Swami Keshvanand Institute of Technology, Management &Gramothan,
Ramnagaria, Jagatpura, Jaipur-302017

# Question Paper Solution

Branch : Civil engg Semester: III year/ V sem Subject: CT &E Mid Term: I

Submitted By : suniti kumari

Part A

Q1. Engineering economy: It involves formulating estimating and evaluating the expected economic outcomes of alternatives designed to accomplish a defined purpose.

Q2.cost of an accident includes direct cost and indirect cost.

Direct costs are those costs that are accured directly from the accident and are quite easy to calculate. The direct cost consists of compensation, medical bills and sometimes legal payments paid directly by the company or through their insurance schemes.

Indirect costs includes:

Lost productivity due to the absence of an injured worker or workers.

Damage to an organization's public image.

Cost of first aid supplies used to treat the injured.

Costs of hiring and training new employees to fill in for the injured

Q3.causes of construction site accidents include:

- Lack of fall protection for workers on elevated structures
- Lack of protection for people on the ground from falling objects
- Tripping hazards from construction materials and debris
- Missing guards or protections on power tools
- Unsafe equipment
- Lack of safety precautions when working near power lines
- Lack of protection for workers in trenches
- Unsafe property conditions

Part B

Q4 Depreciation is defined as the decrease or loss in the property value due to its wear and tear, decay, use, life and deteoriation of structure, etc.

Methods to calculate:

1.straight line method

2.constant percentage or declining balance method

3.Detailed estimate method or quantity survey method

4.Sinking fund method

Q5. Protective equipments:

| | |
|---|---|
| Eye protection | Spectacles, goggles, face shield |
| Ear protection | Ear muffs, plugs |
| Hand protection | Gloves & barrier creams |
| Foot protection | Shoes & boots |
| Head protection | Helmets,caps, hoods, hats |

Part C

# Question Paper Solution

Branch : Civil engg Semester: III year/ V sem Subject: CT &E Mid Term: I

Submitted By : suniti kumari

Q7.

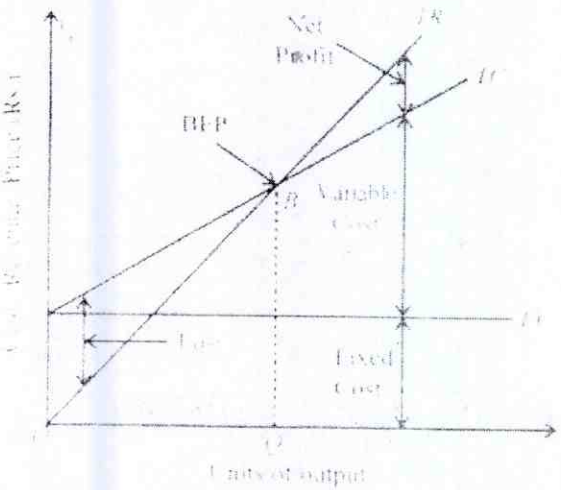


Fig. 1.

Breakeven point: It is the point at which revenues equal expenses. In investing, the break-even point is the point at which gains equal losses. The Break Even Analysis (BEA) is a useful tool to study the relation between fixed costs and variable costs and revenue. It's inextricably linked to the **Break Even Point** (BEP), which indicates at what moment an investment will start generating a positive return. It can be graphically represented or calculated with a simple mathematical calculation. A Break-Even Analysis calculates the size of the production at a certain (selling) price that is necessary to cover all the costs that have been incurred.

Break-even analysis entails the calculation and examination of the margin of safety for an entity based on the revenues collected and associated costs. Analyzing different price levels relating to various levels of demand a business uses break-even analysis to determine what level of sales are necessary to cover the company's total fixed costs.

Assumption and limitation:

1. All costs are categorised into fixed and variable costs. This in practise is difficult. Further, the concept of variability varies with situation. The break even analysis for a given situation may not hold good for another similar situation.
2. The fixed costs and the rate of variable cost of each unit of production remains constant even with the rise in production volume. though in practise this may not be true.
3. Variable costs will fluctuate in direct proportion to the volume of output .generally, these assumed linear relationships of various parameters; it may take the shape of curves instead of straight lines.
4. Selling price, production quantity, productivity will remain constant, but this may not be true always.
5. The construction project consists of wide varied types of activities but this analysis deals with only one activity.

# Question Paper Solution

Branch : Civil Semester: V Subject: CT & E Mid Term: I/II/Extra/Imp. ✓

Submitted By : SUMIT KUMAR

Q6. (i) Break Even Point (in units)

$$= \frac{\text{Fixed costs}}{\text{Selling Price} - \text{variable cost}}$$

$$= \frac{2,40,000}{30 - 15} = \boxed{16,000 \text{ units}}$$

(ii) Break Even Point (in Sales)

$$B.E.P. = \frac{\text{Fixed Cost}}{P/V \text{ ratio}}$$

$$\frac{P}{V} \text{ ratio} = \frac{\text{Selling cost} - \text{variable cost}}{\text{Selling cost}} \times 100$$

$$= \frac{30 - 15}{30} \times 100$$

$$= 50\%$$

$$B.E.P = \frac{2,40,000}{50\%} = \frac{2,40,000}{50} \times 100$$

$$= \boxed{\text{Rs } 4,80,000}$$

# Question Paper Solution

Branch : Civil Semester: V Subject: C T & E Mid Term: I/II/Extra/Imp.

Submitted By : SUNIT KUMARI

(ii) Margin of Safety = Actual Sales − Break Even Sales

= (20,000 × 30) − 4,80,000

= 6 lac − 4 lac

= Rs. 1,20,000

(iii) Sales = $\frac{\text{Fixed cost + Desired Profit}}{\text{P/V ratio}}$

= $\frac{(2,40,000 + 2,00,000)}{50\%}$

= $\frac{4,40,000}{50} \times 100$

= 8,80,000

# Question Paper Solution

Branch : Civil Semester: V Subject: CT & E Mid Term: I/II/Extra/Imp. ✓

Submitted By : SUNITI KUMARI

Q8: Safety measures taken while construction of a building are as follows:

(i) Wear sturdy work gloves, long sleeves, & full length trousers to protect your hands, arms, legs. Indirect contact through clothing can be as serious as direct contact, so promptly rinse out wet concrete or mortar from clothing

(ii) Wear rubber boots when placing & handling of concrete for slabs are done.

(iii) Since masonary involves heavy lifting, be careful to avoid back strain & injury — always bend your knees, keep your back straight & lift with your legs.

(iv) Forms for concrete must be strong, tightly fitted, Rigidly constructed in earth trenches.

(v) Wheelbarrows or buggies are used to move the concrete from the mixer to the formworks. Building of ramps & runways over the forms will be helpful in non-displacement of reinforcing steel out of place.

# Question Paper Solution

Branch : Civil Semester: V Subject: C.T & E Mid Term: I/II/Extra/Imp.
Submitted By : SUNITI KUMARI

Precautionary measures taken against fire before intialing the construction work :-

(i) Use of less flammable materials like timber, banboos, coal, Paints etc.

(ii) Quantities of flamable materials should be kept to the minimum, remainder should be kept in fireproof Stores.

(iii) Flammable solids, liquids & gas should be separately Stored away from oxygen & Oxidizing materials.

(iv) Cigarette butt or match Stick could be the cause of ignition. Smoking, therefore should be prohibited.

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# Question Paper Solution

**Branch : Civil Semester: 5th Subject: STRUCTURAL ANALYSIS-I Mid Term: I/II/Extra/Imp.**

**Submitted By : Ankur Mishra**

Ans 1

In static, a structure is statically indeterminate, when the static equilibrium equations are insufficient for determining the internal forces and reactions on that structure.

Ans 2

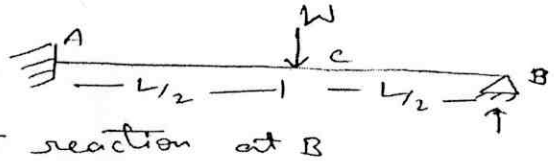
***Generalised Statement.*** **If an elastic system is in equilibrium under one set of forces with their corresponding displacements and if the same system is also in in equilibrium under second set of forces acting through the same points with their corresponding displacements then the product of first group of forces and the corresponding displacements caused by second group is equal to the product of the second group of forces and the corresponding displacements caused by the first group.**

$$P_A \Delta_{A'} + P_B \Delta_{B'} = P'_A \cdot \Delta_A + P_{B'} \Delta_B$$

Ans 3.

DOF are a set of independent displacement/rotations that completely define the displaced position of the mass with respect to its initial position.

Ans 4




Let $V_B$ = redundant reaction at B

replacing prop at B by an unknown vertical reaction $V_B$ ↑

Let $\Delta_B$ = deflection at basic determinate structure due to external loading

$\delta_{BB}$ = deflection at B due to unit load at B

$$\Delta_B + V_B \cdot \delta_{BB} = 0 \quad -(A)$$

deflection $\Delta_B$ and $\delta_{BB}$ can be obtained by area moment method

Bending moment diagram

$$\Delta_B = -\frac{1}{EI} \sum_B^A A\bar{x} = -\frac{1}{EI}\left[-\frac{1}{2} \times \frac{WL}{2} \times \frac{L}{2}\right]\left[\frac{L}{2} + \frac{2}{3}\frac{L}{2}\right]$$

$$= \frac{5WL^3}{48EI}$$

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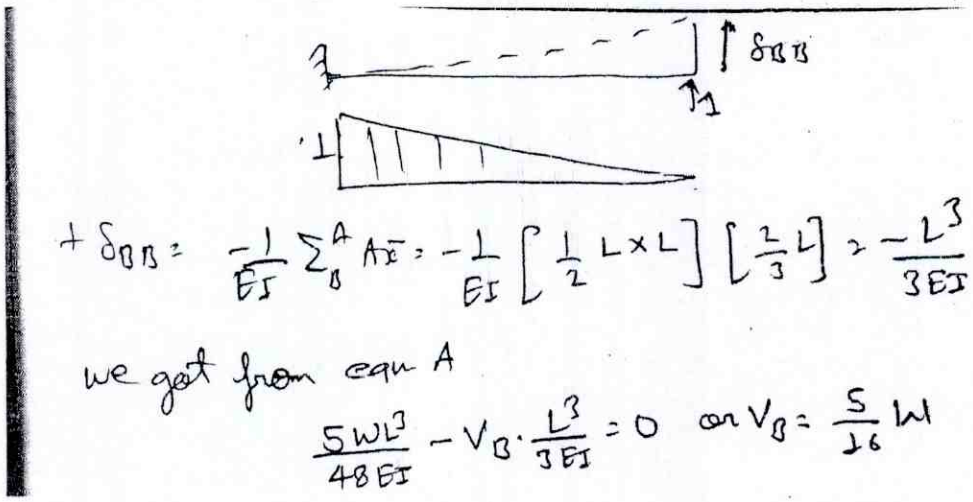
**Submitted By : Ankur Mishra**



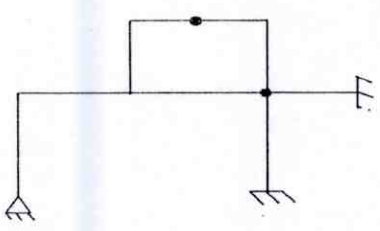

$$+\delta_{BB} = \frac{-1}{EI}\sum_{B}^{A} A\bar{x} = -\frac{1}{EI}\left[\frac{1}{2} L \times L\right]\left[\frac{2}{3}L\right] = \frac{-L^3}{3EI}$$

we get from eqn A

$$\frac{5WL^3}{48EI} - V_B \cdot \frac{L^3}{3EI} = 0 \quad \text{or} \quad V_B = \frac{5}{16} W$$

Ans 5. Kinematic Indeterminacy:- A structure said to be kinematically indeterminate if the displacement component of its joint cannot be determined by compatibility conditions alone. No. of these unknown joint displacement are called unknown degree of freedom or degree of kinematic indeterminacy ($D_k$).

(I)



No. member reaction = 8

No. of joint = 8

No. of member = 8

Addition degree of freedom = 4 in internal hinge + (4-1) in joint hinge = 7

$D_K = (3x\ 8 - 8) + 7 = 23$

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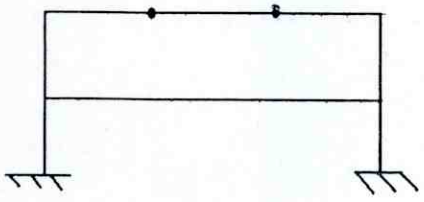
(II)



No. of joint = 6

No. of member = 8

Addition degree of freedom = 2 internal hinge X 4= 8

$D_k$ = (3J-R) + Additional degree of freedom

(3 x 6 -6) + 8 = 20

Ans 6

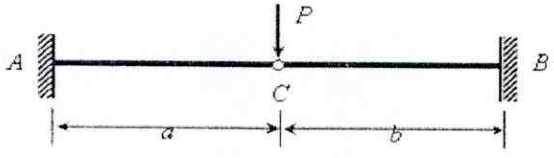



Figure 5 3(a)

**Solution:** The static indeterminacy of the beam is = 4-2-1 =1 Let the shear in the internal hinge be *R* . The free body diagrams of the two separated portions of the beam are shown in Figure 5.3(b) along with their *M/EI* diagrams. The unknown *R* can be obtained with the condition that the vertical deflection of the free ends of the two separated cantilever beams is identical.

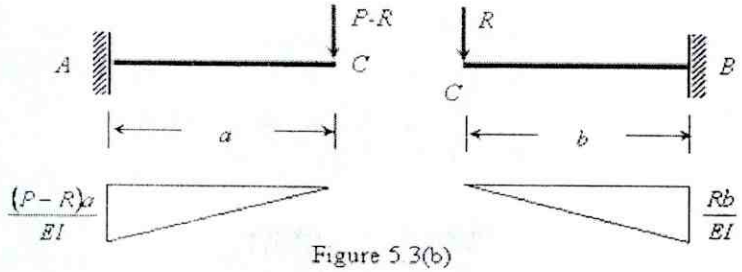



Figure 5 3(b)

*Consider AC* : The vertical displacement of *C* is given by

$$\Delta_C = t_{CA} = -\frac{1}{2} \times a \times \frac{(P-R)a}{EI} \times \frac{2a}{3}$$

or

$$\Delta_C = -\frac{(P-R)a^3}{3EI}$$

*Consider CB* : The vertical displacement of *C* is given by

# Question Paper Solution

**Branch : Civil Semester: 5th Subject: STRUCTURAL ANALYSIS-I Mid Term: I/II/Extra/Imp.**
**Submitted By : Ankur Mishra**

$$\Delta_C = t_{CB} = -\frac{1}{2} \times b \times \frac{Rb}{EI} \times \frac{2b}{3}$$

$$\Delta_C = -\frac{Rb^3}{3EI}$$

Equating the $\Delta_C$ from Eqs. (i) and (ii)

$$-\frac{(P-R)a^3}{3EI} = -\frac{Rb^3}{3EI}$$

Solving for $R$ will give

$$R = \frac{Pa^3}{(a^3+b^3)}$$

The reactions at the supports are given by

$$V_A = \frac{Pb^3}{(a^3+b^3)} \quad (\uparrow) \qquad M_A = \frac{Pb^3a}{(a^3+b^3)} \quad (\circlearrowleft)$$

$$V_B = \frac{Pa^3}{(a^3+b^3)} \quad (\uparrow) \qquad M_B = \frac{Pa^3b}{(a^3+b^3)} \quad (\circlearrowright)$$

Ans 7

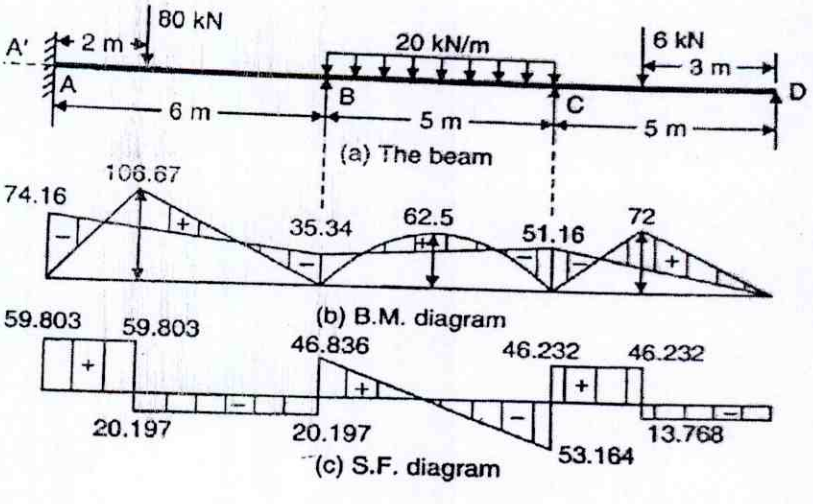
***Solution*** : Imagine a point $A'$ to the left of $A$, such that $AA' = 0$. Then for the spans $A'A - AB$,

$$0 + 2M_A(0+6) + M_B \times 5 = -\left[0 + \frac{6}{6}\left(\frac{1}{2} \times 6 \times 106.67\right) \times \left(\frac{6+4}{3}\right)\right]$$

or $12M_A + 5M_B = -1066.7$

or $M_A + 0.4167M_B = -88.89$ ...(1)

For span $AB - BC$, we have



$$M_B + 4M_C + M_D = -240 \text{ where } M_D = 0$$

$$\therefore \quad M_B + 4M_C = -240$$

From (1) and (2), we get $M_B + 0.2564\,M_C = -48.46$

From (3) and (4), we get $M_C = -\mathbf{51.16}$ **kN-m**

Hence from (4), we get $M_B = -\mathbf{35.34}$ **kN-m**

Lastly from (1), we get $M_A = -\mathbf{74.16}$ **kN-m**

For reaction at $D$, write equation for B.M. at $C$.

$$\therefore \quad R_D \times 5 - 60 \times 2 = M_C = -51.16, \text{ from which } R_D = 13.768 \text{ kN}$$

For reaction at $C$, write equation for B.M. at $B$

$$\therefore \ 13.768 \times 10 + R_C \times 5 - 60 \times 7 - 20 \times 5 \times \frac{5}{2} = M_B = -35.34, \text{ from which } R_C = 99.396 \text{ kN}$$

For reaction at $B$, write equation for B.M. at $A$.

$$\therefore \ 13.768 \times 16 + 99.396 \times 11 + R_B \times 6 - 60 \times 13 - 100 \times 8.5 - 80 \times 2 = M_A = -74.16$$

From which we get $R_B = \mathbf{67.033\ kN}$

For reaction at $A$, write equation for B.M. at $B$, considering L.H.S.

$$R_A \times 6 + M_A - 80 \times 4 = M_B$$

$$6R_A - 74.16 - 320 = -35.34 \text{ from which } R_A = 59.803 \text{ kN}$$

***Check*** Total load = 80 + 100 + 60 = 240 kN

Total reaction = 59.803 + 67.033 + 99.396 + 13.768 = 240 kN

The B.M. and S.F. diagrams are shown in Fig. 8.14 ($b$) and ($c$) respectively.

# Question Paper Solution

**Branch : Civil Semester: 5th Subject: STRUCTURAL ANALYSIS-I Mid Term: I/II/Extra/Imp.**

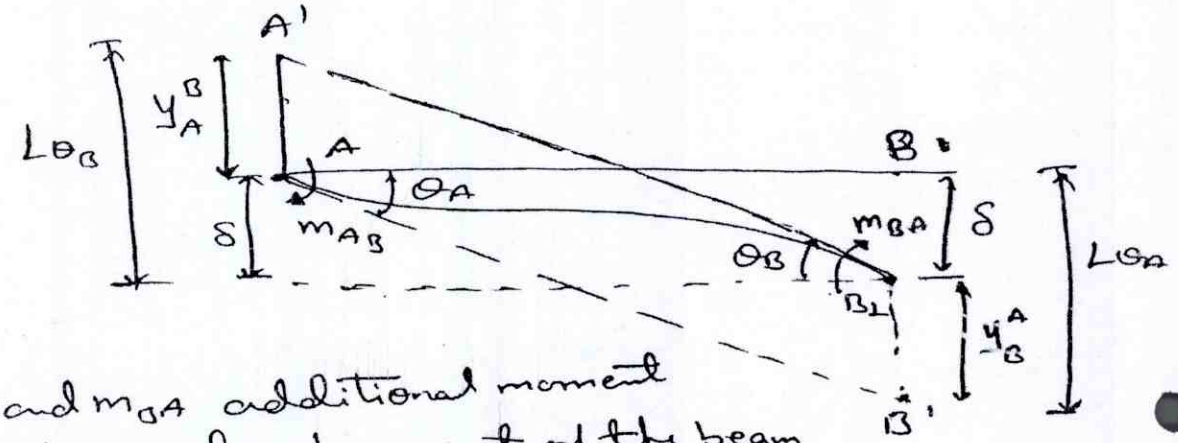
**Submitted By : Ankur Mishra**

Ans 8

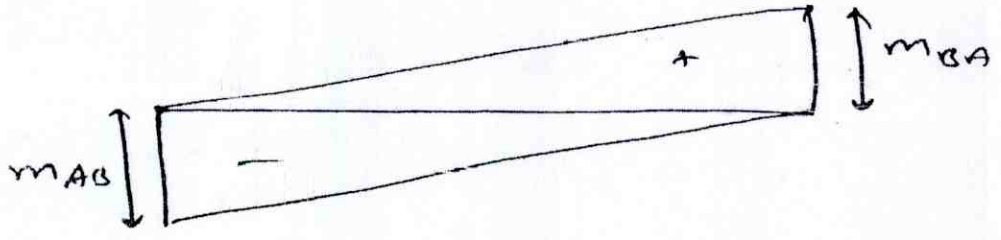
## Slope Deflection Equation

End moment at A $M_{FAB}$ at B $M_{FBA}$ and slope $\theta_A$ and $\theta_B$ are reduced to zero. joint treated as fixed ends.

Let the end A and B rotate through $\theta_A$ and $\theta_B$ respectively and end B deflects (Settle) downward by an amount $\delta$. From that beam has both rotation as well as translation. (relative moment).




Let $m_{AB}$ and $m_{BA}$ additional moment resulting from displacement of the beam



# Question Paper Solution

**Branch : Civil Semester: 5th Subject: STRUCTURAL ANALYSIS-I Mid Term: I/II/Extra/Imp.**
**Submitted By : Ankur Mishra**

Let $y_B^A$ = deviation of B with reference to tangent A

from Mohr's Theorem

$$y_B^A = -\frac{1}{EI}\sum_B^A A\bar{x}$$

$$= -\frac{1}{EI}\left[\frac{1}{2} m_{BA} \cdot L \cdot \frac{L}{3} - \frac{1}{2} m_{AB} \cdot L \cdot \frac{2L}{3}\right]$$

$$= \frac{L^2}{6EI}\left[2m_{AB} - m_{BA}\right]$$

$\because y_B^A = L\theta_A - \delta$

$$\therefore \frac{L^2}{6EI}\left[2m_{AB} - m_{BA}\right) = \left(L\theta_A - \delta\right)$$

$$2m_{AB} - m_{BA} = \frac{6EI}{L}\left(\theta_A - \frac{\delta}{L}\right) \quad -(1)$$

Similarly $y_A^B$ = deviation of A with reference to tangent [illegible]

$$y_A^B = \frac{1}{EI}\sum_A^B A\bar{x}$$

$$= \frac{L^2}{6EI}\left(2m_{BA} - m_{AB}\right) = L\theta_B - \delta$$

$$= 2m_{BA} - m_{AB} = \frac{6EI}{L}\left(\theta_B - \frac{\delta}{L}\right) \quad -(2)$$

Solving (1) and (2)

$$m_{AB} = \frac{2EI}{L}\left(2\theta_A + \theta_B - \frac{3\delta}{L}\right) \quad ...(i)$$

$$m_{BA} = \frac{2EI}{L}\left(2\theta_B + \theta_A - \frac{3\delta}{L}\right) \quad ...(ii)$$

# Question Paper Solution

**Branch : Civil Semester: 5th Subject: STRUCTURAL ANALYSIS-I Mid Term: I/II/Extra/Imp.**

**Submitted By : Ankur Mishra**

final moment

$$M_{AB} = m_{AB} + M_{FAB}$$

$$\boxed{M_{AB} = \frac{2EI}{L}\left(2\theta_A + \theta_B - \frac{3\delta}{L}\right) + M_{FAB}}$$

$$\boxed{M_{BA} = \frac{2EI}{L}\left(2\theta_B + \theta_A - \frac{3\delta}{L}\right) + M_{FBA}}$$

if $\frac{I}{L} = K$ and $\frac{\delta}{L} = R$

So

$$M_{AB} = 2EK(2\theta_A + \theta_B - 3R) + M_{FAB}$$

$$M_{BA} = 2EK(2\theta_B + \theta_A - 3R) + M_{FBA}$$

# Question Paper Solution

Branch : Civil Engg. Semester: V Subject: DCS Mid Term: I/~~II/Extra/Imp.~~

Submitted By : LALIT KUMAR GUPTA

## PART (A)

Q.1 Define the following term (in 25 words)

(a) Balance section : A section is said to be balance when strain in steel and concrete reaches their maximum values at ~~their~~ same time. or A section is said to be balance when depth of neutral axis ($x_u$) is equal to permissible depth of neutral axis ($x_{u,max}$).

(b) Partial Safety Factor : The partial safety factor ~~for~~ concrete and steel is 1.5 and 1.15, respectively in Limit state method of design. The values for concrete and steel are ~~3~~ 3 and 1.8, respectively in working stress method.

(c) Characteristic Strength : The term characteristic strength means that value of the strength of the material below which not more than 5% of the test results are expected to fall.

(d) Limit State of Serviceability : The durability aspect of concrete and steel is checked in this section. It involves deflection and cracking of members.

## PART (B)

Q.2 Find the moment of resistance by working stress method in a RCC beam 300 mm wide and 500 mm effective depth is reinforced with 3 bars of 16 mm diameter. M20 concrete and Fe 415 steel is used.

Soln: Given data -

$b = 300\,mm$ ; $d = 500\,mm$ ; ~~$f_{ck} = 20\ N/mm^2$~~ ; ~~$f_y = 415\ N/mm^2$~~.

$A_{st} = 3 \times \frac{\pi}{4} \times (16)^2 = 603.19\ mm^2$

- Permissible stress in concrete $\sigma_{cbc} = 7\ N/mm^2$
- Permissible stress in steel $\sigma_{st} = 230\ N/mm^2$

- Modular ratio $m = \frac{280}{3\sigma_{cbc}} = \frac{280}{3 \times 7} = 13.33$

- Depth of critical nutral axis ($n_c$)

$$\frac{m \cdot \sigma_{cbc}}{\sigma_{st}} = \frac{n_c}{d - n_c}$$

$$\Rightarrow \frac{13.33 \times 7}{230} = \frac{n_c}{500 - n_c}$$

$$\Rightarrow 323.31\, n_c = 46655$$

$$\Rightarrow \boxed{n_c = 144.30 \text{ mm}}$$

- Depth of actual neutral axis (n)

$$\frac{b n^2}{2} = m \cdot A_{st} (d - n)$$

$$\Rightarrow \frac{300\, n^2}{2} = 13.33 \times 603.19 (500 - n)$$

$$\Rightarrow n^2 + 53.6n - 26801.74 = 0$$

$$\Rightarrow n = \frac{-53.6 \pm \sqrt{(53.63)^2 - 4 \times 1 \times (-26801.74)}}{2 \times 1}$$

$$\Rightarrow n = \frac{-53.6 \pm 331.79}{2} = \frac{278.19}{2} \quad [\text{Taking (+)ive sign}]$$

$$\Rightarrow n = 139.095 \text{ mm} \simeq 139.1 \text{ mm}$$

$\because n_c > n$, Section is under reinforced.

- Moment of resistance

$$M = \sigma_{st} \cdot A_{st} \cdot \left(d - \frac{n}{3}\right)$$

$$\Rightarrow M = 230 \times 603.19 \cdot \left(500 - \frac{139.09}{3}\right)$$

$$\Rightarrow M = 62934693.22 \text{ N-mm}$$

$$\Rightarrow \boxed{M = 62.93 \text{ kN-m}}$$

Q.3 Determine the depth of neutral axis by limit state method of design of a beam 250 mm x 500 mm (effective), reinforced with 3 bars of 20 mm diameter. Also calculate moment of resistance. Use M20 concrete and Fe-415 steel.

Soln: Given Data -

$b = 250\text{mm}$ ; $d = 450\text{mm}$ ; $f_{ck} = 20 \text{ N/mm}^2$

$A_{st} = 3 \times \frac{\pi}{4} \times (20)^2 = 942.48 \text{ mm}^2$ ; $f_y = 415 \text{ N/mm}^2$.

$$\frac{x_{u,max}}{d} = 0.48 \Rightarrow x_{u,max} = 0.48 \times 450 = 216 \text{ mm}.$$

- Depth of neutral axis ($x_u$)

$$x_u = \frac{0.87 f_y A_{st}}{0.36 f_{ck} b} = \frac{0.87 \times 415 \times 942.48}{0.36 \times 20 \times 250} = 189.05 \text{ mm}$$

$\because x_u < x_{u,max}$, The section is under r/f.

- Moment of resistance

$$M_u = 0.87 f_y \cdot A_{st} \cdot d \left(1 - \frac{A_{st} \cdot f_y}{b d f_{ck}}\right)$$

# Question Paper Solution

Branch : Civil Engg. Semester: V Subject: DCS Mid Term: I/~~II/Extra/Imp.~~

Submitted By : LALIT KUMAR GUPTA

$$\Rightarrow M_u = \frac{0.87 \times 415 \times 942.48 \times 450}{} \left[1 - \frac{942.48 \times 415}{250 \times 450 \times 20}\right] \text{ (N-mm)}$$

$$\Rightarrow \boxed{M_u = 126.51 \text{ kN-m}}$$

Q.4 Compare the salient features of "Limit State Design Philosophy" and "Working Stress Design Philosophy".

| Ans. Working Stress Method | Limit State Method |
|---|---|
| 1. This method is based on the elastic theory which assumes that concrete and steel are elastic and the stress-strain curve is linear for both. | 1. This method is based on the actual stress-strain curves of steel & concrete. |
| 2. In this method, the factor of safety are applied to the yield stress. | 2. In this method, partial safety factors are applied to get design values of ~~stresses~~ loads. |
| 3. Exact margin of safety is not known. | 3. Exact margin of safety is known. |
| 4. This method gives thicker sections so less economical. | 4. This method is more economical as it gives thinner sections. |
| 5. This method is termed as deterministic method. | 5. This method is termed as non-deterministic method. |

# Question Paper Solution

Branch : Civil Engg. Semester: V Subject: DCS Mid Term: I/II/~~Extra/Imp.~~

Submitted By : LALIT KUMAR GUPTA

## PART - C

**Q.5** A rectangular beam of width 350 mm is subjected to a uniformly distributed load of 15 kN/m over an effective span of 8m. Determine the depth required for the beam and also calculate area of tensile reinforcement required by using working stress method. Use M20 concrete and Fe-250 steel.

Given Data :

$b = 350\ mm$

$w = 15\ kN/m$

$L = 8\ m$

- Permissible stress for M20 concrete

$$\sigma_{cbc} = 7\ N/mm^2 \quad [TN-21, PN-81]$$

- Permissible stress for Fe250 steel

$$\sigma_{st} = 140\ N/mm^2 \quad [T.N-22, PN-82]$$

- Modular ratio $m = \frac{280}{3\sigma_{cbc}} = \frac{280}{3\times 7} = 13.33$

- Neutral axis depth factor $k = \frac{m \cdot \sigma_{cbc}}{m\sigma_{cbc} + \sigma_{st}}$

$$\Rightarrow k = \frac{13.33 \times 7}{13.33\times 7 + 140} = 0.40$$

- Lever arm depth factor $j = 1 - \frac{k}{3}$

$$\Rightarrow j = 1 - \frac{0.40}{3} = 0.87$$

- Resisting moment factor $R = \frac{1}{2}\sigma_{cbc}\, k\, j$

$\Rightarrow R = \frac{1}{2} \times 7 \times 0.40 \times 0.87$

$\Rightarrow R = 1.22 \text{ N/mm}^2$

- Maximum bending moment

  If beam is simply supported

  $M_{max} = \frac{wL^2}{8} = \frac{15 \times 8^2}{8} = 120 \text{ kN-m}$

- Depth of beam $d = \sqrt{\frac{M_{max}}{Rb}} = \sqrt{\frac{120 \times 10^6}{1.22 \times 350}}$

  $\Rightarrow d = 530.12 \text{ mm}$

  Take $\boxed{d = 535 \text{ mm}}$

- Area of Steel $A_{st} = \frac{M}{\sigma_{st} \cdot j \cdot d} = \frac{120 \times 10^6}{140 \times 0.87 \times 535}$

  $\Rightarrow \boxed{A_{st} = 1841.54 \text{ mm}^2}$

- No. of bars

  If diameter of bar is 20 mm

  No. of bars $= \frac{A_{st}}{A_\phi} = \frac{1841.54}{\frac{\pi}{4} \times (20)^2} = 5.86$

Provide 6 bars of 20 mm diameter as tensile reinforcement.

# Question Paper Solution

Branch : Civil Engg. Semester: V Subject: DCS Mid Term: I/~~II/Extra/Imp.~~

Submitted By : LALIT KUMAR GUPTA

**Q.6** Design a RCC beam by Limit state method 300 mm wide to carry a load of 10 kN/m over an effective span of 5m. Use M20 concrete and Fe-415 steel. Take effective cover 50 mm and $b/d = 0.5$. Check for criteria of minimum and maximum r/f of beam.

Given Data :

$b = 300$ mm ; $d' = 50$ mm ; $f_y = 415$ N/mm$^2$

$L_e = 5000$ mm ; $f_{ck} = 20$ N/mm$^2$ ; $\frac{x_{u,max}}{d} = 0.48$

$\frac{b}{d} = 0.5$ ; $d = 600$ mm ; Live load = 10 kN/m

Soln:

- Overall depth $D = d + d' = 600 + 50 = 650$ mm
- Self weight of beam $= 25 \times 0.300 \times 0.650 = 4.875$ kN/m
- Total weight of beam = Live Load + Self weight
  $= 10 + 4.875$
  $= 14.875$ kN/m

If the beam is simply supported, max$^m$ bending moment

$$M_{max} = \frac{14.875 \times (5)^2}{8} = 46.48 \text{ kN-m}$$

- Ultimate moment $M_u = 1.5 \times 46.48 = 69.72$ kN-m
- Permissible moment of resistance factor

$$R_u = 0.36 f_{ck} \left(\frac{x_{u,max}}{d}\right)\left(1 - 0.42 \frac{x_{u,max}}{d}\right)$$

$$\Rightarrow R_u = 0.36 \times 20 \times 0.48 \times (1 - 0.42 \times 0.48)$$

$$\Rightarrow R_u = 2.76 \text{ N/mm}^2$$

# Question Paper Solution

Branch : Civil Engg. Semester: V Subject: DCS Mid Term: ~~I/II/Extra/Imp.~~

Submitted By : LALIT KUMAR GUPTA

- Effective depth required

$$d_{req} = \sqrt{\frac{M_u}{R_u \cdot b}} = \sqrt{\frac{69.72 \times 10^6}{2.76 \times 300}}$$

$$\Rightarrow d_{req} = 290.18 \text{ mm} < d_{provided} = 600 \text{ mm}$$

"OK"

- If the section is under reinforced
- ~~Moment of resi~~
- Area of tensile r/f

$$A_{st} = 0.5 \frac{f_{ck}}{f_y} \left[1 - \sqrt{1 - \frac{4.6 M_u}{f_{ck} b d^2}}\right] bd$$

$$\Rightarrow A_{st} = 0.5 \times \frac{20}{415} \left[1 - \sqrt{1 - \frac{4.6 \times 69.72 \times 10^6}{20 \times 300 \times (600)^2}}\right] 300 \times 600$$

$$\Rightarrow A_{st} = 334.93 \text{ mm}^2$$

- Minm reinforcement

$$A_{st,min} = \frac{0.85 bd}{f_y} = \frac{0.85 \times 300 \times 600}{415} = 368.67 \text{ mm}^2$$

- Maxm reinforcement

$$A_{st,max^m} = 0.04 bD = 0.04 \times 300 \times 650 = 7800 \text{ mm}^2$$

$\because$ $A_{st}$ ~~area~~ $< A_{st,min} < A_{st,max}$

Hence, Provide ~~area~~ $A_{st,min}$ as reinforcement in section.

If 16mm diameter is used

- No. of bars $= \frac{368.67}{\frac{\pi}{4} \times (16)^2} = 1.83 \simeq 2$ bars

Therefore, Provide 2 bars of 16 mm diameter as reinforcement in beam.

# Question Paper Solution

Branch : Civil Engg. Semester: 5th Subject: G.E. Mid Term: I/II/Extra/Imp.

Submitted By : Pankaj Gupta, Srijan Mishra

## PART-A

**Q.1** Inter Properties are used to classification and identification of soil. As follows.

(1) **water content** :- It is the amount of water present in soil mass. given by

$$w = \frac{W_w}{W_s}$$

(2) **Liquid limit** :- It is the amount of water content at which soil has tendency to flow and poses negligible shear strength.

**Q.2** For various Engineering purposes different property and types of soil required. Different types of soil, different property based on their size, shape + Binding property. ex: Sand, Silt, Clay, Gravel.

$$C_u = \frac{D_{60}}{D_{10}}$$

$$C_c = \frac{D_{30}^2}{D_{60} \cdot D_{10}}$$

$D_{10}$ = effective size = 10% of soil particle are finer than this dia.

$D_{30}$ = 30% of soil particle are finer than this dia.

$D_{60}$ = 60% of soil particleare finer than this dia.

Qu 3 :

| Compaction | Consolidation |
|---|---|
| (1) Expulsion of pore air | (1) Expulsion of pore water. |
| (2) Achived by mechanical means. | (2) It is natural phenomena. |
| (3) Instaderious process | (3) Time dependent process. |
| (4) Dry density Increase without change in water content | (4) Dry density increase with decrease in water content |
| (5) Fast procen | (5) Slow procen |
| (6) Applicable to partially saturated soil | (6) Applicable to fully saturated soil. |

# Question Paper Solution

Branch : Civil Engg. Semester: 4th Subject: G.E. Mid Term: I/II/Extra/Imp.

Submitted By : Pankaj Gupta Sajan Mishra

Q. 4: $G = \frac{W}{V_s}$ , $G_m = \frac{W}{V}$

$V = V_s + V_v$ , from $e = \frac{V_v}{V_s}$

$V_v = eV_s$

$G_m = \frac{W}{V_s + eV_s} = \frac{W}{V_s(1+e)}$

$G_m = \frac{G}{(1+e)} \Rightarrow \boxed{G = (1+e)G_m}$

$G = 2.7$ $G_m = 1.84$

$2.7 = (1+e)1.84$

$\boxed{e = 0.46}$

# Question Paper Solution

Branch : Civil Engg. Semester: 4th Subject: C.E. Mid Term: I/II/Extra/Imp. ✓

Submitted By : Pankaj Gupta, Srijan Mishra

## Part-B

**Q.5: Factor affecting Compaction:-**

**(i) water content:-**

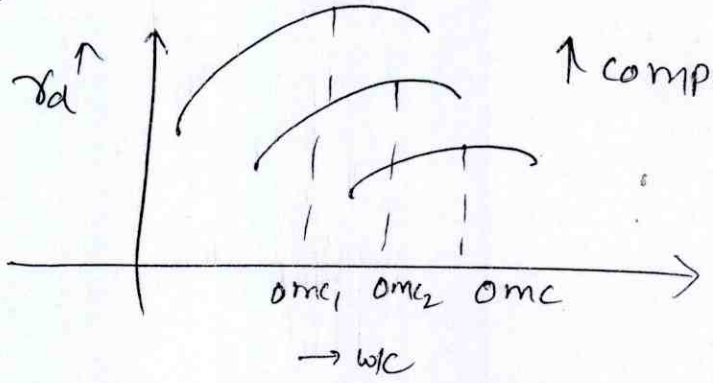
→ At lower water content soil is relatively stiff as compared to high water conte

→ As water content increase lubrication effect makes the soil ~~more~~ less resistance to compacted effort.

→ But after a limit (omc). water start replacing soil ~~wat~~ particle and dry unit weight start decreasing.

**(ii) Degree of compaction:**

→ With increase in degree of compaction max. dry unit weight increase and omc decrease.



(iii) Method of Compaction :-

→ It also affect the compactenes of soil.
ex: ① Robler, Rammes, Vibrator

(iv) Types of Soil :-

→ with increase in % fineness, dry unit weight increases.

→ well graded coarse grain soil with are found with max. dry density.

Sol. (6) Consistency refers to degree of deformation which may be recorded in a soil due to change in water content.

→ It is a measure of relative ease with soil can be deformormed.

Liquid limit by Casagrande method

→ Test is performed by Casagrande apparatus by the height of free fall is adjusted to 1 cm and groove is cut eight wing Casagrande or ASTM Tool

# Question Paper Solution

Branch : Civil Engg. Semester: 5th Subject: GE Mid Term: I/II/Extra/Imp.

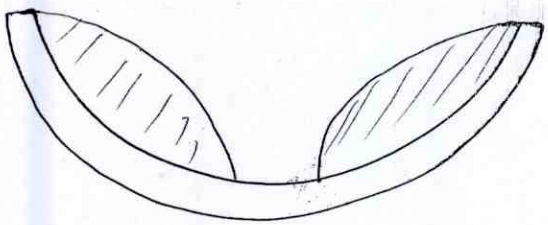
Submitted By : Pankaj Gupta Srijan Mishra

. After cutting the groove, cup is allow to freely fall on the hard rubber base.

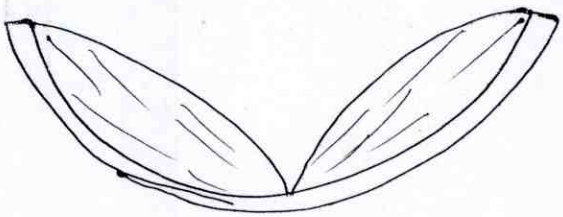
→ The No. of blow required to close the groove are noted and test is repeated.

→ A graph is plotted on semi-log graph.

→ water content at 25 No. of Blow is termed as liquid limit.



Befor the Test



After the test

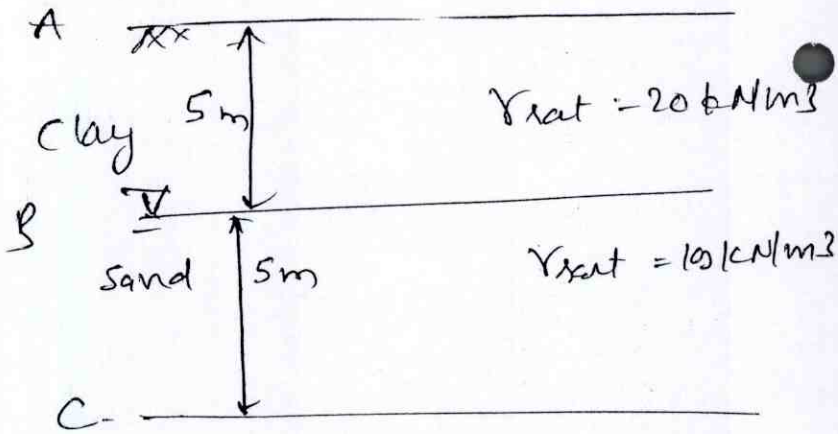
Sol^n (7)

For Point A

$\sigma = 0$

$u = 0$

$\bar{\sigma} = 0$




For Point B

$\sigma = 5 \times 20 = 100 kN/m^2$

$u = 0$

$\bar{\sigma} = \sigma - u = 100 kN/m^2$

# Question Paper Solution

Branch : Civil Engg. Semester: 5th Subject: GE Mid Term: I/II/Extra/Imp.

Submitted By : Pankaj Gupta Srijan Mishra

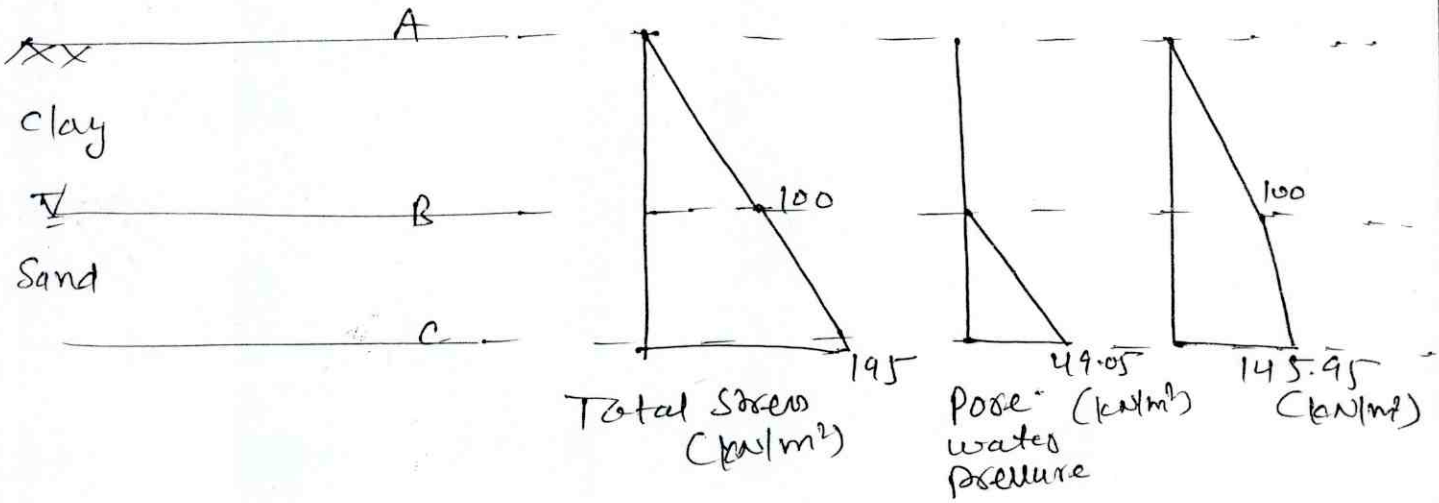
For Point C

$\sigma = 5 \times 20 + 5 \times 19 = 195 \text{ kN/m}^2$

$u = 9.81 \times 5 = 49.05 \text{ kN/m}^2$

$\bar{\sigma} = \sigma - u = 195 - 49.05$

$= 145.95 \text{ kN/m}^2$



# Question Paper Solution

Branch : Civil Engg. Semester: 4th Subject: C.E Mid Term: I/II/Extra/Imp.

Submitted By : Srijan mishra Pankaj Gupta

## Part. C

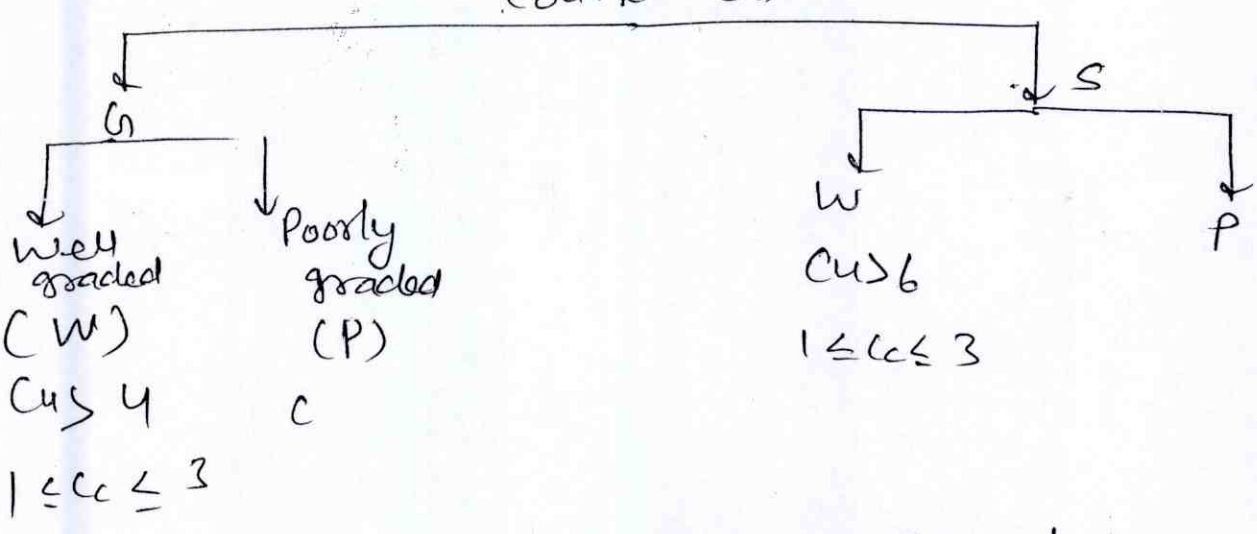
**Soln: (8):** **Coarse grain soil**: if 50% or more by weight by soil particle are greater than the size 0.075 mm.

(i) Gravel fraction > Sand fraction then soil is gravel (G)

(ii) Sand fraction > Gravel fraction then soil is Sand (S)

**Case-1:** when Fines is < 5%.

Coarse soil




(A) GW → well graded gravel
G > S, Cu > 4, 1 ≤ Cc ≤ 3

(B) GP → Poorly graded Gravel
G > S, Cu ≯ 4, Cc ≮ 1, G > 3

(C) SW → well graded sand
S > G, Cu > 6, 1 ≤ Cc ≤ 3

# Question Paper Solution

Branch : Civil Engg. Semester: 4th Subject: G.E Mid Term: I/II/Extra/Imp.

Submitted By : Srijan Mishra, Pankaj Gupta

(e) SP — Poorly graded sand
$S > G$, $C_u > 6$, $C_c < 1$, or $C_c > 3$

Case 2: Fineness between (5-12)%
→ Dual symbol is used.

(a) GW - GM → well graded gravel with silt
$G > S$, $M > C$, $C_u > 4$,
$1 \le C_c \le 3$

(b) GW - GC → well graded gravel with clay
$G > S$, $C > M$, $C_u > 4$, $1 \le C_c \le 3$

(c) GP - GM — Poorly graded gravel with silt
$G > S$, $M > C$, $C_u > 4$, $C_c < 1$, or $C_c > 3$

(d) GP - GC — Poorly graded gravel with clay
$G > S$, $C > M$, $C_u > 4$, $C_c < 1$, or $C_c > 3$

(e) SW - SM
(f) SW - SC
(g) SP - SM
(h) SP - SC

Case-3: when Fineness > 12%

(a) GM — Silty gravel (b) GC — Clayey gravel (c) SM — Silty sand (d) SC — Clayey sand

# Question Paper Solution

Branch : Civil Engg. Semester: 8th Subject: G.E Mid Term: I/II/Extra/Imp. ✓

Submitted By : Pankaj Gupta, Srijan Mishra

Soln. (9). $H = 25\ mm$

$\sigma_1 = 50\ kN/m^2$ $\sigma_2 = 120\ kN/m^2$

$e_1 = 0.92$ $e_2 = 0.78$

Time for 50% consolidation = 2.5 min.

(i) $a_v = \frac{\Delta e}{\Delta \sigma} = \frac{0.92 - 0.78}{120 - 50}$

$$a_v = 2 \times 10^{-3}\ m^2/kN$$

(ii) $m_v = \frac{a_v}{1 + e_0}$

$\Rightarrow \frac{2 \times 10^{-3}}{1 + 0.92}$

$$m_v = 1.04 \times 10^{-3}\ \frac{m^2}{kN}$$

(iii) $k = C_v\, m_v\, \gamma_w$

$T_v = C_v \frac{t}{d^2}$

For Both faces $d = H/2 = 12.5\ mm$

$C_v = \frac{T_{v_{50}} d^2}{t_{50}} = \frac{0.197 \times (0.0125)^2}{2.5}$

$= 1.23 \times 10^{-5}\ m^2/min$

$$k = C_v\, m_v\, \gamma_w = 1.26 \times 10^{-7}\ m/min$$

# Question Paper Solution

Branch : Civil Engg. Semester: 8th Subject: Water resource Engg. Mid Term: I/II/Extra/Imp.

Submitted By : Sitaram saini

## Part-A. (25 words). (3X2=6) marks

Q.1. principle Indian crop seasons

Ans 1) North india.
2) Central & south india.
3) Bombay - Deccan region

- North-india:-
  (A) Kharif crop season. (sown in June-July & Harvested in Oct - Nov)
  (B) Rabi crop season. (sown in Oct-Nov. & Harvested in March - April.)
  (C) Perennial crop season (one year).

(i) Kharif → rice, Maize, spiked millet, Pulse etc.
(ii) Rabi → wheat, gram, peas etc.
(iii) Perennial → Sugarcane

Q.2 Ans. Duty & factors affecting Duty.

Duty :→ Duty of water is it's capacity to irrigate land
OR
the area of land which can be irrigated if one cumec of water was applied to the land continuously for the entire base period of the crop.

unit → Hactares/cumes.

Factors affecting Duty :-

1) type of soil
2) type of crop
3) climatic conditions
4) system of irrigation
5) structure of soil
6) method of application of water
7) Base period.
8) salt content of soil.

# Question Paper Solution

Branch : Civil Engg. Semester: 4th Subject: WRE Mid Term: I/II/Extra/Imp.

Submitted By : sitaram saini

**Q.3. Consumptive use of water & factors affecting it**

→ **Consumptive use** :- C.U. (consumptive use) is synonymous to evapotranspiration (ET crop.)

→ C.U. is the depth of water required by the crop to meet its evapotranspiration losses and water used for metabolic processes

$$C.U = \underbrace{E+T}_{>99\%} + \underbrace{W_m}_{<1\%}$$

$$\boxed{C.U \simeq E+T}$$

**factors affecting C.U.**

1) Evaporation
2) Humidity
3) Temperature
4) Growing seasons
5) Cropping patterns
6) Precipitation
7) Wind velocity
8) Soil & Topography.
9) Water table
10) Day-time hours.
11) Intensity of sun-light
12) stage of growth.

# Question Paper Solution

Branch : Civil Engg. Semester: 4th Subject: WRE Mid Term: I/II/Extra/Imp.

Submitted By : Ctaram saini

## part (B) (4X2 = 8)

**Q4 Compare Lacey's & Kennedy's theory in detail.**

1) **Relevant parameters.**
   1. Kennedy's consider depth (D) as relevent parameter
   2. Lacey's consider Hydraulic Radius (R) as relevent parameter

2) **Flow Equation.**
   1) → Kennedy did not give any flow equation, he use kutter eq.
   2) → Lacey gave his own flow equation.

3) **Silt grade parameter.**
   1) Kennedy take C.V.R (m) to account for silt grade.
   2) Lacey introduced $f$ = silt factor = $1.76\sqrt{M_d}$ or $M_m$

4) **Bed slope.** → Kennedy did not give formula for slope.
   → Lacey $S = \frac{f^{5/2}}{3344\,Q^{1/6}}$

5) **uniqueness.**
   → Kennedy theory is not unique theory.

6) **Trial & error.** → Kennedy based on Trial & error

7) **Applicability.** → Kennedy theory is Applicable for irrigation channels.

8) **Regime in artificial channels.**
   → Lacey indicated that artificial channels cannot be in true regime.

9) **Regime shape.**
   → Lacey indicated that regime shape of channels is semi-elliptical.
   → Kennedy did not mention about shape.

10) **Shock resistance.**
    Lacey made difference b/w frictional resistance & shock resistance.

11) **General flow equation.**
    → Lacey gave general flow eqn. applicable to both the regime & non-regime channels.

# Question Paper Solution

Branch : Civil Engg. Semester: 8th Subject: WRE Mid Term: I/II/Extra/Imp.

Submitted By : Sitaram Saini

Q.5 given $S = 1/5800$, $M_d = M_R = 0.323$ mm

Step.01 Silt factors.

$$f = 1.76\sqrt{M_R} = 1.76\sqrt{M_d} = 1.76\sqrt{0.323}$$

$$\boxed{f = 1.0}$$

Step.02 To find discharge

$$S = \frac{f^{5/3}}{3340\, Q^{1/6}}$$

$$S = \frac{1}{5800} = \frac{f^{5/3}}{3340 Q^{1/6}} = \frac{(1)^{5/3}}{3340\,(Q)^{1/6}}$$

$$\boxed{Q = 27.67 \text{ cumecs}}$$

Step.03 To find velocity.

$$r = \left(\frac{Qf^2}{140}\right)^{1/6} = \left(\frac{27.67 \times (1)^2}{140}\right)^{1/6} = 0.76 \text{ m/sec.}$$

$$\boxed{r = 0.76 \text{ m/sec}}$$

Step.04 To find area of cross-section.

$$A = Q/r = \frac{27.67}{0.76} = 36.41 m^2$$

$$\boxed{A = 36.41 m^2}$$

Step-05 To find wetted perimeter.

$$P = 4.75\sqrt{Q} = 4.75\sqrt{27.67} = 24.99 m$$

$$\boxed{P = 24.99 m}$$

# Question Paper Solution

Branch : Civil Engg. Semester: 5th Subject: WRE Mid Term: I/II/Extra/Imp. ✓

Submitted By : Sitaram Saini

Step.06 To find depth & width of channel.

$$A = 36.41 = BD + 0.5D^2 \quad -(i)$$

$$P = 24.99 = B + D\sqrt{5} \quad -(ii) \Rightarrow B = 24.99 - D\sqrt{5}$$

Now

$$1.736D^2 - 24.99D + 36.41 = 0$$

By using Shridhracharya formula for D

$$D_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\left\{ \begin{array}{l} D = 1.64\,m \\ B = 21.32\,m \end{array} \right\}$$

Q. 6

(i) Kharif:

Kharif area irrigated = Intensity of irrigation × Culturable commanded area

= 15% × 70% of Gross Commanded area.

= 0.15 × 0.70 × 20,000

= 2100 ha.

(D) outlet discharge factor = $\frac{8.64 \times B}{\Delta}$ → days, Δ → in m, → weeks

$= \frac{8.64 \times (2.5 \times 7)}{0.19}$ → m

= 796 ha/cumecs

outlet discharge = $\frac{\text{Area irrigated}}{\text{outlet discharge factor}}$

$= \frac{2100}{796} = 2.64$ cumecs.

(ii) Rabi:

Area irrigated = 0.3 × 0.7 × 20000

= 4200 ha.

outlet discharge factor = $\frac{8.64 \times (4 \times 7)}{0.135}$ = 1792 ha/cumecs

outlet discharge = $\frac{4200}{1792}$ = 2.34 cumecs.

**Question Paper Solution**

Branch : Civil Engg. Semester: 7th Subject: WRE Mid Term: I/II/Extra/Imp.

Submitted By : Ratanam Saini

(iii) Sugarcane :-

Area Irrigated $= 0.10 \times 0.70 \times 20000$

$= 1400$ ha.

Outlet discharge factor $= \frac{8.64 \times (4 \times 7)}{0.165}$

$= 1466$ ha/cumecs

outlet discharge $= \frac{1400}{1466}$

$= 0.95$ cumecs.

As sugarcane usually requires irrigation along with rabi they

total outlet factor

$= 2.34 + 0.95$

$= 3.29$ cumecs.

Now discharge required at the tail end of the distributary $= 3.29 + 1.0$

$= 4.29$ cumecs.

# Question Paper Solution

Branch : Civil Engg. Semester: 5th Subject: WRE Mid Term: I/II/Extra/Imp.
Submitted By : Sitaram Saini

## Part-C (6 X 1 = 6 marks)

**Q.7 Design an irrigation channel by kennedy theory**

**Step.01, given data.**

Q = discharge = 5 cumecs
m = C.V.R = 1.0
N = 0.0225
B/D = 4.40

**Step.02 find 'B' in terms of 'x' (Ratio).**

$$\frac{B}{D} = x$$

$$\frac{B}{D} = 4.40$$

$$\boxed{B = 4.40\,D}$$

**Step.03. To find Area of cross-section & Wetted Perimeter.**

Area.

$$A = BD + 0.5D^2 = 4.40\,D \times D + 0.5D^2$$

$$A = (4.4 + 0.5)D^2$$

$$\boxed{A = 4.9\,D^2}$$

perimeter.

$$P = B + D\sqrt{5}$$

$$P = 4.40D + D\sqrt{5}$$

$$P = (4.40 + \sqrt{5})D$$

$$\boxed{P = (4.40 + \sqrt{5})D}$$

**Step.04. To find velocity of flow.**

$$V = 0.55\,m\,D^{0.64} = 0.55 \times 1 \times D^{0.64}$$

# Question Paper Solution

Branch : Civil Engg. Semester: 5th Subject: WRE Mid Term: I/II/Extra/Imp.

Submitted By : Sitaram Saini

$$V = 0.55\, D^{0.64}$$

**Step.05** To find depth, & width (D & B) by using Continuity equation. ($Q = AV$).

$$Q = AV = 4.9D^2 \times (0.55\, D^{0.64})$$

$$5 = 0.55 \times 4.9 \times D^{2.64}$$

$$5 = 2.695\, D^{2.64}$$

$$D = \left[\frac{5}{2.695}\right]^{1/2.64}$$

$$D = 1.26\text{m}, \quad B = 1.26 \times 4.40 = 5.54\text{m}$$

$$B = 5.54\text{m}$$

**Step.06** To find Hydraulic radius.

$$R = A/P = \frac{4.9(1.26)^2}{5.54 + 1.26\sqrt{5}}$$

$$R = 0.93\text{m}$$

**Step.07** To find bed slope (S) by using Kutter's formula.

$$V = 0.55 \times D^{0.64} = 0.55 \times 1.26^{0.64}$$

$$V = 0.64\ \text{m/sec.}$$

# Question Paper Solution

Branch : Civil Engg. Semester: 8th Subject: NRE Mid Term: I/II/Extra/Imp.

Submitted By : Sitaram saini

$$V = 0.64 = \frac{\frac{1}{N} + \left(23 + \frac{0.00155}{S}\right)}{1 + \left(23 + \frac{0.00155}{S}\right)\frac{N}{\sqrt{R}}} \sqrt{RS}$$

Neglecting the term $\frac{0.00155}{S}$, then.

$$0.64 = \frac{\left(\frac{1}{0.0225} + 23\right)}{1 + 23 \times \frac{0.0225}{\sqrt{0.93}}} \sqrt{0.93\,S}$$

$$0.64 = \frac{67.44}{1.537} \sqrt{0.93S}$$

$$S = \text{slope} = 2.288 \times 10^{-4}$$

So the Design is

$D = 1.26\,m$, $B = 5.54\,m$

$$S = 2.30 \times 10^{-4} = \frac{1}{4348}$$

$S = 1$ in $4348$ ✓

# Question Paper Solution

Branch : Civil Engg. Semester: 4th Subject: WRE Mid Term: I/II/Extra/Imp.

Submitted By : Sitaram saini

**Q.08** Derive the following.

i) Wetted perimeter, ii) Hydraulic radius iii) Slope equation

**i) Wetted perimeter:**

$$V^4 = \frac{4}{25} f^2 R^2 \quad \text{---(1) Eqn.}$$

$$f^2 = \frac{140 v^5}{A} \quad \text{---(2) Eqn.}$$

Eliminating $f^2$ from eqn. (1) & (2)

$$V^4 = \frac{4}{25}\left(\frac{140 v^5}{A}\right) R^2$$

$$\frac{25}{4}\frac{AV}{R^2} = 140 v^2$$

$$\frac{25}{4}\frac{Q}{R^2} = 140 v^2$$

writing $R = A/P$,

$$\frac{25 Q}{4 (A/P)^2} = 140 v^2$$

$$P^2 Q \frac{25}{4A^2} = 140 v^2$$

$$P^2 Q = \frac{140 \times 4}{25} Q^2$$

$$\boxed{P = 4.75\sqrt{Q}} \quad (3)$$

(ii) **Hydraulic radius (R).**

$$V^2 = \frac{2}{5} f R$$

$$R = \frac{5}{2} \frac{V^2}{f}$$

We know

$$V^2 = \left(\frac{Q f^2}{140}\right)^{1/3} \quad \text{OR} \quad V = \left(\frac{Q f^2}{140}\right)^{1/6}$$

$$R = \frac{5}{2} \times \left(\frac{Q f^2}{140}\right)^{1/3} \times \frac{1}{f}$$

$$R = 0.481 (Q/f)^{1/3}$$

$$R = 0.47 (Q/f)^{1/3}$$ { generally constant is taken 0.47 }

(iii) **Slope Equation: (S).**

S = slope of Bed. / Bed Slope.

$$V = 10.8 R^{2/3} \cdot S^{1/3}$$

$$V^3 = 1260 R^2 S$$

$$V^3 = \left(\frac{2}{5}\right)^{3/2} \cdot f^{3/2} \cdot R^{3/2}$$

$$R^2 S = \left(\frac{2}{5}\right)^{3/2} \cdot f^{3/2} \cdot R^{3/2}$$

$$S = \frac{f^{3/2}}{4980 R^{1/2}}$$

$$S = \frac{0.0002 f^{3/2}}{R^{1/2}} \quad / \quad \text{OR} \quad S = \frac{f^{5/3}}{3340 Q^{1/6}}$$

Swami Keshvanand Institute of Technology, Management &Gramothan,
Ramnagaria, Jagatpura, Jaipur-302017

# Question Paper Solution

Branch : CIVIL Engg. Semester: V Subject: Town Planning Mid Term: I/II/Extra/Imp.
Submitted By : Amit Kumar

Q.1 What is the definition of an Urban area, as per the census of India?

Ans. As per census of India, a place ~~bee~~ becomes urban if it has more than 5000 population, more than 75 percent of which are engaged in non-agricultural occupation and the density is more than 1000 persons per square km. However there are exceptions.

Q.2 What is the concept of Town Planning?

Ans. Planning means pre-thinking or pre-arranging things. Town planning is considered as an art of shaping and guiding the physical growth of the town, creating buildings and environment to meet the various needs such as social, cultural, economical, recreational etc. and to provide healthy living conditions for both rich and poor.

Q.3. What do you understand by country planning?

Ans. The country (land that is not in towns, and left in its natural condition) is allowed to develop in an orderly manner. There should not be haphazard methods of planning. The town should be linked with surrounding villages by suitable transport facilities. Scope should be given to village industries, maintaining a proper balance with the agriculture in the village development scheme.

# Question Paper Solution

Branch : CIVIL Engg. Semester: V Subject: Town Planning Mid Term: I/II/Extra/Imp.
Submitted By : Amit Kumar

Q.4 What are the factors that distinguishes one town from another?

Ans. The factors that distinguishes one town from another are -

(a) Location :- Hill stations, River banks, Sea-fronts suggest their respective location.

(b) Function :- Pilgrim towns, health resorts, education, fishing, industrial, commercial and political towns indicate their function.

(c) Shape :- The shape or the pattern of the town is fixed by the ~~population~~ type of road system which depends on the topographical features. A (d) town is known as linear, rectangular, radial, circular or radial and circular (Spider's Web) according to the road system.

(d) Size :- The size of the town is fixed by the population such as a community with more than five thousand but not more than 1,00,000 - population may be roughly called as a town, that with population of 1,00,000 to one million a city ; that with more than one million may be called as 'metropolitan City'.

**Question Paper** Solution

Branch : CIVIL Engg. Semester: IV Subject: Town Planning Mid Term: I/II/Extra/Imp.

Submitted By : Amit Kumar

Q.5 Write down the principles of planning enunciated by Sir Patrick Geddes.

Ans - The principles of planning enunciated by Sir Patrick Geddes are -

(a) The town planning primarily meant establishing - organic relationship among, 'Folk, Place and Work' which corresponds to triad of organism, function - and environment, Folk organism (social aspect), place (Physical aspect), work (economical aspect).

(b) He laid emphasis on 'Survey before plan', which means diagnosis before treatment to make correct diagnosis of ~~the~~ various ills from which town - suffers.

(c) The city is no longer a mere physical structure but it is now meant the people, their families and communities they formed, their places to live, to work and to play. Hence here human needs are most important than physical aspects.

Q.6 What are the principles of planning advocated by Le-Corbusier?

Ans. Le-Corbusier advocated the following - principles of planning -

# Question Paper Solution

Branch : CIVIL Engg. Semester: V Subject: Town Planning Mid Term: I/II/Extra/Imp.
Submitted By : Amit Kumar

(a) Core of the city should be decongested by removing the excess of population and should be inhabited at the outer countryside in satellite towns which are linked to the main city.

(b) Provision of speedy transportation.

(c) Provision of plenty of open spaces in the form of gardens, parks etc. round the tall buildings throughout the length and breadth of the city,

(d) Population control. The high density should be spread over the entire area of the town. He suggested a plan for paris city with buildings, 24 no. sky-scrapers, 215m high, 400m apart with about 1500-2000 ~~per~~ person in each. There high rise buildings to be linked underground with one another by central area such as shopping centre, civic services centre etc. Plenty of open area with parks, recreational centres to be provided all around these high rise buildings.

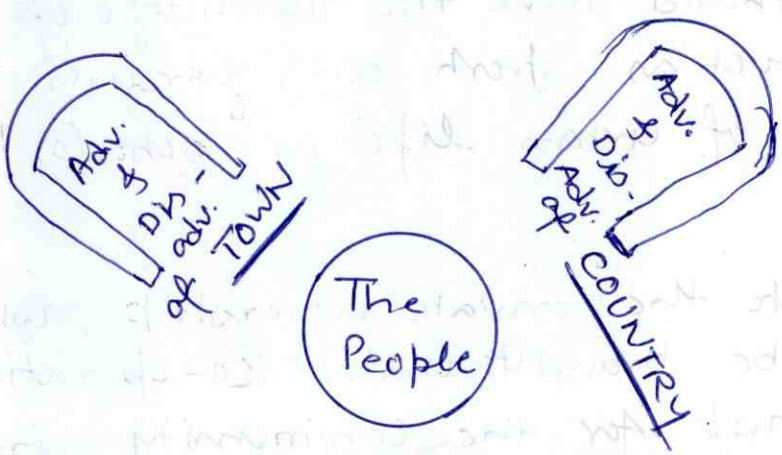
# Question Paper Solution

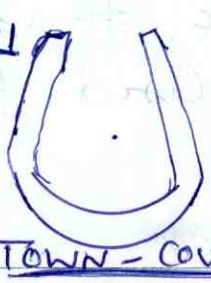
Branch : CIVIL Engg. Semester: V Subject: Town Planning Mid Term: I/II/Extra/Imp.

Submitted By : Amit Kumar

Q.7. What do you understand by Garden city concept? Who was the progenitor of this concept and what are the main features of this concept?

Ans. Sir Ebenzer Howard was the progenitor of the Garden city concept. He explained the idea of the 'Garden city' by an impressive diagram of 'The Three Magnets', namely the town magnet, the country magnet with their advantages and disadvantages and the third magnet with attractive features of both town and country life. People preferred the third magnet, namely Garden city. It was broadly adopted throughout the world.



# Question Paper Solution

Branch : CIVIL Engg. Semester: V Subject: Town Planning Mid Term: I/II/Extra/Imp.
Submitted By : Amrit Kumar

The main features of Garden city concept are-

(i) The dwellings for all the classes of people should be distributed about a large central court in which the public buildings would be located.

(ii) The shopping centre to be located on the edge of the town.

(iii) Various type of industries to be provided for employment for all the people. Industries should be located on the outskirts of the town.

(iv) The city should have maximum population of 30,000 – 35,000 people in one thousand acres.

(v) A permanent greent belt should surrand the city for 3000 - 5000 acres.

(vi) The city should have the advantage of both rural life such as fresh air, gardens, play-fields, and amenities of urban life as schools, Hospitals, theatres, etc.

(vii) To eliminate the private ownership, whole of the land to be braught under co-operative basis or held in trust for the community, in order to have control over the finance and the profit gained by thereby be utilised for upliftting the community itself.

# Question Paper Solution

Branch : CIVIL Engg. Semester: V Subject: Town Planning Mid Term: I/II/Extra/Imp.

Submitted By : Amit Kumar

Q.8 What do you understand by growth of the town according to origin? Elaborate the natural growth.

Ans. The growth of town according to origin can be of two types (a) Natural Growth (b) Planned Growth.

Natural growth is result of evolution of town rather than ~~chance~~ pre-planned development. Here the primary factors are availability of water, rich soil, immediate comfort and convenience of the people, rather than amenities like school, hospital, theatre etc.

In planned growth, the town develops on pre-determined line as prepared by the town planner. The development is in the orderly fashion. factors like selection of site for the town, various features to be embodied in the plan, topography, climatic condition should be considered before planning the development of Town.

Natural Growth can be further divided into following categories -

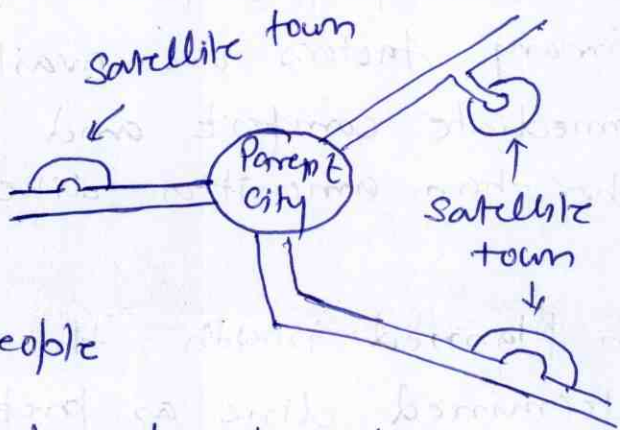
(i) Concentric Spread
(ii) Satellite Growth
(iii) Ribbon Development
(iv) Scattered growth

# Question Paper Solution

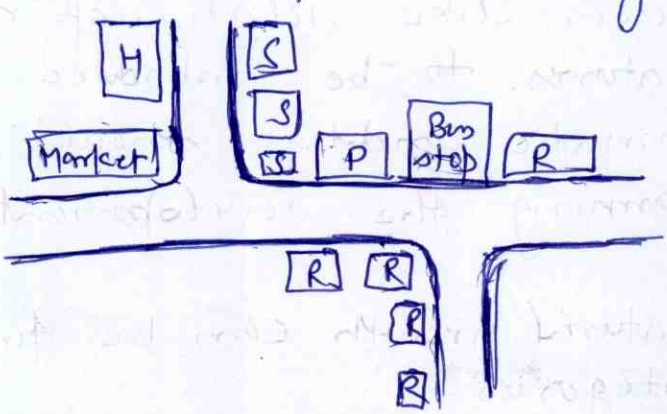
Branch : Civil Engg. Semester: V Subject: Town Planning Mid Term: I/II/Extra/Imp.
Submitted By : Amit Kumar

(a) **Concentric Spread**:- Here the town develops in the form of concentric rings, with centre as town, since the tendency of people is to keep the centre or heart of town as near as possible.

(b) **Satellite Growth**:-
The satellite growth implies dependency on the parent city but still have its own identity. When a town reaches a certain size, satellite devolution must take place, to break the suburban sprawl. Since its periphery falls away from the parent city, it becomes less convenient for the distant people




(c) **Ribbon Development**:- Here the development is in the form of a ribbon or line, like row of houses along the bus-stops, bus routes, railway lines etc. It happens specially in newly developing areas and is very dangerous from traffic point of view




(d) **Scattered Growth**:-
Here the town shows erratic growth, scattered here and there, in a very irregular way, without any order. It results into traffic congestion, slums etc.

# Question Paper Solution

Branch : civil Semester: III year/ V sem Subject: RRS Mid Term: I

Submitted By :Nikhil kumar Sharma

Q1. **Abrasion** is the process of scuffing, scratching, wearing down, marring, or rubbing away. It can be intentionally imposed in a controlled process using an abrasive. Abrasion can be an undesirable effect of exposure to normal use or exposure to the elements

Q2. **Carbonation** is the reaction of carbon dioxide in the environment with the calcium hydroxide in the cement paste. This reaction produces calcium carbonate and lowers the pH to around 9. At this value the protective oxide layer surrounding the reinforcing steel breaks down and corrosion becomes possible.

Q3. **Sorptivity** is a measure of the capacity of the medium to absorb or deabsorb liquid by capillarity.

Part B

Q4. **Chloride Attack On Concrete**

**Chloride source**

- CEMENT OF THE CONCRETE
- WATER MIXED IN CONCRETE
- AGGREGATES OF CONCRETE
- ADDMIXTURES ADDED TO THE CONCRETE
- DIFFUSION FROM ATMOSPHERE

Chloride ions originated from sea water or other sources may penetrate through the pore by diffusion or may have direct access through cracks to the interior of the concrete. Although cement has a natural ability to bind chloride ions, but not all the chloride ions can be bound. There always exist dissolution equilibrium between bound chlorides and free chloride ions in the pore water. Only the free chloride ions are relevant to the corrosion of the reinforcement.

**Mechanism of Chloride Ingress in Concrete**

Chlorides can enter into concrete by both absorption and diffusion processes.

(i) **Absorption:** A relatively dry concrete surface will promote chloride to enter into the concrete. Process of capillary absorption is responsible for chlorides in solution to enter into the concrete matrix.

**(ii) Diffusion:** Once the concrete becomes saturated due the capillary absorption, the process of diffusion will then kick in. Due to Fick's law of diffusion, chloride ion will diffuse through the concrete mass as there will be a concentration gradient of chloride ions from outer surface to the inner part of concrete, closer to the reinforcement bars.

**Forms of Chlorides**

There are following three forms of chloride can be existed in concrete mass:

**(i) Free Chlorides**

They are the most dangerous forms of chlorides in the concrete as upon entering into concrete free chloride will diffuse through the pore water to attack the reinforcement bar by breaking down its passive oxide layer.

**(ii) Physically Adsorbed Chlorides**

Weakly bonded Chloride ions can be existed in the concrete due to the chemical composition of cement hydrate and type of surface area of hydrate. These forms of physically adsorbed Chlorides have the potential to move toward the reinforcement bar to start corrosion.

**(iii) Chemically Adsorbed Chlorides**

There are strongly chemically bonded chloride ions with the Calcium Aluminium Hydrate to form Friedell's salts. These forms of chlorides are safer as they can not proceed to the reinforcement to induce corrosion.

**Chloride-Induced Corrosion**

**(i) Chloride threshold level:**

Chloride threshold level is a critical chloride content to start off corrosion. It is about 8000 ppm.

**(ii) Corrosion process:**

Chloride-induced corrosion is a very specific type of 'pitting' corrosion. Chloride-induced corrosion is characterized by galvanic action between relatively large areas of passive steel acting as cathodes and very small, local anodic pits connected by means of an electrolyte (pore fluid).

For initiation of corrosion, the passive oxide layer must be broken down and chloride ions must activate the steel surface to form an anode, with the passive surface being the cathode. The important factor here is that chloride ions are regenerated so that the corrosion products do not contain chlorides..

**(iii) Prevention of Chloride Induced Corrosion:**

Chloride-induced corrosion can be minimized by addressing the following requirements:

- Preventing Ingress of Chlorides
- Preventing Ingress of Moisture
- Preventing Ingress of Oxygen

**Q5.** **Alkali Aggregate Reaction**

Factor affecting the Alkali Aggregate Reaction are following:

(i) Reactive type of aggregate

(ii) High Alkali content in cement

(iii) Availability of moisture

(iv) Optimum temperature Condition

# Question Paper Solution

Branch : civil Semester: III year/ V sem Subject: RRS Mid Term: I

Submitted By :Nikhil kumar Sharma

Q6. **Corrosion** is defined as the destruction (or deterioration) of materials due to chemical (or electrochemical) reaction with the environment, & also the loss of steel due to formation of rust. The corrosion of steel is the depassivation of steel with reduction in concrete alkalinity through carbonation.

The reinforcement in concrete has a passivating layer of gamma Ferric Oxide ($Fe_2O_3$). Any cracks that occur in the protective film are quickly repaired in the presence of sufficiently high hydroxyl ion concentration, forming Ferrous Hydroxide first & then cubic Ferric Oxide ($Fe_3O_4$) and gamma oxide ($Fe_2O_3$)

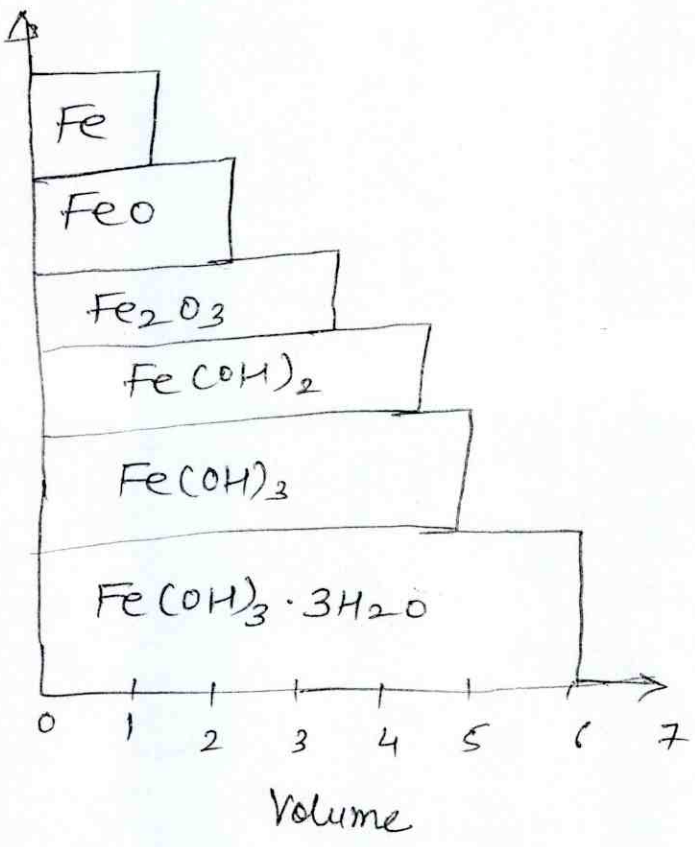



Fig :- Increment in Volume of concrete due to corrosion

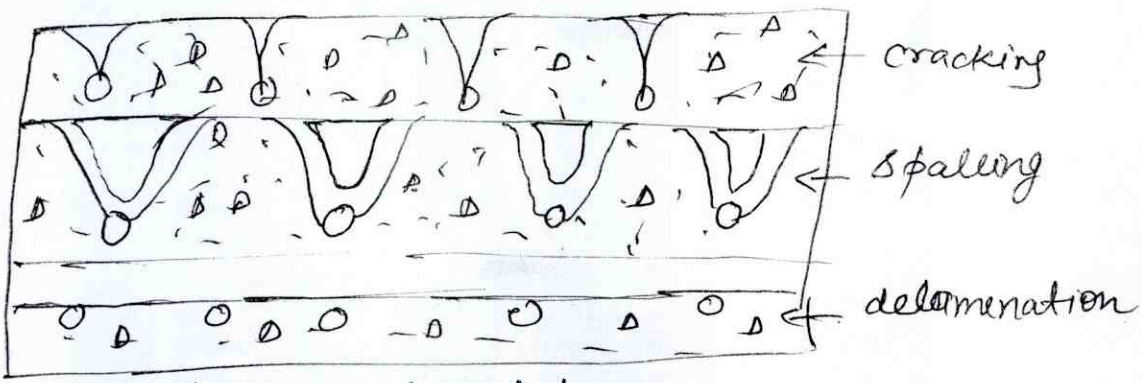



Fig :- damage of concrete

# Question Paper Solution

Branch : civil Semester: III year/ V sem Subject: RRS Mid Term: I

Submitted By :Nikhil kumar Sharma

**Q7.** Sulfate attack is a chemical breakdown mechanism where sulfate ions attack components of the cement paste.The compounds responsible for sulfate attack are water-soluble sulfate-containing salts, such as alkali-earth (calcium, magnesium) and alkali (sodium, potassium) sulfates that are capable of chemically reacting with components of concrete.

Sulfate attack might show itself in different forms Depending on :

- The chemical form of the sulfate
- The atmospheric environment which the concrete is exposed to
- It combines with the C-S-H, or concrete paste, and begins destroying the paste that holds the concrete together. As sulfate dries, new compounds are formed, often called **ettringite**.
- These new crystals occupy empty space, and as they continue to form, they cause the paste to crack, further damaging the concrete.
- Industrial waste waters.

**Sulphate Attack** processes decrease the durability of concrete by changing the chemical nature of the cement paste, and of the mechanical properties of the concrete.

- Extensive cracking
- Expansion
- Loss of bond between the cement paste and aggregate
- Alteration of paste composition, with mono sulphate phase converting to ettringite and, in later stages, gypsum formation. The necessary additional calcium is provided by the calcium hydroxide and calcium silicate hydrate in the cement paste

The effect of these changes is an overall loss of concrete strength

**Method of Controlling Sulphate Attack**

(I) Use of Sulphate Resisting Cement

(II) Good Quality Concrete

(III) Use of pozzolana material

(IV) Use of air-entrainment

(V) High pressure Steam Curing

(VI) Use of High Alumina Cement

# Question Paper Solution

Branch : civil Semester: III year/ V sem Subject: RRS Mid Term: I

Submitted By :Nikhil kumar Sharma

Q8.

Most cracks occur as a result of shrinkage of concrete. Shrinkage is simply a reduction in the volume of concrete as it hardens. If this reduction in volume were unrestricted, then a crack would not occur. However, in reality, ground friction and a number of things such as structural connections inhibit free shrinkage and thus cause cracks.

**TYPES OF CRACKS:**

**(a) SULFHATE ATTACK CRACK:**

Sulfate attack can be 'external' or 'internal'.

**External:** due to penetration of sulfates in solution into the concrete from outside.

**Internal:** due to a soluble source incorporated into concrete at the time of mixing.

External sulfate attack

This is the more common type and typically occurs where water containing dissolved sulfate penetrates the concrete. A fairly well-defined reaction front can often be seen in polished sections; ahead of the front the concrete is normal, or near normal. Behind the reaction front, the composition and microstructure of the concrete will have changed. The effect of these changes is an overall loss of concrete strength. These changes may vary in type or severity but commonly include:

- Extensive cracking
- Expansion
- Loss of bond between the cement paste and aggregate
- Alteration of paste composition

Sources of sulfate which can cause sulfate attack include:

- Seawater
- Oxidation of sulfide minerals in clay
- Bacterial action in sewers - anaerobic bacterial produce sulfur dioxide
- Masonry - sulfates in bricks can be gradually released over a long period

**Internal sulfate attack**

Internal sulfate attack occurs when a source of sulfate is incorporated into the concrete when mixed. Examples include the use of sulfate-rich aggregate, excess of added gypsum in the cement or contamination. Proper screening and testing procedures should generally avoid internal sulfate attack.

**(b) LOADING CRACK**

A loading crack is a result of the loading to which the structure is subjected. A properly designed structure would not exhibit these cracks, but an improperly designed structure is very susceptible to this damage. Vertical cracking at the end of a structure is typically due to a concentrated force being applied at the top of a structure which exceeds the shear capacity within the end section of the structure. This type crack typically maintains a tight appearance at the top and at the bottom but may show a wider gap at approximately mid-height of the structure. This would tend to indicate a bulging effect of the end segment of the structure away from the remainder of the structure.

**(c) PLASTIC SHRINKAGE CRACKS**

When water evaporates from the surface of freshly placed concrete faster than it is replaced by bleed water, the surface concrete shrinks. Due to the restraint provided by the concrete below the drying surface layer, tensile stresses develop in the weak, stiffening plastic concrete, resulting in shallow cracks of varying depth. These cracks are often fairly wide at the surface.

# Question Paper Solution

Branch : civil Semester: III year/ V sem Subject: RRS Mid Term: I

Submitted By :Nikhil kumar Sharma

### (d) DRYING SHRINKAGE CRACKS

Because almost all concrete is mixed with more water than is needed to hydrate the cement, much of the remaining water evaporates. causing the concrete to shrink. Restraint to shrinkage, provided by the sub grade, reinforcement, or another part of the structure, causes tensile stresses to develop in the hardened concrete. Restraint to drying shrinkage is the most common cause of concrete cracking. In many applications, drying shrinkage cracking is inevitable. Therefore, contraction (control) joints are placed in concrete to predetermine the location of drying shrinkage cracks.

### (e) D-CRACKING

D-cracking is a form of freeze-thaw deterioration that has been observed in some pavements after three or more years of service. Due to the natural accumulation of water in the base and sub base of pavements, the aggregate may eventually become saturated. Then with freezing and thawing cycles, cracking of the concrete starts in the saturated aggregate at the bottom of the slab and progresses upward until it reaches the wearing surface. D-cracking usually starts near pavement joints.

### (f) ALKALI AGGREGATE REACTION CRACK

Alkali-aggregate reactivity is a type of concrete deterioration that occurs when the active mineral constituents of some aggregates react with the alkali hydroxides in the concrete. Alkali-aggregate reactivity occurs in two forms alkali-silica reaction (ASR) and alkali-carbonate reaction (ACR). Indications of the presence of alkali-aggregate reactivity may be a network of cracks, closed or spalling joints, or displacement of different portions of a structure.

### (g) THERMAL CRACK

Temperature rise (especially significant in mass concrete) results from the heat of hydration of cementitious materials. As the interior concrete increases in temperature and expands, the surface concrete may be cooling and contracting. This causes tensile stresses that may result in thermal cracks at the surface if the temperature differential between the surface and center is too great. The width and depth of cracks depends upon the temperature differential, physical properties of the concrete, and the reinforcing steel.

### (h) SETTLEMENT CRACK

Loss of support beneath concrete structures, usually caused by settling or washout of soils and sub base materials, can cause a variety of problems in concrete structures, from cracking and performance problems to structural failure. Loss of support can also occur during construction due to inadequate formwork support or premature removal of forms.

### (i) CORROSION CRACK

Steel reinforcement, in the alkaline environment provided by concrete, is in a stable condition because a protective oxide layer forms on the steel surface, which stops corrosion. There are, however, two situations where this passivating environment at the reinforcement can be disrupted. The first is known as carbonation. This is when atmospheric carbon dioxide dissolves in water to form carbonic acid, which neutralises the concrete alkalinity. The carbonation proceeds through the concrete cover and eventually reaches the reinforcement, at which point the passive layer is no longer sustained and corrosion occurs. The second disruptive effect is chloride attack.

Chlorides may have been cast in the original mix, or may be introduced from an external source such as de-icing salts or a marine environment. When in sufficient concentration at the reinforcement, they will disrupt the passive film on the steel and also cause corrosion to occur rapidly. To support the corrosion activity there must be oxygen and water available and this is normally the case in atmospherically exposed concrete. Corrosion of reinforcing steel and other embedded metals is one of the leading causes of deterioration of concrete. When steel corrodes, the resulting rust occupies a greater volume than steel. The expansion creates tensile stresses in the concrete, which can eventually cause delamination and spalling.