadth)

59. The loss of pressure head in case of laminar flow is proportional to

- a) Velocity b) (velocity)² c) velocity³ d) Velocity⁴

60. In a prismatic compass, the zero of the graduated ring is located at

- a) North end ~~b) South end~~ c) East end d) West end

61. The magnetic bearing of a line is $55^{\circ}30'$ and the magnetic declination is $4^{\circ}30'$. The true bearing of a line will be

- a) 30° b) $34^{\circ}30'$ c) 49° ~~d) 51°~~

62. The process of turning the telescope of a theodolite over its supporting axis through 180° in a vertical plane is called
a) Transiting b) reversing c) plunging ~~d)~~
any one of these.
63. A joining the optical center of the object glass and the center of eye piece is known as
a) Fundamental line b) axis of level tube
~~b)~~ Axis of telescope d) line of collimation.
64. An angle measured clockwise from the preceding survey line to the following survey line is called
a) direct angle b) vertical angle c) horizontal angle
~~a)~~ deflection angle d) deflection angle.
65. The method of surveying used for determining the relative height of points on the surface of the earth is called
~~a)~~ levelling b) simple levelling c) longitudinal levelling
d) differential levelling.
66. The collimation method of obtaining the reduced levels of points does not provide a check on.

- a) fore sights b) back sights c) change points
d) ~~Intermediate~~ sights.

67. The compressive strength of sand stone is a) 40 MN/m² b) 55 MN/m² c) 65 MN/m² d) 80 MN/m²

68. The crushing strength of sand stone depends upon its a) texture b) sp. gravity c) workability d) ~~all~~ a, b, c

69. The compressive strength of perforated bricks should be

- a) 4 MN/m² b) 5 MN/m² c) 6 MN/m² d) 7 MN/m²

70. A good quality cement should have higher percentage of

- a) silica b) free lime c) di-calcium silicate
d) ~~Tri-calcium silicate~~.

71. Rcc construction, the max^m size of coarse aggregate is limited to

- a) 20 mm b) 15 mm c) 20 mm d) ~~25 mm~~

72. The shrinkage of ordinary concrete is — (b) 3 to 6 mm/m

73. The degree of saturation of moist soil is about

- a) 0% b) 4 to 25% c) 25 to 30% d) ~~50 to 75%~~

74. A soil sample is having a sp. gravity 2.60, $e = 0.78$, water content required to fully saturate the soil at that void ratio will be
a) 10 ~~b) 30~~ c) 50 d) 70

75. The water content of soil can be accurately determined by ~~a) Oven drying method~~
a) sand bath method b) calcium carbide method c) Pyrometer method d) Pycnometer method

76. The ratio of unconfined - sensitivity
~~Janata-17~~ water content \rightarrow Ans: shrinkage limit ~~Janata-17~~

77. The property of the soil mass which permits the pass of water through its interconnecting voids is called
a) Capillarity ~~b) permeability~~ c) porosity d) None.

79. The time factor corresponding to 25% degree $\rightarrow \frac{\pi}{64}$ ~~Janata-17~~

80. Which of the following parameters can be used to determine the angle of friction of a sandy soil?
a) Particle size ~~b) density index~~
b) roughness of particle c) particle size distribution d) particle size distribution.

81. The lateral earth pressure exerted by the soil when the retaining wall moves to the soil is known as passive earth pressure.
82. When the water table is close to the ground surface, the bearing capacity of soil is three-fourth.
83. The minimum depth of building on clay is
a) 2 to 4m b) 4 to 6m c) 6 to 9m ~~d) 9 to 16m~~
84. Which of the following foundation is used for weaker soil.
a) column footing b) grillage footing c) raft footing ~~d) all of these.~~
85. In the pre-cast reinforced concrete piles the thickness of concrete covering the main bars should not be less than
a) 40mm b) 55mm c) 75mm d) 100mm
86. The minimum depth of foundation for the load bearing wall of a building is restricted to
a) 600mm b) 700mm c) 800mm d) 900mm
87. Herring bone bond is commonly used for
a) brick paving b) very thick wall c) partition wall d) footings in foundation.

88) In residential building average value of stair width is

- a) 600 mm b) 700 mm c) 800 mm d) 900 mm

89) Which of the following ingredients of cement when added in excess quantity? causes the cement set slowly.

- a) lime b) silica c) Alumina d) Iron-oxide

90) High % of tricalcium silicate and low percentage dicalcium silicate in cement results in

- a) Rapid hardening c) high heat generation
b) high early strength ~~d) All of these.~~

91) The resistance of wear of aggregate is known as

- a) shear value b) crushing value ~~c) abrasion value~~
d) impact value.

92) With the moisture content of 5% to 10% by weight, the bulking of sand increase by

- a) 20% b) 30% c) 40% ~~d) 50%~~

93) A compaction factor .88 indicates that the workability of concrete mix is

- a) Very low b) low ~~c) medium~~ d) high.

94) For highly loaded column, the concrete mix used is of proportion.

- a) 1:1:2 b) 1:1.5:3 c) 1:2:4 d) 1:3:6

95) The longitudinal shearing stress acting on the surface betⁿ the steel and concrete is called

- a) bond stress b) tensile stress c) compressive stress d) none.

96) For simply supported slabs spanning in one direction, the ratio span to overall depth should not exceed

- a) 15 b) 20 c) 30 d) 50

97) For the purpose of the design of reinforced concrete footing, pressure distribution is assumed to be

- a) linear b) parabolic c) hyperbolic d) none

98) The major loss of pre-stressed due to

- a) creep of concrete b) relaxation of steel c) shrinkage of concrete d) ~~all~~ all of these

99) Activated carbon is used for

- a) disinfection b) removing hardness c) removing odors d) removing cohesiveness

Jan 10)

Q00 The correct relation betⁿ TOD, COD and

^{make} BOD is given by

- a) ~~TOD > BOD > COD~~
- b) ~~TOD > COD > BOD~~

- c) COD > BOD > TOD
- d) BOD > COD > TOD

सालगी १५ - २०१३

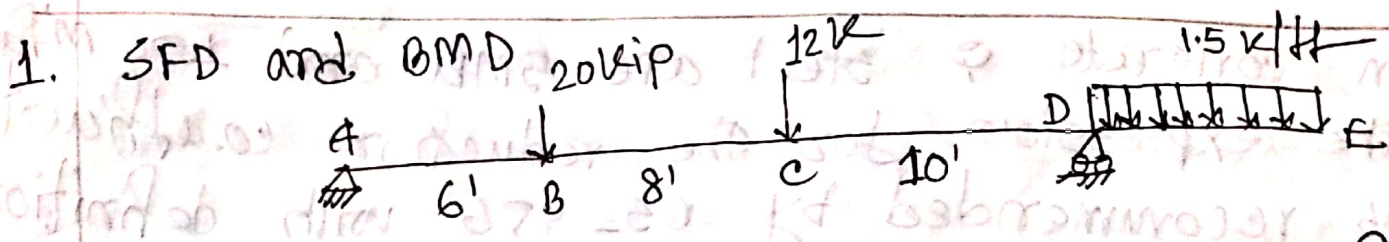
बिचल - ५०

तन → बाण्य -

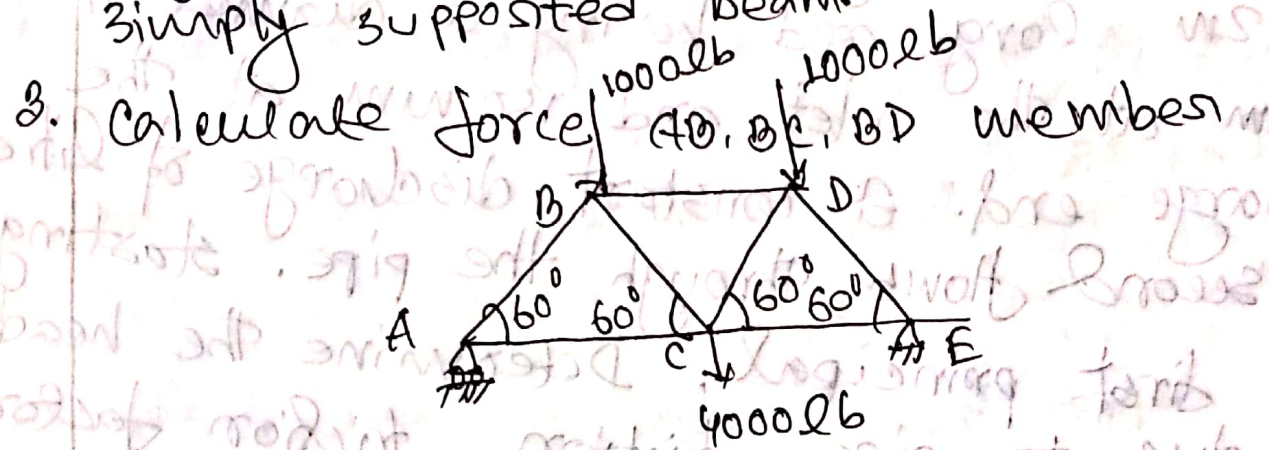
२०१३ -

५५ - ४०

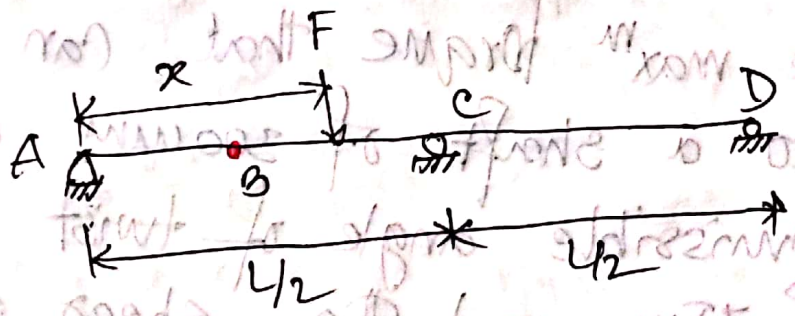
१००



2. Differentiate between internal hinge and plastic hinge. Draw different types of crack in a simply supported beam.



4. IL line for R_c and M_B



5. Calculate by working stress method the main reinforcement and ties required for a column of effective length $4.5m$ to carry a service load of $550 kN$ including self weight of column. The size of column is $300 \times 300 mm$. The allowable stress in direct compression

in concrete & steel are 5MPa and 190 MPa
The expression for the reduction coefficient
as recommended by BS-456 with definition
is : $C_r = 1.25 - \frac{I_{ef}}{48b}$

6. Water flows through a horizontal conical pipe 2m long and having a diameter 200mm at the inlet and 150mm at the discharge end. A constant discharge of litre per second flows through the pipe. Starting from first principal, Determine the head loss due to pipe friction. friction factor $f = 0.4$

7. Find the max^m torque that can be applied safely to a shaft of 300mm diameter. The permissible angle of twist is 15° in a length of 7.5m and the shear stress not exceed 42 N/mm^2 . Take modulus of rigidity $G = 84.4 \text{ kN/m}^2$

8. Explain the difference betⁿ on street parking and off street parking. In a wide road with low traffic volume, which method of parking (parallel or angular) do you

recommend and why?

9. The length of a line measured with 20m chain was found to be 500m. It was subsequently found that the chain was 0.04m long. What is the length of the line.

10. The total volume of a soil sample was 80000 mm³ and its wt is 150gm. The dry wt of 3 specimen is 130gm and density of the soil solid 2680 gm³. Find (1) W (2) e (3) n (4) Sr.

11. What are the three major types of reinforcements used in prestressing? Why is the span length ratio of end span/ approach span to its neighbour, inner spans usually 0.75?

12. Briefly explain unit hydrograph, Non-tensioned flume and suppressed weir.

13. Calculate FM.

Sieve No	75mm	37.5mm	19mm	4.75mm	2.36mm	1.18mm	600mm
Material retained (gm)	0	1750	1750	1400	0	0	0
	300mm	0.15mm					

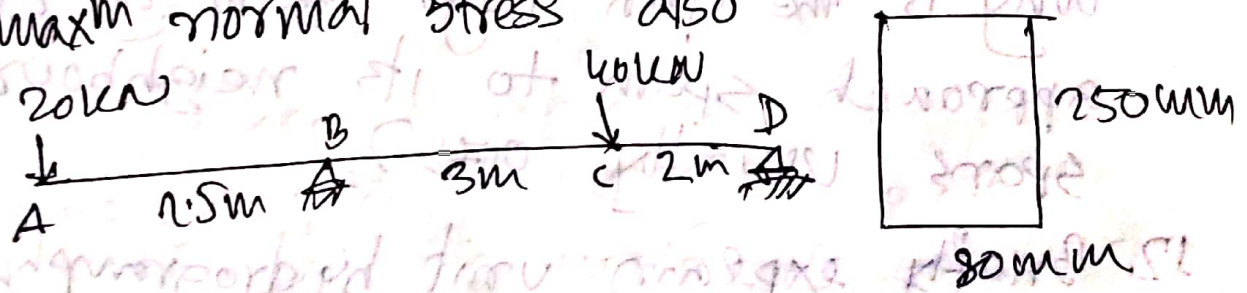
14. Write a letter to the editor of a newspaper complaining the reckless driving of motor cars in the road.

15. Write an essay discussing ways to improve transport system in Dhaka city.

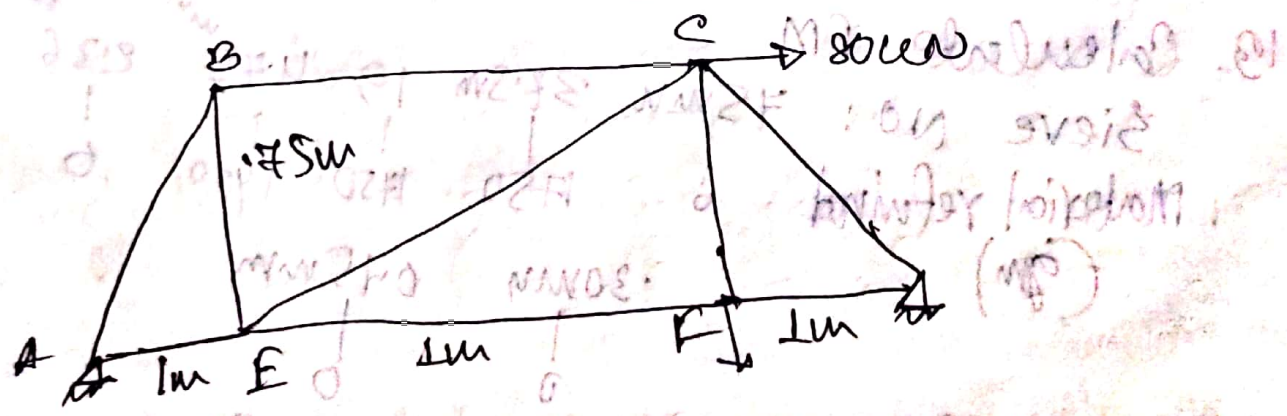
16. - বঙ্গবন্ধু জাতীয় সড়ক পরিবহন ব্যবস্থা
সম্বন্ধে আলোচনা করুন।

Senior officer (Civil)

1. Draw SFD and BMD of the following beam. The max normal stress also



2. Calculate member force, AB, AC, BC



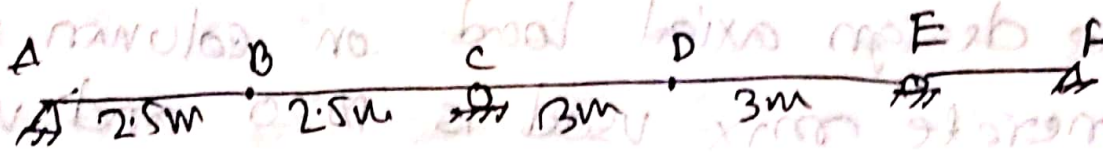
3. A reinforced concrete column of effective length 4.8m is 250x400mm in overall dimension. The design axial load on column is 60ton. Concrete mix used is M20 and mild steel reinforcement, using working stress method determine the reinforcement required for column. Also design tie spacing.

4. A masonry retaining wall of trapezoidal section has a height of 4.5m. Its top width is 0.6m and the base width is 0.4m. The vertical face of wall retains a soil of unit weight 12 kN/m^3 to full height. Angle of repose of soil is 30° . If no tension in the wall is to be permitted, check the safety of the wall at the top with a width of 0.6m should be revised so that no tension developed at the base. Unit wt of masonry is 20 kN/m^3 .

5. A rectangular trapezoidal concrete channel 12' wide with a slope of 20' in 8000' is design for a discharge of 600 cfs. For a water temperature of 40°F . Estimate

the depth of flow.

6. ILD for R_c , R_E , R_F



7. What do you understand by preset during the installation process of bridge bearing? Describe various methods of concrete curing.

8. What is the function of followers in driven H-piles? What are the advantages of using up-down approach in basement construction?

9. An undisturbed sample of clayey soil have wet weight 285 N, dry weight 250 N and volume $1 \times 10^3 \text{ cm}^3$. $G = 2.70$ then w , e & S_r .

10. In a concrete compression test normally $150 \text{ mm} \times 150 \text{ mm} \times 150 \text{ mm}$ concrete cube sample is used for testing. Why isn't $100 \text{ mm} \times 100 \text{ mm} \times 100 \text{ mm}$ sample used instead of this cube?

What is the difference in application

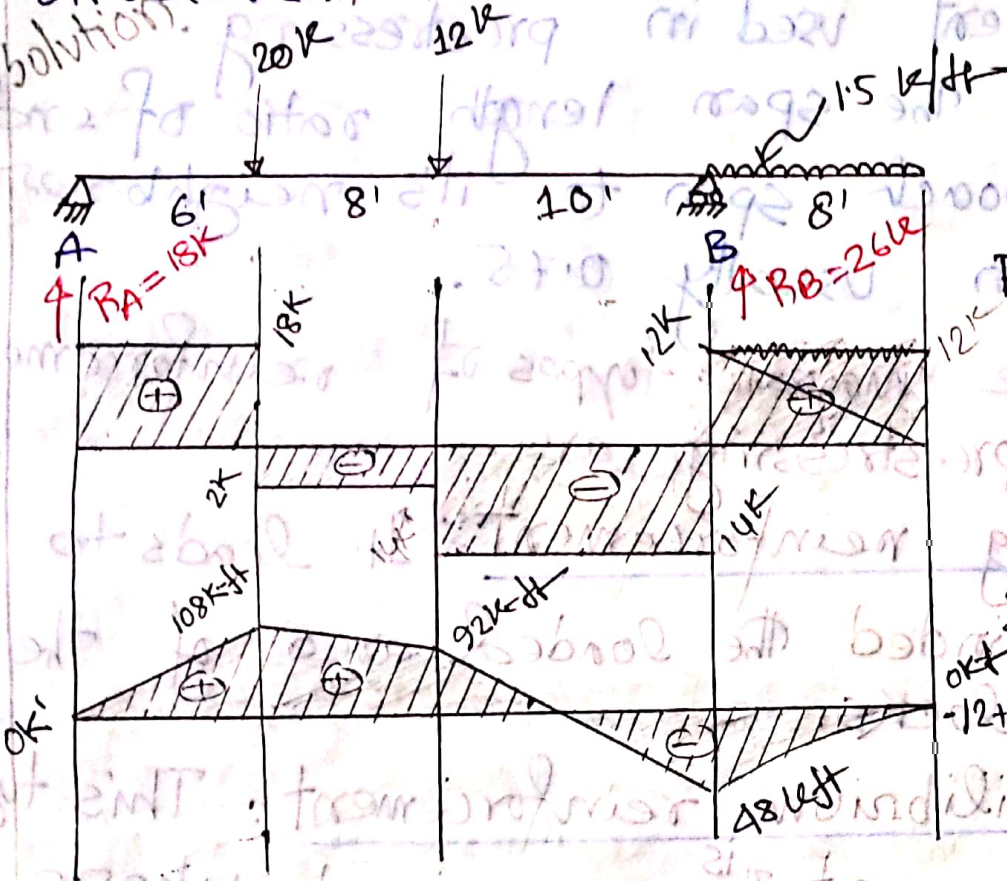
between open stirrups and closed stirrups in concrete beam?

11. State the basic difference between aerobic and anaerobic degradation of organic waste with equation? ~~is~~
why COD value is higher than BOD value?
12. What is the function of sand layer underlying paving slab on interlock blocks. What is the importance of air void content in bituminous pavement.
13. Define preconsolidation pressure and procedure to determine the pressure
14. Role of Green banking in sustainable growth of Bangladesh.
15. ১৫৭৭-৩৩০.০০০ ফর্মুলা ও প্রকল্প

Total: 200 marks
 Q no: 16/20

Banker's Selection Committee
 Officers (Civil). 13/07/18 10:00-12:00

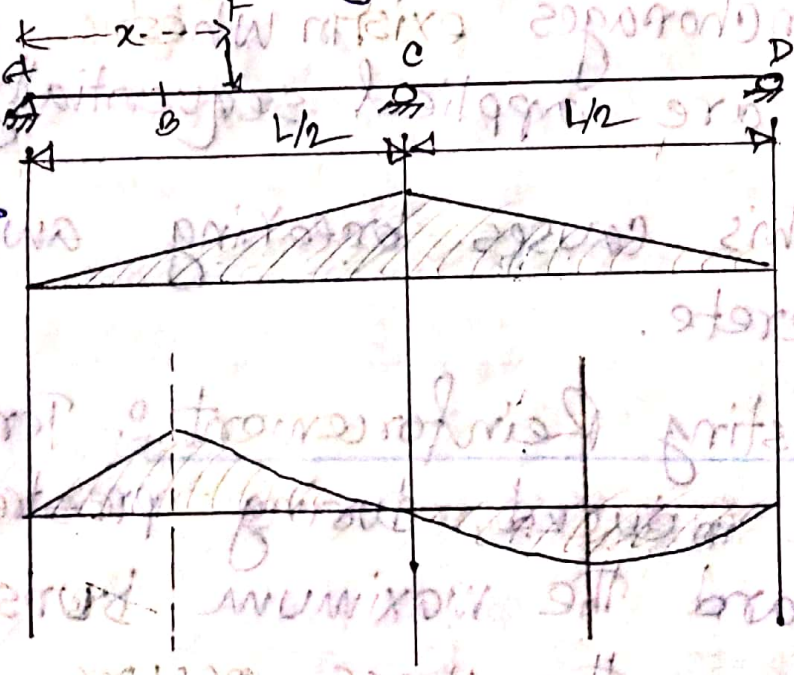
1. Draw the SFD and BMD of the following structure:



$\sum M_B = 0$
 $R_A \times 24 + 8 \times 1.5 \times \frac{8}{2} - 20 \times 18 - 12 \times 10 = 0$
 $R_A = 18 \text{ k}$
 $\sum F_y = 0$
 $-12 + R_A + R_B - 32 = 0$
 $R_B = 26 \text{ k}$

Upland
 13/07/20

2. Draw the ILD for R_c and M_B



ILD diagram for R_c

ILD diagram of M_B

$20 \times 6 + 12 \times 14 + 12 \times 28 = 24 R_B$
 $R_B = 26 \text{ k}$
 $R_A + R_B = 32$
 $R_A = 12 \text{ k}$

3.

What are the three major types of reinforcement used in prestressing.

Why is the span length ratio of end span approach span to its neighbour inner span usually 0.75.

Three major types of reinforcement used in pre-stressing are -

(i) Spalling reinforcement: It leads to stress behind the loaded area of the anchor blocks.

(ii) Equilibrium reinforcement: This type of reinforcement is required where several anchorages in which prestressing loads are applied sequentially.

and this causes breaking away of surface concrete.

(iii) Bursting Reinforcement: Tensile stresses are induced during prestressing operation and the maximum bursting stress occurs where the stress trajectories are concave towards the line of

action of the load. Reinforcement are needed to resist these lateral tensile forces.

~~Google~~ # From structural point of view, for a multi span bridge with equal span length, the sagging moment at the mid span of the end span/approach span is largest. In order to reduce this moment, the span length of end span/approach span is designed to be 0.75 of inner spans.

However, this ratio should not be less than 0.40 because of the effect of Uplifting at the end span/approach span support.

4. Briefly explain (i) Unit hydrograph (ii) Non-newtonian fluid (iii) Suppressed weir.

(i) Non Newtonian Fluid:

~~Google~~ A non-newtonian fluid is a fluid that does not follow Newton's law of viscosity. Most commonly, the viscosity of non-newtonian fluids is dependent on shear rate or shear rate history. Therefore, a constant coefficient of viscosity cannot be defined.

Example: Tooth paste, Soup, butter, magma, lava, gum, honey, blood etc.

Extra Google **Q1** Is honey a Newtonian or non Newtonian fluids -

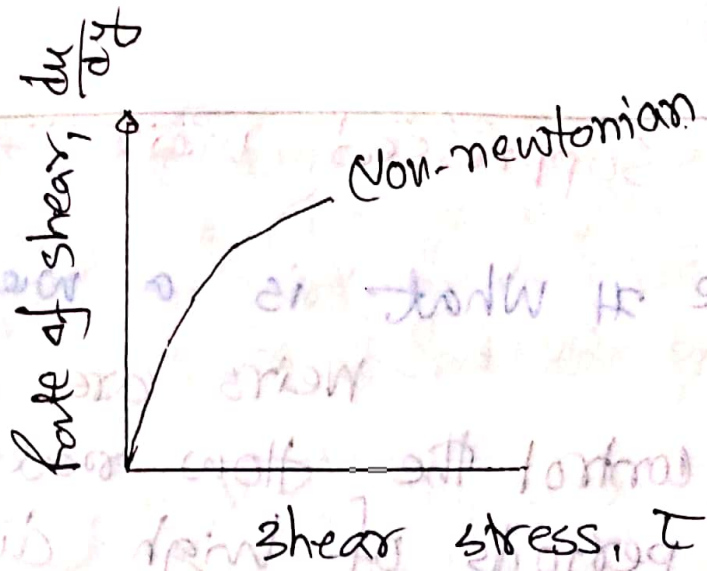
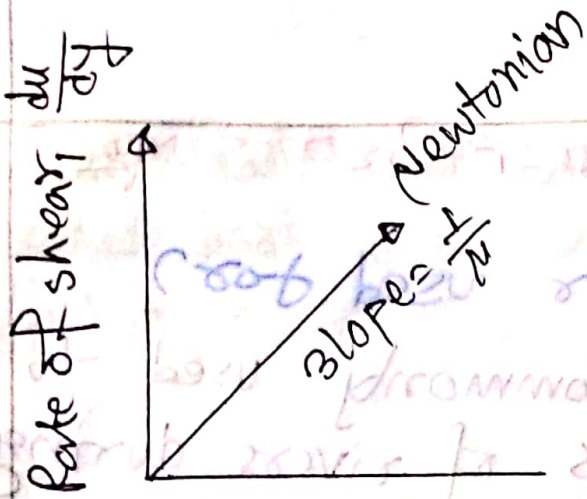
Their viscosity changes when a shearing force is applied. Blood, Ketchup, gravy, mud, pudding, custard and honey all are examples of non-newtonian fluids.

Extra **Q2** Is the air a Newtonian fluids

Fluids such as water, air, ethanol, and benzene are Newtonian. This means that a plot of shear stress versus shear rate at given temperature is a straight line with a constant slope that is independent of the shear rate. All gases are Newtonian.

Extra **Q3** Is water a Newtonian fluids? ①

Some examples of Newtonian fluids include water, organic solvents and honey. For those fluids viscosity is only dependent on temperature.



(ii) Unit hydrograph → $\frac{1 \text{ cum}}{\text{cm}^2 \text{ area}} \rightarrow \frac{1 \text{ cum}}{\text{km}^2}$

Extra Google What does a hydrograph measure?

* A hydrograph is a graph showing the rate of flow (discharge) versus time past a specific point in a river, channel or conduit carrying flow. The rate of flow is typically expressed in cubic meters or cubic feet per second (cms/cfs).

What is a hydrograph and hyetograph?

A hyetograph is a graphical representation of the relationship between the rainfall intensity and time. It is the plot of the rainfall intensity drawn on the ordinate axis against time on the abscissa axis. The hyetograph is a bar diagram.

* []

(iii) Suppressed weir: ~~अमर बाँध~~ ~~अमर बाँध~~!

Google
Extra

What is a weir used for?
Weirs are commonly used to control the flow rates of rivers during periods of high discharge. Sluice gates can be altered to increase or decrease the volume of water flowing downstream.

5.
Anal
Nur

Explain the difference on street parking and off street parking.
In a wide road with low traffic volume which method of parking (parallel or angular) do you recommend and why?

On street parking (Kerb)	Off street parking
(i) In this type of parking vehicles are parked on the kerb which may be designed for parking.	(i) When parking facilities are provided away from the kerb is known as off site parking.
(ii) There are various methods of on side parking.	

are parallel parking, 30° angle parking, 45° angle parking, right angle parking etc.

(ii) Examples: surface car parking, multistory car parking, roof parking, underground car parking etc.

(iii) Need physical changes like painting, sign, meters etc.

(iii) Need securing land/shade, toll collection, paving etc.

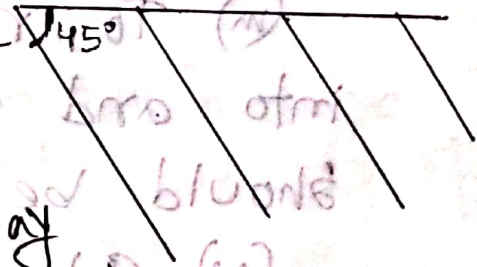
(iv) Less or short time.

(iv) Generally longer time uses.

(v) Cost and time construction is relatively low.

(v) Cost and time of construction relatively high.

When narrow traffic with high volume then Angular parking is more preferable as —



(i) It is easiest and fastest way of parking.

(ii) Reduce crushing during parking between existing vehicle and new comer.

(iii) More space efficient (less driving lane are required).

In a wide road with low traffic volume parallel parking will be suggested by me. As, there is enough space to park the car.

Extra # What are the points to be considered for designing an off-street parking.

The following are the required points

(i) Exit and entrance to the parking place should be located far away from intersection.

(ii) These should be provided on unimportant or minor streets with less traffic flow.

(iii) To reduce congestion, right turn into and out of the parking facility should be restricted.

(iv) Adequate sight distance should be provided.

(v) Vehicles entering and leaving the parking space should divergent and merge at low speed.

6. Differentiate betⁿ internal hinge and plastic hinge.

Draw Different types of cracks in simply supported beams.

Internal Hinge	Plastic hinge
(i) Bending moment at internal hinge is always zero	(i) Deformation of a section where plastic bending occurs.
(ii) It makes the structure more flexible (free rotation)	(ii) It allows large rotation and makes the structure complex.
(iii) It reduces stress in the member.	(iii) It allows the structure to bend within plastic limit.
(iv) Internal hinges are provided to reduce static indeterminacy of the structure, so the analysis is easy.	(iv) It can not reduce static indeterminacy of the structure.

Different types of cracks → ANSWER

Ans - ANSWER, Agrani - 69

~~Extra Google~~ # What are the causes of cracks in RCC slabs —

- (i) Inadequate quality control in accepting the ingredients —
- (ii) Improper control on material proportions
- (iii) Excessive vibrations during casting.
- (iv) Inadequate curing of the slab.
- (v) Insufficient precautions during striking off.
- (vi) Excessive deformation of the cantilever slab at the ends.

~~Extra Google~~ # What is the common size of rebar used in RCC slab?

It mostly depends on the type of structure and other factors, but most commonly used sizes are 8mm, 10mm and 12mm diameter.

~~Extra Google~~ What is the difference betⁿ RCC slab and a normal slab.

RCC refers to reinforced cement concrete.

Hence an RCC slab comprises of carefully worked out steel reinforcements

in order to provide tensile strength to the structure as it is an obvious fact that concrete mainly withstands compression load and is tremendously weak in withstanding tensile loads. RCC slabs are most prevalent in normal construction practices and can easily be located in any of the common buildings.

Normal slabs, there is nothing as such. The normal slabs are completely made up of cements and as such used in places where high compression loads are not be dealt with. One can easily find out these kinds of slabs in road and pavement constructions.

Extr # What is difference betⁿ normal slab and post-tensioned slab.

Normal slab	post-tensioned slab
(i) The slab which is supported with beams and columns is called normal slab.	(i) The slab which is tensioned after constructing slab is called post tension slab.

(ii) In this type of slab the thickness of slab is small whereas depth of beam is large.

(ii) This is a kind of concrete slab.

(iii) Reinforcement are provided both horizontal and vertical direction.

(iii) Reinforcement is provided to resist the compression.

(iv) Bars are placed as main and distribution bar.

(iv) In this types of slab cables are tied instead of reinforcement.

(v) Used in constructing floors of multi storeyed building.

Extra Google

What is transverse post-tensioning in a bridge slab? What are its advantages over longitudinal post-tensioning.

Transverse post-tensioning is done to strengthen the deck slab in direction perpendicular to traffic flow. Its purpose is similar to longitudinal post-tensioning, only the direction of application is different.

It is usually done in bridges where the deck width is large, which make it difficult to design the deck slab conventionally.

⑥ What are the functions of grout inside tendon ducts (आम) ?

Grout in prestressing works, serves the following -

- (i) Protect the tendon from corrosion.
- (ii) Improve the ultimate capacity of tendon.
- (iii) Provide a bond betn the structural member and the tendon.
- (iv) In case of failure, the anchorage is not subject to all strain energy.

$V = 80000 \text{ mm}^3$
 $A = 8 \times 10^2 \text{ mm}^2$
 $M = 180 \text{ kNm} = 0.18 \text{ kNm}$
 $M_p = 130 \text{ kNm} = 0.13 \text{ kNm}$
 $M_m = 0.18 - 0.13$
 $M = 0.05 \text{ kNm}$

$$\frac{0.01 \times 20.0}{0.10} = \frac{M_m}{M_p}$$

$$0.02 = \frac{M_m}{M_p}$$

$$\frac{0.10}{2 \times 0.10} = \frac{M_m}{M_p}$$

$$0.5 = \frac{M_m}{M_p}$$

7. # The length of a line measured with a 20m chain was found to be 500m. It was subsequently (rechecked) found that the chain was 0.04m long. What is the actual length of the line. 10.00

Anal
 Soln:
 We know,
 Actual length = $\frac{L'}{L} \times \text{measured length}$
 $= \frac{20.04}{20} \times 500 = 501\text{m}$
 Here
 $L' = 20 + 0.04 = 20.04\text{m}$
 $L = 20\text{m}$
 Measured length, $= 500\text{m}$

8. The total volume of soil specimen is 80000 mm³ and its weight is 180 gm. The dry weight of specimen is 130 gm and density of soil solid 2680 kg/m³. find the (i) w (ii) e (iii) ρ_s (iv) γ → 15.00

Anal
 Soln:
 (i) $w = \frac{W_w}{W_s} \times 100 = \frac{0.05}{0.13} \times 100 = 38.46\%$
 $\gamma_d = \frac{W_s}{V} = \frac{0.13}{8 \times 10^{-5}} = 1625 \text{ kg/m}^3$
 $V = 80000 \text{ mm}^3 = 8 \times 10^{-5} \text{ m}^3$
 $W = 180 \text{ gm} = 0.18 \text{ kg}$
 $W_s = 130 \text{ gm} = 0.13 \text{ kg}$
 $W_w = 0.18 - 0.13 = 0.05 \text{ kg}$

$$(w) \gamma_d = \frac{G_s \gamma_w}{1+e}$$

$$\Rightarrow 1625 = \frac{2.68 \times 1000}{1+e}$$

$$e = 0.65$$

$$\gamma_s = 2.680 \text{ kg/m}^3$$

$$G_s = \frac{\gamma_s}{\gamma_w} = \frac{2.680}{1000} = 2.68$$

$$(iii) n = \frac{e}{1+e} = \frac{0.65}{1+0.65} = 0.39$$

$$(iv) S_r e = W G$$

$$\Rightarrow S_r = \frac{W G}{e} = \frac{0.18 \times 2.68}{0.65} = 0.742 = 74.2\%$$

(i) water content, $w = \frac{W_w}{W_s} = \frac{\text{Weight of water}}{\text{Weight of soil solids}}$

(ii) Unit weight, $\gamma = \frac{W}{V} = \frac{\text{Weight of soil}}{\text{volume}} \Rightarrow W = W_s + W_w$

$$\text{Dry unit weight, } \gamma_d = \frac{W_s}{V}$$

Ref: Page: 45 BM Das - 15th

9. find the maxm. torque that can be applied safely to a shaft of dia 300mm. The permissible angle of torque is 1.5° in a length of 7.5m, and the shearing stress not exceeding 42 N/mm^2 . Take modulus of rigidity $G = 84.4 \text{ N/mm}^2$

Soln:

$$\theta = \frac{T L}{J G} \Rightarrow T = \frac{\theta J G}{L}$$

$$= \frac{0.026 \times 7.95 \times 10^8 \times 84.4}{7.5 \times 1000}$$

$$= 2.345 \times 10^5 \text{ N-mm.}$$

$$J = \frac{\pi d^4}{32}$$

$$= \frac{\pi}{32} \times 300^4 = 7.95 \times 10^8 \text{ mm}^4$$

$$\theta = \frac{\pi}{180} \times 1.5^\circ = 0.0262$$

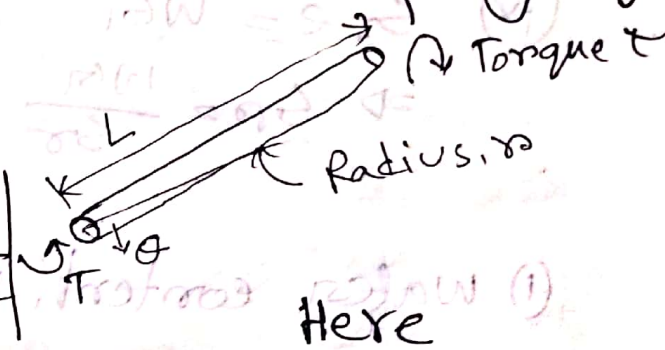
Final

find the max^m torque that can be applied on a solid shaft of 500 mm dia. The permissible angle of twist is 15° on a length of 7.5 m and the shear stress not exceed 42 N/mm². Take modulus of rigidity G = 84.4 N/mm².

Solⁿ:

$$\frac{\tau}{r} = \frac{T}{J} = \frac{G\theta}{L}$$

where, $J = \frac{\pi d^4}{32}$



$d = 500 \text{ mm}$, $r = 250 \text{ mm}$

$\theta = \frac{\pi}{180} \times 15^\circ = 0.26 \text{ rad}$

$L = 7.5 \text{ m} = 7500 \text{ mm}$

$\tau = 42 \text{ N/mm}^2$

$G = 84.4 \text{ N/mm}^2$

$T = ?$

$$\frac{T}{J} = \frac{G\theta}{L}$$

$$\Rightarrow T = \frac{G\theta J}{L}$$

$$= \frac{84.4 \times 0.26 \times 6.14 \times 10^9}{7500}$$

$$= \boxed{17.96 \text{ N-m}}$$

τ = Shear stress (MPa)

r = radius (mm)

T = Torque (mm)

J = Polar 2nd moment of area (mm⁴)

G = Modulus of rigidity (MPa)

θ = Angle of twist (rad)

L = length (mm)

$$J = \frac{\pi}{32} d^4$$

$$= \frac{\pi}{32} \times (500)^4 = 6.14 \times 10^9 \text{ mm}^4$$

Again, $\frac{T}{r} = \frac{T}{J}$

$\Rightarrow T = \frac{T r}{J}$

$= \frac{17.96 \times 250 \times 10^6}{6.14 \times 10^9}$

$= 0.73 \text{ N/mm}^2 < 42 \text{ N/mm}^2$

$T = 17.96 \times 10^6 \text{ N-mm}$

10

Water flows through a horizontal conical pipe 2m long and having a diameter of 200mm at the inlet and 150mm at the discharge end. A constant discharge of 40 l/s flows through the pipe, starting from first principal. Determine the head loss due to pipe friction. friction factor 0.4

Solution:

$A_1 = \frac{\pi}{4} \times 0.2^2 = 0.0314 \text{ m}^2$

$A_2 = \frac{\pi}{4} \times 0.15^2 = 0.0177 \text{ m}^2$

$V_1 = \frac{40 \times 10^{-3}}{0.0314} = 1.27 \text{ m/s}$

$V_2 = \frac{40 \times 10^{-3}}{0.0177} = 2.26 \text{ m/s}$

$H_{L2} = \frac{f L V_2^2}{2 g d_2} = \frac{0.4 \times 2 \times 2.26^2}{2 \times 9.81 \times 0.15} = 1.39 \text{ m}$

$H_{L1} = \frac{f L V_1^2}{2 g d_1} = \frac{0.4 \times 2 \times 1.27^2}{2 \times 9.81 \times 0.2} = 0.33 \text{ m}$

Total head loss = 1.39 - 0.33

$L = 2 \text{ m}$

$d_1 = 200 \text{ mm} = 0.2 \text{ m}$

$d_2 = 150 \text{ mm} = 0.15 \text{ m}$

$Q = 40 \text{ l/s}$

$= 40 \times 10^{-3} \text{ m}^3/\text{s}$

$h_L = ?$

Confused +00-

Solution:

$$L = \frac{D_2 L}{D_1 - D_2} \quad (D_1 > D_2)$$

$$= \frac{0.15 \times 2}{0.2 - 0.15}$$

$$= 6 \text{ m}$$

$$f = 0.4$$

$$D_1 = 200 \text{ mm} = 0.2 \text{ m}$$

$$D_2 = 150 \text{ mm} = 0.15 \text{ m}$$

$$Q = 40 \text{ l/s}$$

$$= 40 \times 10^{-3} \text{ m}^3/\text{s}$$

$$h_L = ?$$

$$L = 2 \text{ m}$$

$$\text{Head loss} = \frac{4f Q^2 L^5}{2g \pi^2 D_2^5} \left[\frac{1}{L^4} - \frac{1}{(L+l)^4} \right]$$

$$= \frac{4 \times (0.04)^2 \times 4 \times 6^5}{2 \times 9.81 \times (0.15)^5} \left[\frac{1}{6^4} - \frac{1}{(2+6)^4} \right]$$

$$= 1363.46 \times 5.27 \times 10^{-4}$$

$$= 0.715 \text{ m}$$

01

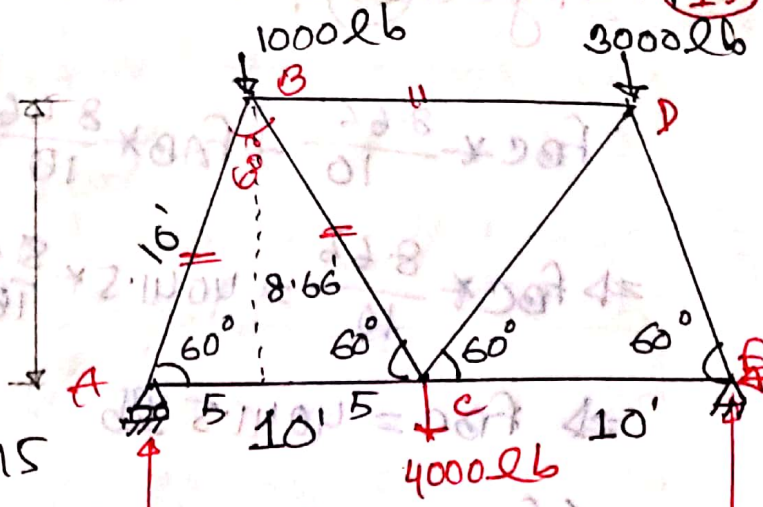
$Q = 40 \text{ l/s} = 0.04 \text{ m}^3/\text{s}$
 $A_1 = \frac{\pi}{4} \times 0.2^2 = 0.0314 \text{ m}^2$
 $A_2 = \frac{\pi}{4} \times 0.15^2 = 0.0177 \text{ m}^2$
 $V_1 = \frac{Q}{A_1} = \frac{0.04}{0.0314} = 1.27 \text{ m/s}$
 $V_2 = \frac{Q}{A_2} = \frac{0.04}{0.0177} = 2.26 \text{ m/s}$
 $f = 0.4$
 $L = 2 \text{ m}$
 $l = 6 \text{ m}$
 $D_1 = 0.2 \text{ m}$
 $D_2 = 0.15 \text{ m}$
 $h_L = 0.715 \text{ m}$

11

Calculate forces AB, BC, BD members (25)

$$\tan 60^\circ = \frac{x}{5}$$

$$\Rightarrow x = 8.66'$$



$$\sum M_A = 0$$

$$1000 \times 5 + 4000 \times 10 + 3000 \times 15$$

$$- R_E \times 20 = 0$$

$$\Rightarrow R_E = 4500 \text{ lb} (\uparrow)$$

$$\sum F_y = 0$$

$$R_A + R_E - 1000 - 3000 - 4000 = 0$$

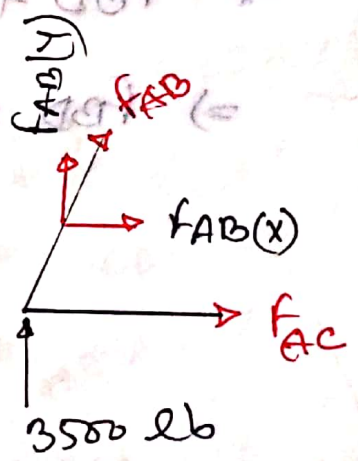
$$\Rightarrow R_A = 3500 \text{ lb} (\uparrow)$$

Now taking at joint B

$$\sum F_y = 0$$

$$3500 + F_{AB}(y) \times \frac{8.66}{10} = 0$$

$$\Rightarrow F_{AB}(y) = -4041.5 \text{ lb (c)}$$

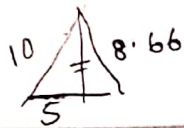


$$\sum F_x = 0$$

$$F_{AC} + F_{AB} \times \frac{5}{10} = 0$$

$$\Rightarrow F_{AC} + -4041.5 \times \frac{5}{10} = 0$$

$$\Rightarrow F_{AC} = 2020.8 \text{ T}$$



$$\sum R_y = 0$$

$$F_{BC} \times \frac{8.66}{10} + F_{AB} \times \frac{8.66}{10} = 0$$

$$\Rightarrow F_{BC} \times \frac{8.66}{10} = 4041.5 \times \frac{8.66}{10}$$

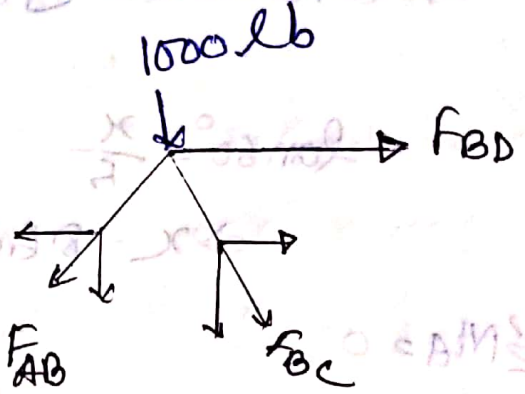
$$\Rightarrow F_{BC} = 4041.5 \text{ lb}$$

$$\sum F_x = 0$$

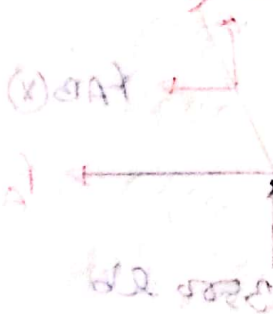
$$\Rightarrow F_{BD} + F_{BC} \times \frac{5}{10} - F_{AB} \times \frac{5}{10} = 0$$

$$\Rightarrow F_{BD} + 4041.5 \times \frac{5}{10} + 4041.5 \times \frac{5}{10} = 0$$

$$\Rightarrow F_{BD} = -4041.5 \text{ lb (C)}$$



$$= -4041.5 \text{ lb}$$



$$\sum F_x = 0$$

$$0 = \frac{2}{10} \times F_{AB} + F_{BC}$$

$$\Rightarrow F_{BC} = -\frac{2}{10} \times F_{AB}$$

$$\Rightarrow F_{BC} = -2050.8 \text{ lb}$$

Alternative

Calculate the members for AB, BC, BD

For equilateral triangle

$$\tan 60 = \frac{x}{5}$$

$$\Rightarrow x = 8.66$$

$$\sum M_A = 0$$

$$1000 \times 5 + 4000 \times 10 + 3000 \times 15 - R_E \times 20$$

$$\Rightarrow R_E = 4500 \text{ lb}, R_A = 3500 \text{ lb}$$

Considering Joint A

$$3500 + F_{AB} \times \frac{8.66}{5} = 0$$

$$F_{AB} = -4041.5 \text{ lb (C)}$$

$$F_{AC} = 2020.8 \text{ lb (T)}$$

Consider the right side of

$$\sum M_C = 0$$

$$R_E \times 10 - 3000 \times 5 + F_{BD} \times 8.66 = 0$$

$$\Rightarrow F_{BD} = -3464.24 \text{ (C)}$$

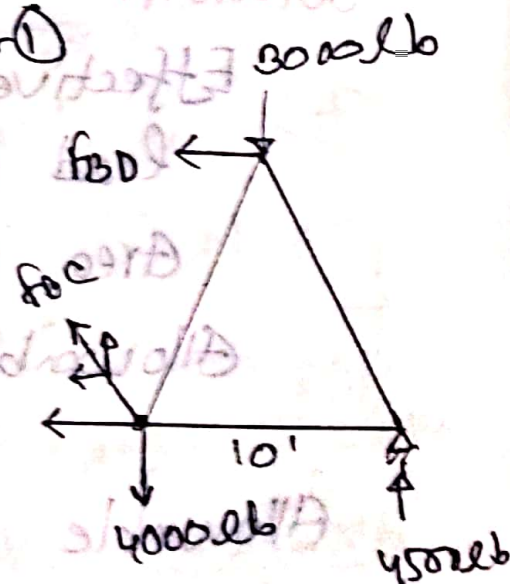
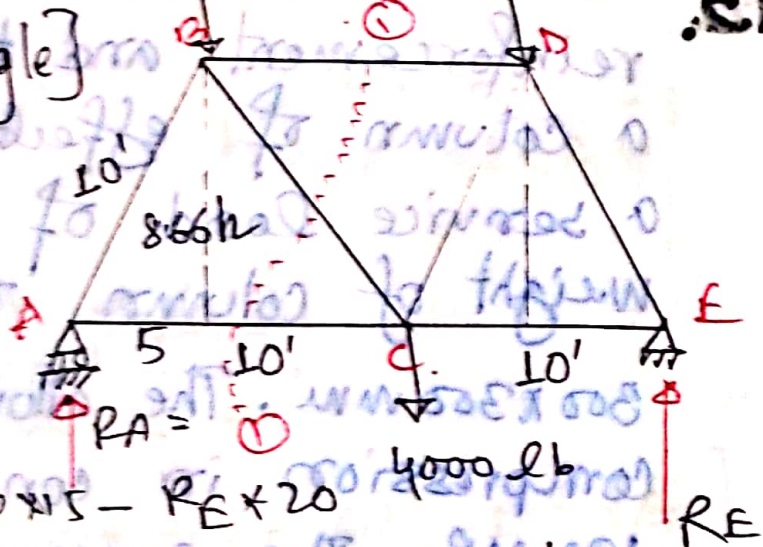
$$\sum F_y = 0$$

$$F_{BC} \sin 60 = 4000 + 4500 - 3500 = 0$$

$$F_{BC} = 2886.8 \text{ (T)}$$

$$\frac{10}{5} = \frac{8.66}{x} = \frac{4500}{F_{BC}}$$

1000 lb 3000 lb



12,

Calculate the WSD method the main reinforcement and tie reinforcement for a column of effective length 4.5m to carry a service load of 550kN including self weight of column. The size of the column is 300x300mm. The allowable stress in direct compression in concrete 5MPa and steel 190MPa. The expression for the reduction co-efficient as recommended by the BS-456 with definition is $C_{p2} = 1.25 - \frac{e_f}{48b}$

Solution:

Effective length $\Rightarrow L = 4.5\text{m} = 4500\text{mm}$

load carried, $P = 550\text{kN} = 550 \times 10^3\text{N}$

Area of column, $A_g = 300 \times 300 = 90000\text{mm}^2$

Allowable stress in concrete, $\sigma_{cc} = 5\text{MPa}$

Allowable stress in steel, $\sigma_{sc} = 190\text{MPa}$

(i) Short or long column check

$$\frac{\text{effective length}}{\text{least dimension}} = \frac{4500}{300} = 15 > 12$$

So, long column or slender column.

column Design WSD formula

$$\Rightarrow P = \phi A_g \cdot (1.25 f_c' + \rho f_s)$$

(ii) Reduction coefficient, $C_p = 1.25 - \frac{L}{48b}$

$$= 1.25 - \frac{4500}{48 \times 300}$$
$$= 0.9375$$

(iii) According to WSD method,

$$P = C_p [\sigma_{cc} A_c + \sigma_{sc} A_s]$$

$$\Rightarrow 550 \times 10^3 = 0.9375 [5 \times (90000 - A_{st}) + 190 \times A_{st}]$$

$$\Rightarrow A_{st} = 738.73 \approx 740 \text{ mm}^2$$

If we use 16mm bar, no of bar = $\frac{740}{\frac{\pi}{4} \times 16^2}$

Use 4 nos 16mm bar $\approx 3.78 \approx 4$

(iv) Dia of tie bar (i) 5mm (ii) $\frac{1}{4}$ dia of

longitudinal bar = 5mm

Spacing (i) least dimension = 300mm

(ii) $4 \times \text{dia of tie bar} = 4 \times 5 = 240 \text{ mm}$

(iii) $16 \times \text{dia. of longitudinal bar} = 16 \times 16$
 $= 256 \text{ mm}$

So use 5mm @ 240mm

717 =

13.

Calculate the FM

Sieve no (mm) : 75mm 37.5 19 9.5 4.75 2.36 1.18 0.6 0.15
 Materials retained: 0 250 1750 1600 1400 0 0 0 0
 gm

Sieve Size mm	Materials retained gm	Cumulative retained gm	Cumulative % retained
75 (3")	0	0	0
37.5 (1.5")	250	250	5
19 (3/4")	1750	2000	40
9.5 (3/8")	1600	3600	72
4.7 (#4)	1400	5000	100
2.36 (#8)	0	5000	100
1.18 (#16)	0	5000	100
0.6 (#30)	0	5000	100
0.3 (#60)	0	5000	100
0.15 (#100)	0	5000	100

F.M = $\frac{5 + 40 + 72 + 100 + 100 + 100 + 100 + 100 + 100}{100}$
 $= 7.17$

* of binders in summer and compaction by road traffic.

(ii) It increases the rate of hardening of binders which produce premature embrittlement of pavements.

(iv) If the air void content is too high, it allows fast intrusion of air and water.

(v) Too high a void content, result in formation of ruts and grooves along the wheel track.

Intrusion
- water

Seminar officer (Civil)

AUST, 13/07/2018, Time: 3.00-5.00

1 What is the function of sand layer overlying the paving slab/ interlocked block?

What is importance of air void content in bituminous pavement?

Function of sand layers underlying paving slab/ interlocked block

(i) Provide a level and flat surface for the paving slab/ interlocking blocks to lay on.

(ii) Protect the foundation (ie underground subgrade and sub-base layers) against adverse outside conditions (e.g. bad weather) during construction of the laying work of paving slab/ interlocking blocks.

Importance of air void content in bituminous pavement.

(i) A minimum amount of air void should be maintained to avoid instability during compaction process and to provide space for bitumen flow in long term consolidation under traffic loads.

(ii) A sufficient amount of air voids should be designed to make room for expansion

2.

Define pre consolidation pressure?

Procedure to determine the pressure?

→ Agrani bank solution



Open stirrups

Closed stirrups

(i) Open stirrups are provided principally to resist shear forces in concrete beams and they are applied in locations in which the effect of torsion is insignificant.

(i) When concrete beams are designed to resist a substantial amount of torsion, closed stirrups should be used instead.

(ii) Heavy reinforcement or beam column joint.

(ii) anywhere in the beam

(iii) helps to pouring concrete.

(iii) Holds all bars together.

(iv) U-shape

(iv) Rectangular shape.

3 In concrete compression test only $150 \times 150 \times 150 \text{ mm}$ used to instead of $100 \text{ mm} \times 100 \text{ mm} \times 100 \text{ mm}$ cube. What is the difference in application betⁿ open stirrups and closed stirrups in concrete beams?

Basically, the force supplied by a concrete compression machine is a definite value. For normal concrete strength application say below 50 MPa , the stress produced by a $150 \text{ mm} \times 150 \text{ mm} \times 150 \text{ mm}$ cube is sufficient for the machine to crush the concrete sample. However, if the designed concrete strength is 100 MPa , under the same force (about 2000 kN) supplied by the machine, the stress under a $150 \text{ mm} \times 150 \text{ mm} \times 150 \text{ mm}$ cube is not sufficient to crush the concrete cube. Therefore, $100 \text{ mm} \times 100 \text{ mm} \times 100 \text{ mm}$ concrete cubes are used instead to increase the applied stress to crush the concrete cube.

For normal concrete strength, the cube size of $150 \text{ mm} \times 150 \text{ mm} \times 150 \text{ mm}$ is already sufficient for the crushing strength of the machine.

2.
4.

What are the basic difference betⁿ aerobic and anaerobic degradation of organic waste with equation? why $COD > BOD$.

Aerobic bio degradation	Inaerobic bio degradation
(i) Most rapid and fast degradation.	(i) Time consuming and slow.
(ii) More expensive	(ii) less expensive.
(iii) large disposable waste generated.	(iii) less waste is generated.
(iv) Acetic acid + $H_2 \rightarrow CH_4$ Acetic acid + $CO_2 \rightarrow CO_2$ Sugar + Oxygen = CO_2 + energy	(iv) Degradation of Toulene. Sugar \rightarrow Alcohol + CO_2 + energy
(v) No pungent gas produced	(v) Pungent gas produced.

COD value is always highest than BOD value because of many organic substance can be oxidized chemically but can not be oxidized biochemically. On the other hand, BOD contains only biodegraded but COD contains both biodegradable and non-biodegradable.

Extension = ~~hammer~~
follower = ~~cap~~

Terminate = ~~end of~~
Subsequent = ~~next~~

5. (a) What are the functions of followers in driven H-piles. www.engineeringint.com.

(b) What are the advantage of up-down approach in basement construction.

A follower is an extension between the pile head and the hammer that transfers the blow to the pile in which the pile head cannot be reached by the hammer as it is under water.

H-piles are designed to be terminated near the base of pile caps. If piles are driven at ground level, a certain length of H-piles is wasted and cut when constructing pile caps. In this connection, followers are used so as to save the wasted section of H-piles because followers can be removed during subsequent construction of pile caps.

(c) Up-down Approach —

- (i) Settlement can be reduced
- (ii) Structure above and below can be carried out simultaneously.
- (iii) Saves the cost of ~~hammer~~
- (iv) Saves time of construction.

6. (i) What do you understand by preset during the installation process of bridge bearing?

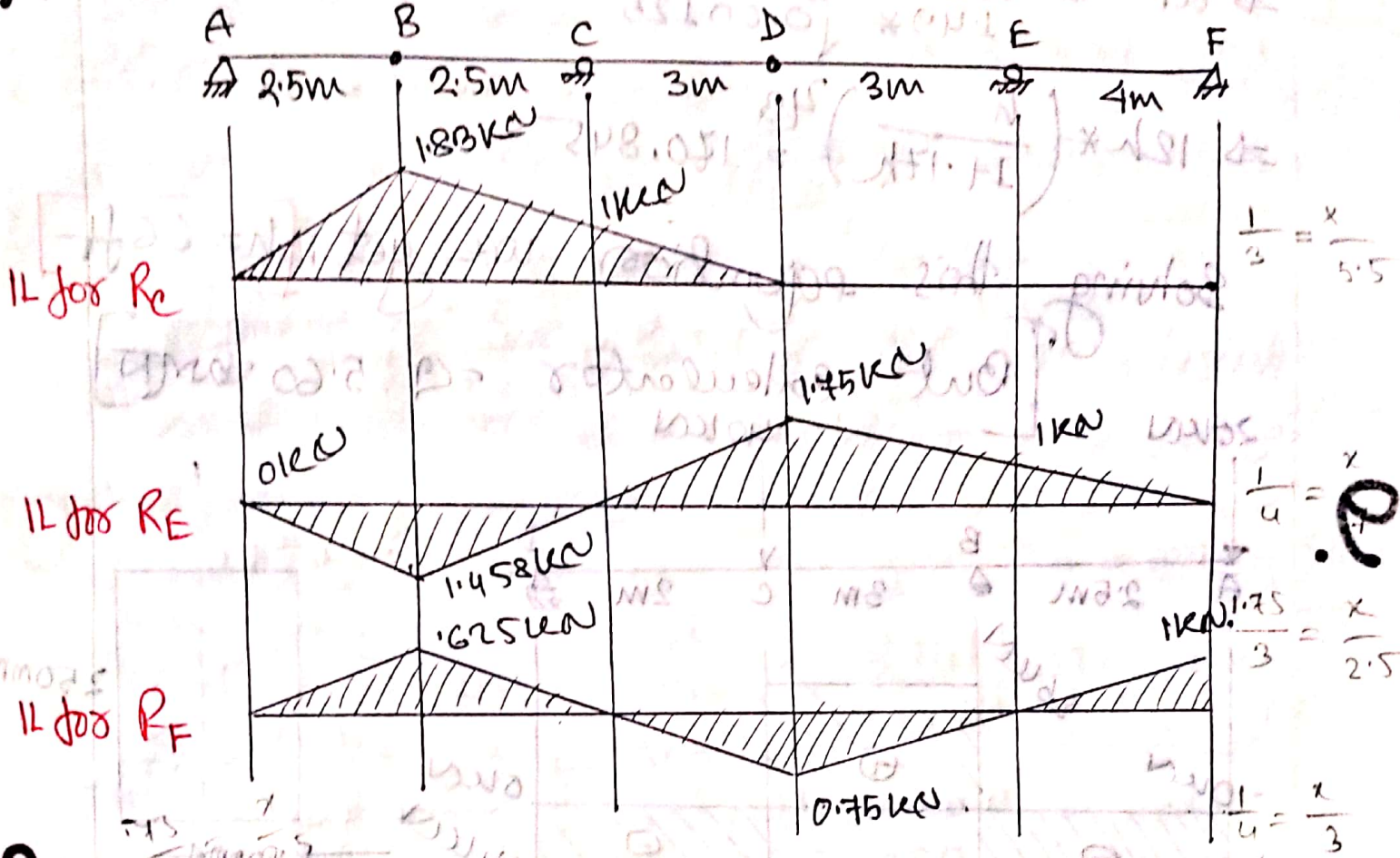
(ii) Describe various methods of concrete curing.

Ans (i) During the installation of bridge bearings the size of the upper plates is reduced to save the material costs. This process is known as preset. The normal length of a upper bearing plate should be composed of the following components = length of bearing + 2 × irreversible movement + 2 × reversible movement. But due to preset process the length of upper plate is equal to = length of bearing + irreversible movement + 2 × reversible movement. In this arrangement the size of upper plate is minimized in which irreversible movement takes place in one direction only.

(ii) Various methods of concrete curing.

- (i) Sprinkling of water
- (ii) Ponding method
- (iii) Membrane curing
- (iv) Wet covering of concrete surface
- (v) Shading concrete work
- (vi) Steam curing

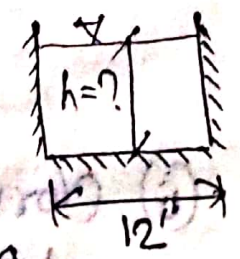
7. Draw the influence line diagram R_c, R_E, R_F



8. # A rectangular trapezoidal concrete channel 12' wide with a slope of 10' in 8000' is designed for a discharge 600 cfs. For water temperature of 40°F. Estimate the depth of flow.

Solution: $S = \frac{10}{8000} = 0.00125$

$A = b \times h = 12h$, $P = b + 2h = 12 + 2h$



Assume, $n = 0.015$

$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$

$\Rightarrow A R^{2/3} = \frac{n Q}{1.49 \sqrt{S}}$

$R = \frac{A}{P}$
 $= \frac{12h}{12+2h}$
 $= \frac{6h}{6+h}$

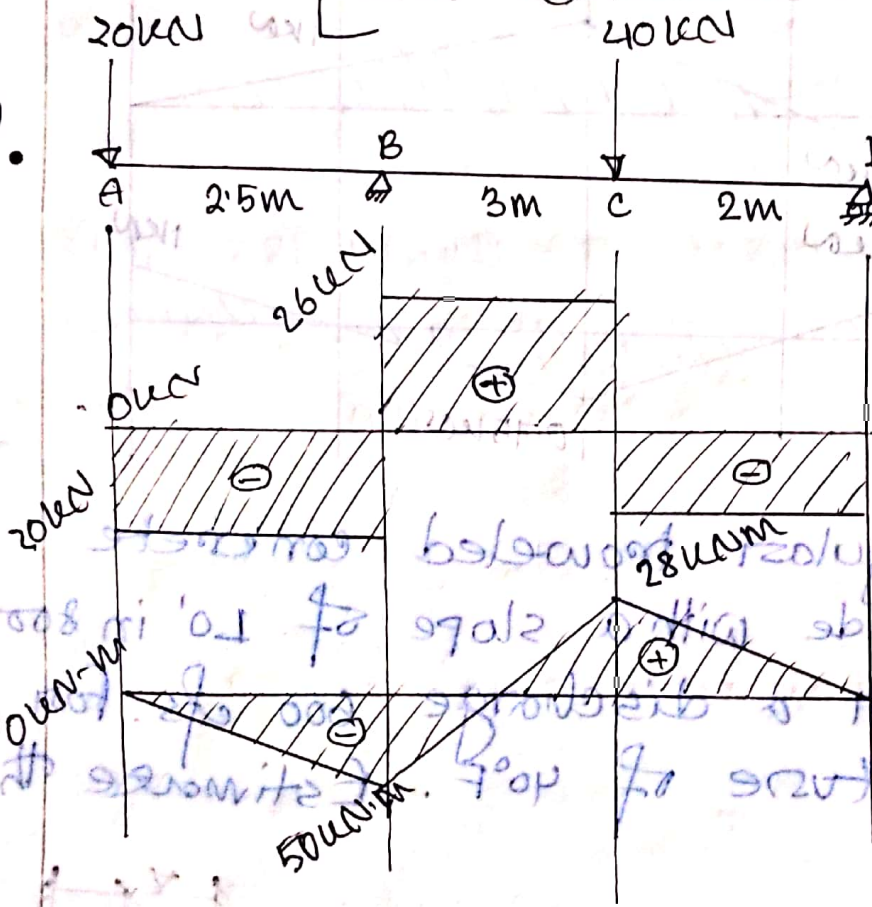
$$\Rightarrow AR^{2/3} = \frac{0.015 \times 600}{1.49 \times \sqrt{0.00125}} = 170.845$$

$$\Rightarrow 12h \times \left(\frac{h}{1+17h} \right)^{2/3} = 170.845$$

Solving this equation we get, $h = 66 \text{ ft}$

Out calculator $\sim 5.60 \text{ v.m.f}$

9.



$$\sum M_D = 0$$

$$R_B \times 5 - 40 \times 2 - 20 \times 7.5 = 0$$

$$\Rightarrow R_B = 46 \text{ kN}$$

$$R_B + R_D - 60 = 0$$

$$\Rightarrow R_D = 14 \text{ kN}$$

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(ii) Normal stress for bending will be max^m when $b > h$

for above B.M.D diagram, $M_{\text{max}} = 50 \text{ kN.m}$
 Here, $b = 250 \text{ mm} = 0.25 \text{ m}$
 $h = 2 \times 80 = 160 \text{ mm} = 0.16 \text{ m}$

Moment of inertia, $I = \frac{1}{12} bh^3 = \frac{1}{12} \times 0.25 \times 0.16^3$
 $= 8.53 \times 10^{-5} \text{ m}^4$

$c = \frac{h}{2} = 80 \text{ mm} = 0.08 \text{ m}$

$\sigma_{\text{max}} = \frac{Mc}{I}$

$= \frac{50 \times 0.08}{8.53 \times 10^{-5}} = 46875 \text{ N/m}^2$
 $= 46.875 \text{ MPa}$

$1 \text{ MPa} = 1 \text{ N/mm}^2$

See that

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An undisturbed sample of clayey soil have weight wet 285 N and dry weight 250 N sample volume $14 \times 10^3 \text{ cm}^3$. If $G_s = 2.70$ then calculate w and S_r .

Solution:

Water content, $w = \frac{285 - 250}{250} = 14\%$

Wet unit weight, $\gamma = \frac{M}{V} = \frac{285}{14 \times 10^3} = 102035 \text{ N/cm}^3$
 $= 2.076 \text{ gm/cm}^3$

$\left\{ \begin{array}{l} 1 \text{ kN} = 101.97 \text{ kg} \\ 1 \text{ N} = 101.97 \text{ kg} \end{array} \right.$

Dry unit weight, $\gamma_d = \frac{\gamma}{1+w} = \frac{2.076}{1+0.14} = 1.82 \text{ gm/cm}^3$

Again, $\gamma_d = \frac{G_s \gamma_w}{1+e}$

$\Rightarrow e = \frac{G_s \gamma_w}{\gamma_d} - 1 = \frac{2.7 \times 1}{1.82} - 1 = 0.48$

$S_r = \frac{w G_s}{e} = \frac{0.14 \times 2.7}{0.48} = 0.784 = 78.4\%$

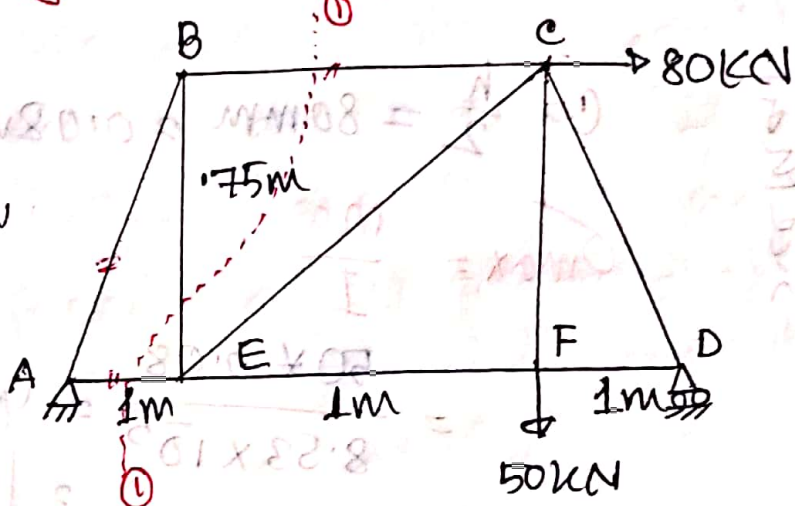
11

find the member force AB, BC, AE

$$\sum M_D = 0$$

$$R_A \times 3 + 80 \times 75 - 50 \times 1 = 0$$

$$\Rightarrow R_A = 3.33 \text{ kN} (\downarrow)$$



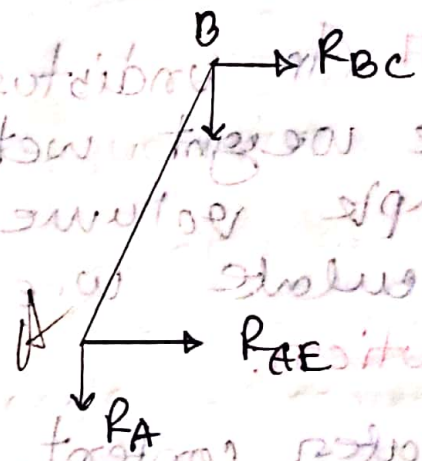
consider the left side of the 1-1 section.

$$\sum M_B = 0$$

$$R_{AE} \times 0.75 + R_A \times 1 = 0$$

$$\Rightarrow R_{AE} = -4.44 \text{ kN}$$

$$R_{AE} = 4.44 \text{ kN (C)} \leftarrow$$



$$\sum F_x = 0$$

$$R_{BC} + R_{AE} = 0$$

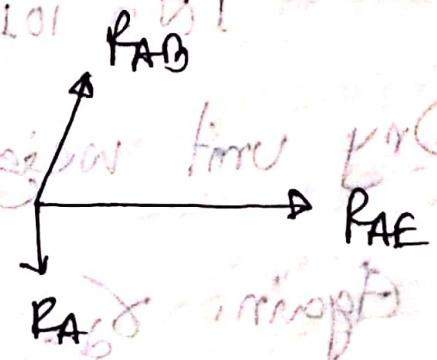
$$\Rightarrow R_{BC} = -R_{AE} = 4.44 \text{ kN (T)} \rightarrow$$

$$\sum F_y = 0$$

$$R_{AB} \sin \theta - R_A = 0$$

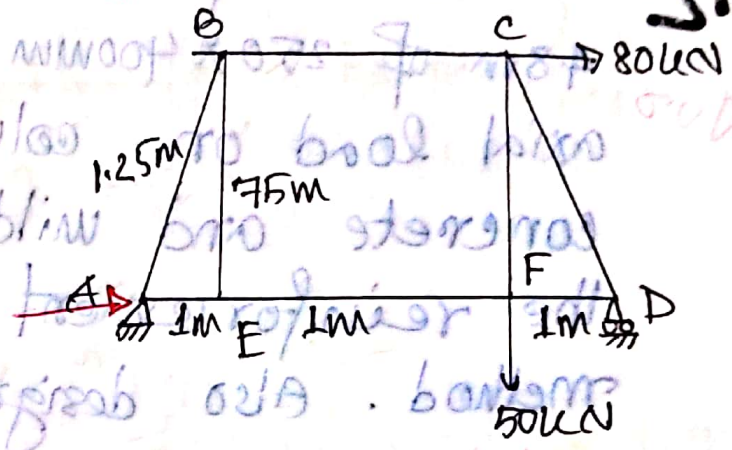
$$\Rightarrow R_{AB} \times \frac{75}{1.25} - 3.33 = 0$$

$$\Rightarrow R_{AB} = 5.55 \text{ kN (T)}$$



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Q. Calculate the forces in members AB, AE & BC



$$\sum M_A = 0$$

$$80 \times 7.5 + 50 \times 2 = R_D \times 3 = 0$$

$$\Rightarrow R_D = 53.33 \text{ kN (}\uparrow\text{)}$$

$$\sum F_y = 0$$

$$R_A + 53.33 - 50 = 0$$

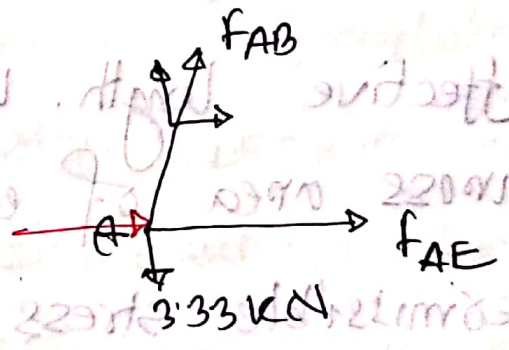
$$\Rightarrow R_A = -3.33 \text{ kN} = 3.33 \text{ kN (}\downarrow\text{)}$$

Taking the joint A

$$\sum F_y = 0$$

$$F_{AB} \times \frac{0.75}{1.25} = 3.33$$

$$\Rightarrow F_{AB} = 5.55 \text{ kN (T)}$$



$$\sum F_x = 0$$

$$F_{AE} + F_{AB} \cos 60 = 0$$

$$\Rightarrow F_{AE} + 5.55 \times \frac{1}{2} = 0$$

$$\Rightarrow F_{AE} = -4.44 \text{ kN}$$

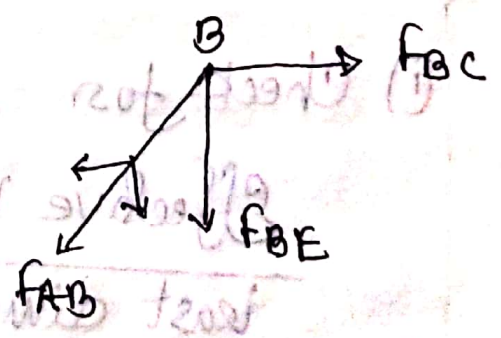
$$= 4.44 \text{ kN (C)}$$

Taking joint B

$$\sum F_x = 0$$

$$F_{BC} - F_{AB} \times \frac{1}{2} = 0$$

$$\Rightarrow F_{BC} = 4.44 \text{ kN (T)}$$



12. A reinforced column of effective length 4.8m of 250 x 400mm dimension. The design axial load on column is 60 tonnes, M20 concrete and mild steel used. Determine the reinforcement required by working stress method. Also design the tie spacing.

Solution:

Axial load, $P = 60 \text{ ton} = 60 \times 1000 = 60000 \times 9.81 \text{ N}$
 $= 588600 \text{ N}$

Effective length, $L = 4.8 \text{ m} = 4800 \text{ mm}$

Gross area of column $\Rightarrow A_g = 250 \times 400$
 $= 100000 \text{ mm}^2$

permissible stress of concrete for M20 = $0.25 f_{cd}$
 $\Rightarrow 5 \text{ N/mm}^2 = \sigma_{cc}$

" " " steel (mild steel) = $130 \text{ N/mm}^2 = \sigma_{sc}$

(i) Check for short or long column

$$\frac{\text{Effective length}}{\text{least dimension}} \leq 12 \Rightarrow \frac{4800}{250} = 19.2 > 12$$

(ii) Calculation reduction co-efficient

$$C_{ro} = 1.25 - \frac{L_{eff}}{4800} = 1.25 - \frac{4800}{48 \times 250} = 0.85$$

$$(iii) P = C_{ro} (A_c \sigma_{cc} + A_{st} \sigma_{sc})$$

$$\Rightarrow 588600 = 1.85 \left\{ (100000 - A_{st}) \times 5 \left[\frac{A_c - A_g - A_{st}}{A_c} \right] + A_{st} \times 130 \right\}$$

$$A_{st} = 1540 \text{ mm}^2$$

let us provide 16mm dia bar

$$\# \text{ No of bar required} = \frac{1540}{201} = 7.66 \approx 8 \text{ nos}$$

$$\text{Provide } A_{st} = 8 \times \frac{\pi}{4} \times 16^2 = 1608.5 \text{ mm}^2$$

8 nos
16mm

Spacing calculation:

(a) least lateral dimension = 250 mm

(b) 16# dia of longitudinal bar = 16#16 = 256 mm

(c) 4# dia of tie bar = 4#5 = 240 mm

Here provide 5mm bar @ 240mm c/c

$$p = 20 \text{ mm} = 0.25 d$$

$$q = 30 \text{ mm} = 1.1 d$$

$$r = 100 \text{ mm} = 1.27 d$$

$$s = 20000 \text{ mm} = 80 d$$

$$f_y = 250 \text{ MPa} = 0.25 \times 10000 = 2500 \text{ kg/cm}^2$$

$$f_c = 12 \text{ MPa} = 1200 \text{ kg/cm}^2$$

4/6 ~~off~~ #1 A reinforced concrete column of effective length 4.8m in 250mm x 400mm in overall dimension. The design axial load on column is 60 tons. Concrete mixed used is M20 and mild steel reinforcement. Using working stress method determine the reinforcement required for column. Also design the spacing — 15 marks.

Solution:

For M20 concrete

$$f_c = 20 \times 1.455 = 29.10 \text{ Psi}$$

$$P_u = 60 \times 1000 = 60000 \text{ kg}$$

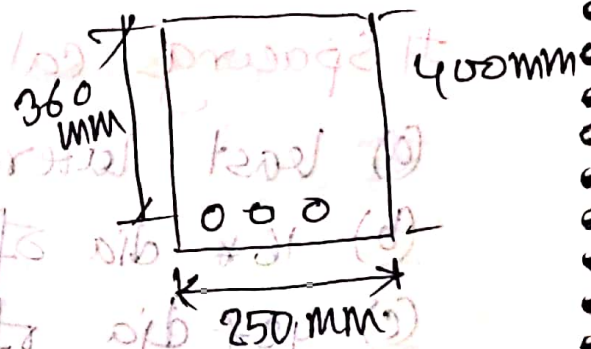
$$L_e = 4.8 \text{ m} = 15.74 \text{ ft}$$

$$b = 250 \text{ mm} = 9.84 \text{ in}$$

$$d = 360 \text{ mm} = 14.17 \text{ in}$$

$$h = 400 \text{ mm} = 15.75 \text{ in}$$

$$p_g = \frac{A_s}{A_g}$$



$$\text{Let, } f_y = 60000 \text{ Psi}$$

$$\therefore f_s = 0.40 f_y = 0.4 \times 60000 = 24000 \text{ Psi} = 24 \text{ ksi}$$

$$A_g = 9.84 \times 15.75 = 15498 \text{ in}^2$$

Principles of Reinforcement

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We know, allowable capacity of column

$$\phi P_n = \phi [0.85 A_g (0.25 f_c' + \rho_g f_s)]$$

$$\Rightarrow 132000 = 0.65 [0.85 \times 154.98 [0.25 \times 2910 + \frac{A_s \times 24000}{154.98}]]$$

$$\Rightarrow A_s = 5.26 \text{ in}^2 \quad \left[\text{for tied column } \phi = 0.65 \right]$$

$$\therefore \text{No of main bars} = \frac{5.26}{0.48} = 10.95 \approx 11 \text{ Nos}$$

\therefore Provide 12 Nos 20mm dia ($\#16$) reinforcement as a main bar

$$\therefore A_s = 0.48 \times 12 = 5.76 \text{ in}^2$$

(Now tie spacing for ACI Code)

$$\text{Spacing} = \text{least dimension of beam} = 9.84''$$

$$= 48 d_b = 48 \times \frac{3}{8} = 18''$$

$$= 16 d_{t/b} = 16 \times \frac{6}{8} = 12''$$

$$\therefore \text{spacing} = 9.84'' \approx 10'' \text{ (least value)}$$

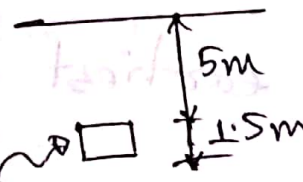
Main rod = 12 $\#16$ 20mm ϕ

ϕ Spacing = 10mm ϕ @ 10" c/c

Date: 12.11.2018

①. Volume, mass, water content & specific gravity are given. find porosity and degree of saturation.

②. What is PIEV? state the requirements of traffic control device.

③.  find force by water on gate position of centre of pressure.

④. Chainage and area are given. find area of earth cutting.

CH:	0	100	200	300	400 (m)
Area:	830	410	320	570	630 (m ²)

⑤. Length of a line measured with a 20m chain was 56m. The chain was 10cm too long. find true length of line.

⑥. Draw a section of serra-lement. What are the characteristics of first class bricks.

⑦. Radius of horizontal curve = 100m, Design speed = 50 km/hr, $f = 0.15$. find superelevation.

⑧. Design a stable alluvial channel by Lacey's theory. Given $Q = 10 \text{ m}^3/\text{sec}$, 2mm sand.

9. Define: Duty and delta. Establish a relation between them. Define development length.

10. Activity: A B C D E F

Immediate predecessor - - B A,C A D,E

Duration: 5 1 2 4 6 3

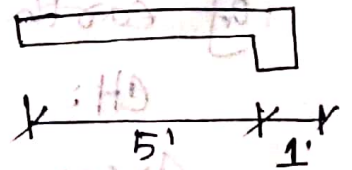
Construct the network, find earliest and latest time.

11. One way slab on a reinforced concrete beam as in figure -

Working live load = 60 psf

$f_y = 60 \text{ ksi}$, $f'_c = 4 \text{ ksi}$

Design the slab

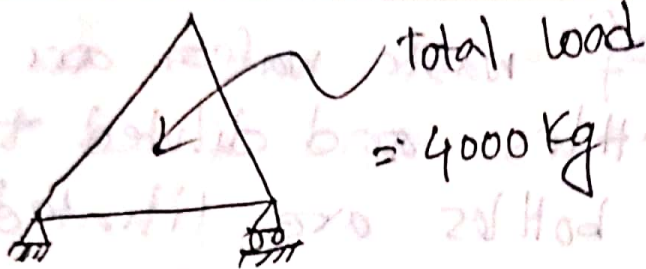


12. Write a brief survey report after construction site visit.

13. A rectangular beam is to carry shear force V_u of 30k. No web reinforcement $f'_c = 4 \text{ ksi}$. What is the minimum cross-section of the beam if controlled by shear?

14. Modulus of elasticity of steel is $30 \times 10^6 \text{ psi}$, poisson's ratio is 0.25. Find modulus of rigidity of steel.

15.



Draw bfd and BMD

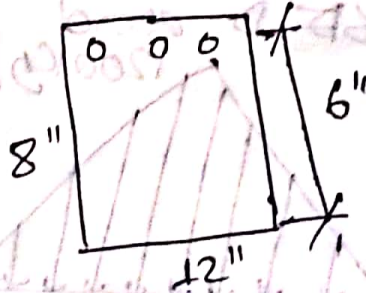
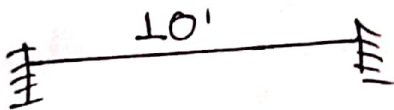
16.

Air content = 3%

Material :	Cement	Water	SSD FA	SSD CA
Mass (Kg) :	279	166	760	1049
Sp. gravity :	3.15	1.00	2.60	2.63
			(Bulk SSD)	(Bulk SSD)

find volume of concrete.

17.



Maximum load controlled by capacity in negative moment region. Based on flexural requirements. find max^m uniform live load the beam can carry. Given

$f_y = 40 \text{ ksi}$, $f'_c = 3.3 \text{ ksi}$, $M_n = 140.2 \text{ Kip-in}$
 $A_s = 0.62 \text{ in}^2$

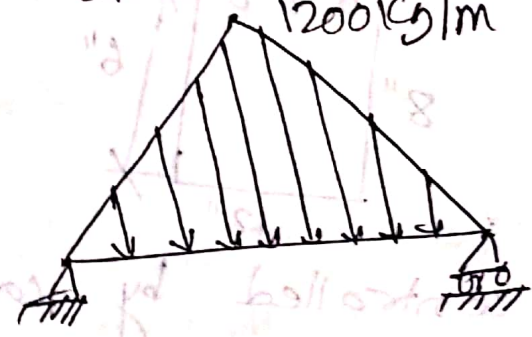
18.

Difference between Intranet and Internet
 what is OLP.

19) Ten 500L samples of waste water are placed in 3000L BOD bottles and diluted to full volume. Half bottles are titrated immediately and average initial concentration of DO is 7.9 mg/L. The remaining bottles are incubated for 5 days after which the average DO is 4.5 mg/L ($k_1 = 0.13/\text{day}$)

Find (i) standard BOD
(ii) Ultimate carbonaceous BOD.

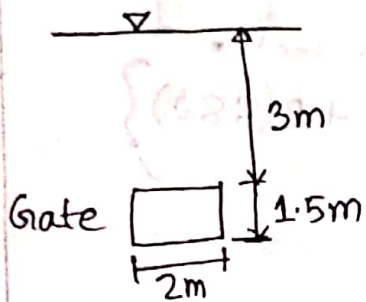
20) Draw SFD and BMD



21. Paragraph - Green Building
22. Short Notes: (i) Intranet, ~~Internet~~ ^{and extranet}
(ii) ~~What is primary~~ ^{what is} the primary colours of ^{monitors}
(iii) spread sheet software
23. (iv) What do you mean by, NLP

1. Find force by water on gate and position of centre of pressure.

1. AHK



Solution:

$$\text{Area, } A = 2 \times 1.5 = 3 \text{ m}^2$$

$$\bar{x} = 3 + \frac{1.5}{2} = 3.75 \text{ m}$$

The force exerted by the water on the gate

$$F = \gamma \bar{x} A$$

$$= 9.81 \times 3.75 \times 3 = 110.36 \text{ kN/m}^2$$

The position of centre of pressure below the free water surface

$$x_p = \bar{x} + \frac{I_g}{A \bar{x}}$$

$$= 3.75 + \frac{0.5625}{3 \times 3.75}$$

$$= 3.80 \text{ m}$$

I_g = moment of inertia

$$= \frac{1}{12} b h^3$$

$$= \frac{2 \times 1.5^3}{12} = 0.5625 \text{ m}^4$$

2. Calculate the volume of earth work necessary for a position of an irrigation canal from the following data.

Chainage: 0 100 200 300 400 500 in ft

Area: 850 875 860 855 860 865 in sq ft

Solution:

Volume by Trapezoidal rule:

$$V = 100 \left\{ \frac{850 + 865}{2} + 875 + 860 + 855 + 860 \right\}$$

$$= 430750 \text{ ft}^3$$

Volume by Prismatic rule:

$$V = \frac{100}{3} \left\{ (850+860) + 4(875+855) + 2(880) \right\}$$

$$= 3450000 \text{ cft}$$

Volume of the last cross-section

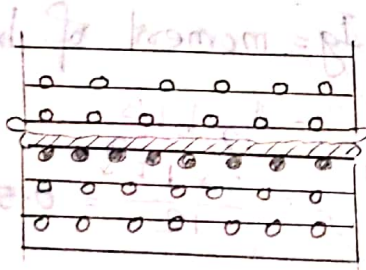
$$= \frac{1}{2} (860+855) \times 100 = 86250 \text{ ft}^3$$

$$\text{Total volume} = 345000 + 86250$$

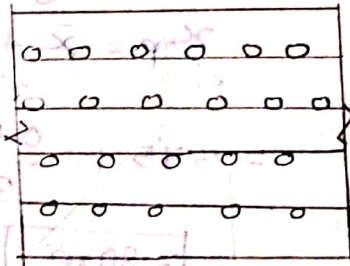
$$= 431250 \text{ ft}^3$$

3. Draw a section of ferro-cement. What are the characteristics of 1st class bricks.

Google
Image



Skeleton steel in two direction



Combination of mesh and discontinuous fibers

Figure: Typical section ferro-cement.

Characteristics of 1st class bricks:

- (i) Bricks should be uniform in colour, size and shape.

MAA A212
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- (ii) They should be sound and compact.
- (iii) The compressive strength of bricks should be in the range of 5000 to 8000 psi.
- (iv) They should be neither overburnt or underburnt.
- (v) They should be non-inflammable and incombustible.
- (vi) Bricks should not change in volume when wetted.
- (vii) They should not absorb more than $\frac{1}{5}$ th of their own wt. of water when immersed in water for 24 hours. (15 to 20% dry wt)

4. $V_u = 30$ Kips, $f_c' = 4000$ psi, what will be the minimum cross-section of beam if it is controlled by shear! No web reinforcement is required.

Solution:

$$V_u = \frac{1}{2} \phi (2 \sqrt{f_c'} b w d)$$

$$\text{or, } b w d = \frac{V_u}{\phi \sqrt{f_c'}}$$

$$= \frac{30 \times 10^3}{0.75 \sqrt{4000}}$$

$$= 632.45 \text{ in}^2$$

Here, $b w = 20''$

$d = 32''$

5.

What is PIEV? State the requirement of traffic control devices?

Solution:

PIEV means perception, intellection, emotion and violation.

These are five requirements for effective traffic control devices -

- (i) Fulfill a need.
- (ii) Command attention
- (iii) convey a clear and simple meaning.
- (iv) Command respect from road users.
- (v) Give adequate time for proper response.

The PIEV theory is one small piece of a larger puzzle.

The PIEV theory was proposed to provide a detailed account of Drivers reaction time

(i) Perception: Time required to perceive an object or situation.

(ii) Intellection: Time required for understanding the situation.

(iii) Emotion: Based on our Emotions at the time (fear, anger, etc). We reach the decision

whether we want to stop or not.

(iv) Volition: Once the decision of stopping has been finalised, time required for moving the foot from the gas to the brake peddle.

6. Modulus of elasticity of steel is 30×10^6 psi. poisson's ratio 0.25. Find modulus of rigidity of steel.

Solution:

Modulus of rigidity, $C = \frac{mE}{2(m+1)}$

$$m = \frac{1}{\mu} = \frac{1}{0.25} = 4$$
$$= \frac{4 \times 30 \times 10^6}{2(4+1)} = \boxed{12 \times 10^6}$$

(i) Bulk modulus

$$K = \frac{mE}{3(m-2)}$$

(ii) Modulus of elasticity

$$E = \frac{9Kc}{3K+c}$$

7. Difference between Internet and Intranet?

Internet :

(i) Internet is wide network of computers and open for all.

(ii) Internet itself contains a large number of intranet.

(iii) The number of users who use internet is unlimited.

(iv) The visitors traffic is unlimited.

(v) Internet contains different source of information and is available for all.

Intranet :-

(i) Intranet is also a network of computers designed for a specific group of users.

(ii) Intranet can be accessed from internet but with restrictions.

(iii) The numbers of users is limited.

(iv) The traffic allowed is also limited.

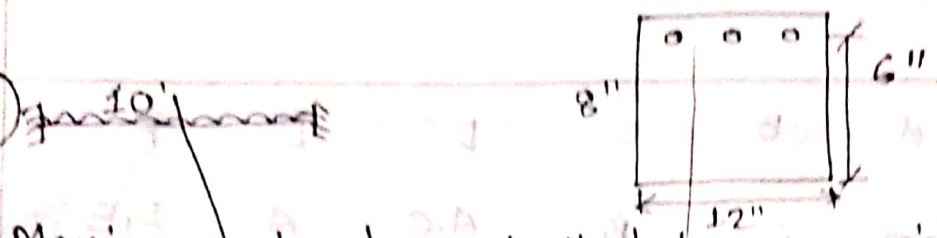
(v) Intranet contains only specific group information.

Others :-

The internet is an open, public space while an intranet is designed to be a private space.

An intranet may be accessible from the internet, but it is protected by a password and accessible only to authorized users.

8.



Maximum load controlled by capacity in negative moment region. Based on flexural requirements. Find max^u uniform live load the beam can carry. Given, $f_y = 40 \text{ ksi}$, $f'_c = 3.3 \text{ ksi}$, $M_n = 140.2 \text{ kip-in}$, $A_s = 1.62 \text{ in}^2$

Solution:

Given, $M_n = 140.2 \text{ K}$

$M_u = \phi M_n = 0.9 \times 140.2 = 126.18 \text{ K}$

We get from figure -

$M_u = \frac{wL^2}{12}$

$\Rightarrow 126.18 = \frac{w \times (10 \times 12)^2}{12}$

$\Rightarrow w = 0.105 \text{ kip/inch}$
 $= 1.26 \text{ kip/ft}$

Here, dead load = $\frac{8 \times 12}{144} \times 150 = 100 \text{ lb/ft}$

Let, live load = $x \text{ lb/ft}$

Total load = $1.4 \text{ DL} + 1.7 \text{ LL}$

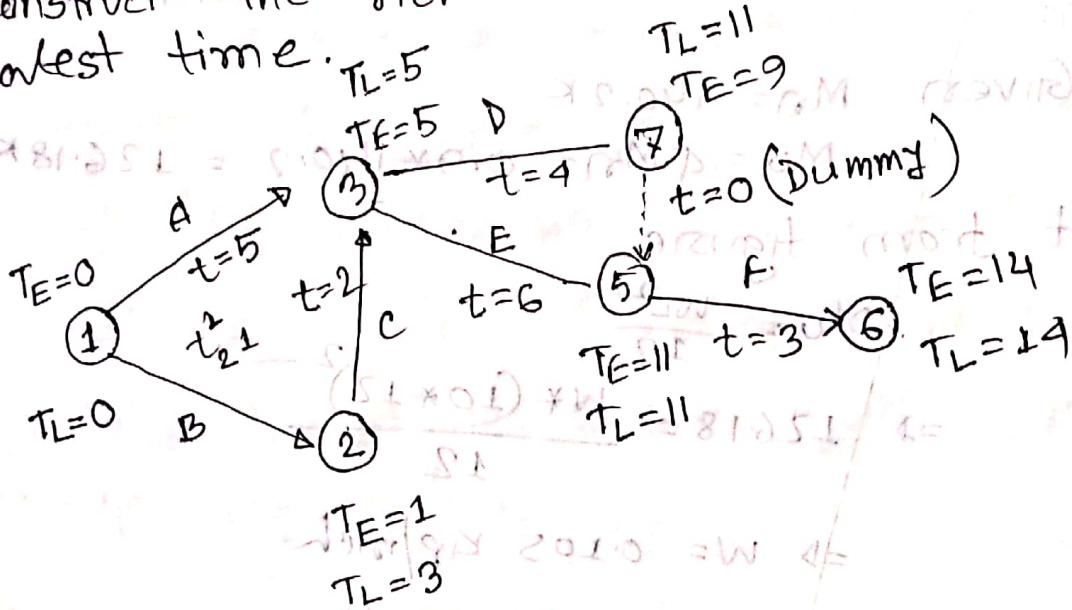
$\Rightarrow 1.26 \times 1000 = 1.4 \times 100 + 1.7 \text{ LL}$

$\Rightarrow \boxed{\text{LL} = 653.8 \text{ lb/ft}}$

1.26 x 1000 = 1.4 x 100 + 1.7 LL

$DL = \frac{8 \times 12}{144} \times 150$

9. Activity A Immediate predecessor Duration: Construct the network, find earliest and latest time.
- | Activity | A | B | C | D | E | F |
|-----------------------|---|---|---|------|---|------|
| Immediate predecessor | - | - | B | A, C | A | D, E |
| Duration | 5 | 1 | 2 | 4 | 6 | 3 |



10. Ten 5mL samples of waste water are placed in 300mL BOD bottles and diluted to full volume. Half bottles are titrated immediately and average initial concentration of DO is 7.9 mg/L. The remaining bottles are incubated for five days after which the average DO is 4.5 mg/L ($K = 0.13/\text{day}$) Find (i) standard BOD (ii) Ultimate carbonaceous BOD.

Solution:

$$DF = \frac{5 \times 10}{300} \left[\text{Half bottles are titrated} \right]$$

$$= 0.1667$$

$$DO_i = 7.9 \text{ mg/L}$$

$$DO_f = 4.5 \text{ mg/L}$$

$$BOD_5 = \frac{DO_i - DO_f}{DF}$$

$$= \frac{7.9 - 4.5}{0.1667} = \boxed{20.4 \text{ mg/L}}$$

$$BOD_5 = BOD_u (1 - e^{-kt})$$

$$\Rightarrow 20.4 = BOD_u (1 - e^{-1.13 \times 5})$$

$$\Rightarrow \boxed{BOD_u = 42.7 \text{ mg/L}}$$

11. Design a stable alluvial channel using the Lacey method. The channel is to carry $10 \text{ m}^3/\text{s}$ through 1 mm sand. [5.6 Open Channel, Halim Sir] 85 page

Solution:

$$f_s = 1.76 \sqrt{d} = 1.76 \sqrt{1} = 1.76$$

Given,

$$Q = 10 \text{ m}^3/\text{s}$$

$$d = 1 \text{ mm}$$

$$S_0 = \frac{f_s^{5/3}}{3340 Q^{1/6}}$$
$$= \frac{(1.76)^{5/3}}{3340 (10)^{1/6}}$$

$$= 5.23 \times 10^{-4}$$

$$R = 0.47 \left(\frac{Q}{f_s} \right)^{1/3}$$

$$= 0.47 (10/1.76)^{1/3} = 0.84 \text{ m}$$

$$P = 4.75\sqrt{Q} = 4.75\sqrt{10} = 15.02\text{m}$$

So that

$$A = PR = 15.02 \times 0.84 = 12.60\text{m}^2$$

Assuming that the side slope is $\frac{1}{2}H:1V$

so that $s = 0.5$, we obtain

$$P = 15.02 = b + 2h\sqrt{1 + 0.5^2} = b + 2.23h$$

$$A = 12.60 = (b + 0.5h)h = bh + 0.50h^2$$

Eliminating b between the above two equations we get the quadratic equation

$$h^2 - 8.652h + 7.258 = 0$$

$$h = 0.94\text{m}$$

$$h = 7.71\text{m}$$

$$b = 12.92\text{m}$$

$$b = -2.22\text{m}$$

$$\therefore \boxed{h = 0.94\text{m}} \text{ and } \boxed{b = 12.92\text{m}}$$

The various equations proposed by Lacey for the design of stable channels in alluvium are —

$$R = 4.75\sqrt{Q}$$

$$R = 0.47 \left(\frac{Q}{f_s} \right)^{1/3}$$

$$30 = \frac{f_s^{1/3}}{3340 Q^{1/6}}$$

$$f_s = 1.76\sqrt{Q}$$

Material	Cement	Water	SSD F.A	SSD C.A
Mass (kg)	279	166	760	1044
Sp. Gravity	3.15	1.0	2.60 (Bulk SSD)	2.63 (Bulk SSD)

If air content is 3% of total volume. Find the volume of concrete.

Solution:

We know, $\rho = \frac{m}{V}$, $\rho_w = 1000 \text{ kg/m}^3$

Volume of cement, $V_c = \frac{279}{3.15 \times 1000} = 0.0886 \text{ m}^3 = 3.13 \text{ ft}^3$

Volume of water, $V_w = \frac{166}{1 \times 1000} = 5.86 \text{ ft}^3$

Volume of SSD F.A, $V_{FA} = \frac{760}{2.60 \times 1000} = 10.31 \text{ ft}^3$

Volume of SSD C.A, $V_{CA} = \frac{1044}{2.63 \times 1000} = 14 \text{ ft}^3$

∴ Volume of concrete, $V = 3.13 + 5.86 + 10.31 + 14 = 33.3 \text{ ft}^3$

As air content 3% volume, $V = 33.3 + 33.3 \times 3\% = 34.3 \text{ ft}^3$

~~$\rho = \frac{m}{V}$~~
 $\Rightarrow m = \rho V$

13. length of a line measured with a 20m chain was 56m. The chain was 10cm too long. find true length of line.

Solution:

True length of line = $\frac{L'}{L} \times \text{measured length}$

$$= \frac{20.1}{20} \times 56 = \boxed{56.28 \text{ m}}$$

14. Volume, mass, water content, and specific gravity are given. find porosity and degree of saturation.

Solution:

Given data

$$G_s = 2.7$$

$$W = 8\%$$

total wt of soil sample = 2400 kg

$$\text{Volume} = 2.4 \text{ m}^3$$

$$\gamma_{\text{bulk/moist}} = \frac{W_{\text{total}}}{V} = \frac{2400}{2.4} = 1000 \text{ kg/m}^3$$

$$\gamma_{\text{bulk/moist}} = \frac{(1+W) G_s \gamma_w}{1+e}$$

$$\Rightarrow 1000 = \frac{(1+0.08) \times 2.7 \times 1000}{1+e}$$

$$\Rightarrow e = 1.92$$

$$(i) \text{ Porosity } n = \frac{e}{1+e} = \frac{1.92}{1+1.92} = \boxed{0.66}$$

$$(ii) \text{ Degree of saturation } S_e = \frac{W G_s}{e}$$

$$\Rightarrow S = \frac{0.08 \times 2.7}{1.92}$$

$$= 0.1125 = \boxed{11.25\%}$$

15. Radius of horizontal curve = 100m,
 Design speed = 50 km/hr. Find super elevation
 frictional co-efficient = 0.15

$$e = \frac{V^2}{225R}$$

$$e + f = \frac{V^2}{127R}$$

$$e + 0.15 = \frac{50^2}{127 \times 100}$$

$$e + 0.15 = \frac{2500}{12700}$$

$$e + 0.15 = 0.1968$$

$$e = 0.1968 - 0.15$$

$$e = 0.0468$$

$$e \approx 0.05$$

$$e = 5\%$$

16.

Define duty and delta? Establish a relationship of them?

Define development length.

Duty :- Duty of water can be defined as the area of land in hectares, which can be irrigated for a full growth of a given crop, if 1 cumec of water is supplied continuously to the land for entire base period of the crop.

Delta (Δ) :- ^{of water}
The total depth/in (cm) required by a crop to come to its maturity is called delta of that crop. It is denoted by Δ .

Relationship between duty and delta:

Let, there be a crop of base period 'B' days.

Let, 1 cumec of water be applied to this on fields for 'B' days.

Now, volume of water applied to this crop during B days -

$$V = (1 \times B \times 60 \times 60 \times 24) \text{ m}^3 = 86400B \text{ m}^3$$

By definition of Duty (D), one m^3 of water supplied for 'B' days matures 'D' hectares of land.

$$\therefore \text{Total depth of water} = \frac{86400B}{D \times 10^4} \text{ meters}$$

$$= \frac{8.64B}{D} \text{ meters}$$

By definition, this total depth of water is called Delta (Δ)

$$\therefore \Delta = \frac{8.64B}{D} \text{ meters}$$

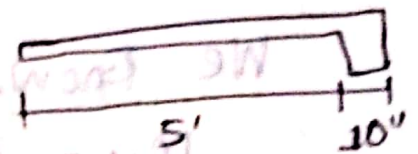
' Δ ' is in meters, 'B' in days, 'D' is in ha/wmer.

One way slab on a reinforcement concrete beam as shown in figure

Working live load = 60 psf

$$f_y = 60 \text{ ksi}, f'_c = 4 \text{ ksi}$$

Design the slab. [Radim Hossain book - 93P
N.B



Solution:-

Slab thickness, $t = \frac{L}{10}$ [for cantilever beam] $t = \frac{L}{20}$ for simply supported slab

$$= \frac{5 \times 12}{10}$$

$$= 6''$$

$$t = \frac{L}{24}, \text{ one end continuous}$$

$$t = \frac{L}{28}, \text{ both end continuous}$$

$$\therefore DL = \frac{6}{12} \times 150 = 75 \text{ psf}$$

$$\text{factored load} = 1.2 DL + 1.6 LL$$

$$= 1.2 \times 75 + 1.6 \times 60$$

$$= 186 \text{ psf}$$

$$\text{Moment} = \frac{WL^2}{2} = \frac{186 \times 5^2}{2} = 2325 \text{ lb}$$

$$= 27900 \text{ lb.in}$$

Now, slab depth

$$p_b = 0.85 \times \beta_1 \times \frac{f_c'}{f_y} \times \frac{87}{87 + f_y}$$

$$= 0.85 \times 0.85 \times \frac{4}{60} \times \frac{87}{87 + 60}$$

$$= 0.028$$

$$p_{max} = 0.75 p_b$$

$$= 0.021$$

We know,

$$M_u = \phi M_n$$

$$\Rightarrow 27900 = \phi A_s f_y \left(d - \frac{a}{2} \right)$$

$$\Rightarrow 27900 = 0.90 \times 252d \times 60000 \times (d - 19d)$$

$$\Rightarrow d = 1.59'' \approx 2''$$

$$\text{Total DL} = 0.83 + 0.75$$

$$= 0.91 \text{ kip}$$

$$1.2 \times 0.91 + 1.6 \times LL = 178.2$$

$$\Rightarrow LL = 110.69 \text{ kip}$$

$$A_s = p b d = 0.021 \times 12 \times 2 = 0.304 \text{ in}^2$$

$$\text{total depth} = d + \frac{1}{2} \times \text{bar dia} + \text{clear cover}$$

$$= 2 + \frac{1}{2} \times \frac{5}{8} + \frac{3}{4} = 3.06'' \text{ use slab thickness } 6''$$

Actual d
Use
= 6 - 3/4 - 5/16
= 4 9/16

$$p = \frac{A_s}{b d}$$

$$\Rightarrow A_s = p b d$$

$$= 0.021 \times 12 \times d$$

$$= 0.252 d$$

$$a = \frac{A_s f_y}{1.85 f_c' b}$$

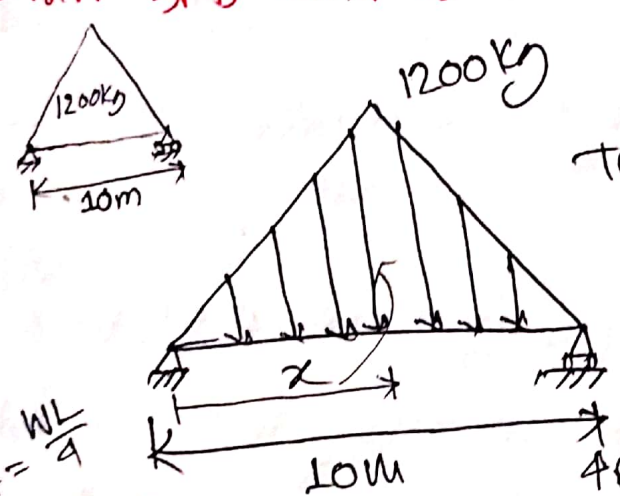
$$= \frac{0.252 d \times 60000}{0.85 \times 40000 \times 12}$$

Development length :-

Development length is essentially provided to create a bond between steel and concrete in order to transfer the bar force without slip to prevent the bar from pulling out under tension.

18. Draw SFD and BMD of the figure.

Anal
12-02-19



total weight = 4000kg?

$$\frac{1}{2} \times x \times 10 = 1200$$

$$\Rightarrow x = 240 \text{ kg/m}$$

$$R_A = \frac{WL}{4}$$

$$R_B = \frac{WL}{4}$$

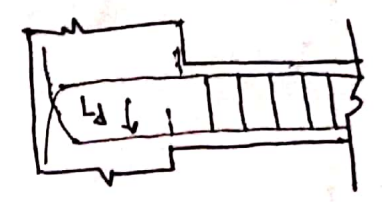
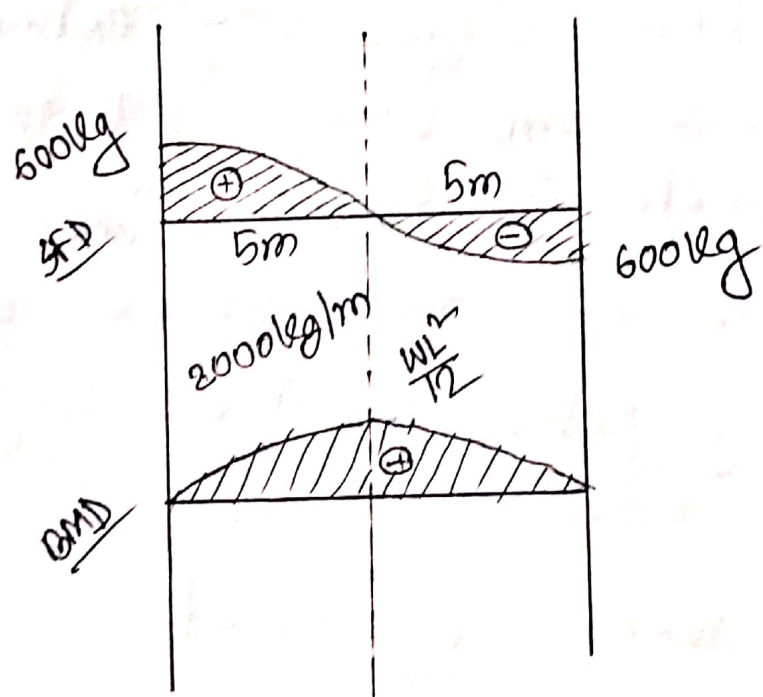


Fig: Detail of beam and column junction with development length.

20. Paragraph - Green building

2041 = 21

- What is the primary additive colours of monitor?
- What do you mean by NLP
- Describe about spreadsheet software?

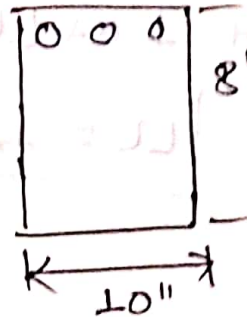
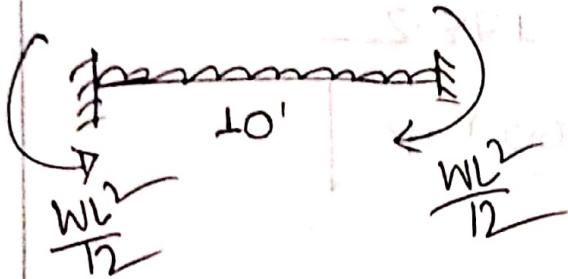
What is the primary additive colours of monitor?

Additive primary colours are the primary colour elements that make up white light. These colours are called additives because you must add the colours together to create white. The additive primary colours are red, green and blue (commonly called RGB) as they are the primary colour elements.

What do you mean by NLP

NLP (Natural language processing) is a subfield of computer science, information

Q.8 Find the maximum live load of the beam carry ($f_c = 4 \text{ Ksi}$, $f_y = 60 \text{ Ksi}$, $M_n = 165 \text{ K-ft}$)



$$A_s = 0.62 \text{ in}^2$$

Again,

$$M_u = \phi M_n$$

$$\Rightarrow \frac{WL^2}{12} = \phi M_n$$

$$\Rightarrow W = \frac{0.9 \times 165 \times 12}{10^2} = 17.82 \text{ Kip/ft}$$

$$1.2 \text{ DL} + 1.6 \text{ LL} = 17.82 \times 10 = 178.2 \text{ Kip}$$

$$\text{self weight} = \frac{10 \times 8}{144} \times 150 \text{ (lb/ft}^3\text{)}$$

$$= 83.33 \text{ lb/ft}$$

$$= \frac{83.33 \times 10}{1000} \text{ Kip}$$

$$= 0.83 \text{ Kip}$$

$$\text{floor load} + \text{floor finish} = 25 \text{ psf} + 50 \text{ psf} + 60 \text{ psf}$$

$$+ \text{partitions wall} = 135 \text{ psf}$$

$$= \frac{135 \times 10 \times 8}{144} \text{ lb}$$

$$= 0.075 \text{ Kip}$$

