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IAT 5

Sub:	Design Of RC Structural Elements							Code:	18CV53
Date:	7/ 02 / 2022	Duration:	90 mins	Max Marks:	50	Sem:	5	Branch:	CIVIL

Note:Answer any Five question (Assume any missing data)

		Marks	OBE	
			CO	RBT
1	What are the assumptions made in limit state of design of collapse in flexure in single reinforced beam section?	[10]	CO3	L2
2	An RCC beam 200mmX500 mm effective is subjected to a factored moment of 200kNm. Find the reinforcement required. Use M20 concrete and Fe415 steel	[10]	CO2	L2
3	Explain the difference between working stress method and Limit state method.	[10]	CO2	L2

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3	Explain the difference between working stress method and Limit state method.	[10]	CO2	L2

4	Derive the expression for Depth of Neutral axis (N.A=0.42 X_u) in the case Rectangular RCC beam design.	[10]	CO2	L2
5	An RCC beam is required to carry a uniform distributed load of 30kN/m inclusive of its self weight. The effective span of beam is 9m. Use M30 and Fe415 steel. Find amount area of steel required to resist the load.(Checks should be done for minimum depth & minimum reinforcement)	[10]	CO3	L3
6	Write difference between Short term deflection and long term deflection?	[10]	CO5	L3

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5.Difference between Short term deflection and Long term deflection
The factors influencing Short term deflection are

(a) magnitude and distribution of live loads,
(b) span and type of end supports,
(c) cross-sectional area of the members,
(d) amount of steel reinforcement and the stress developed in the reinforcement,
(e) characteristic strengths of concrete and steel, and
(f) amount and extent of cracking.

The long-term deflection is almost two to three times of the short-term deflection. The following are the major factors influencing the long-term deflection of the structures.

(a) humidity and temperature ranges during curing,
(b) age of concrete at the time of loading, and
(c) type and size of aggregates, water-cement ratio, amount of compression reinforcement, size of members etc., which influence the creep and shrinkage of concrete.

1) What are the assumptions made in limit state of design of collapse in flexure in single reinforced beam section?

(a) *Plane sections normal to the axis remain plane after bending.* It means that the strain at any point in the cross-section is proportional to the distance from the neutral axis.

(b) *The maximum strain in concrete at the outermost compression fibre is taken as 0.0035 in bending.*

(c) *The relationship between the stress-strain distribution in concrete is assumed to be parabolic.*

For design purpose, the compressive strength of concrete is assumed to be parabolic, as shown in Fig. 4.1. For design purpose, the compressive strength of concrete is assumed to be 0.67 times the characteristic strength of concrete. The partial safety factor (rmc)=1.5 shall be applied in addition to this

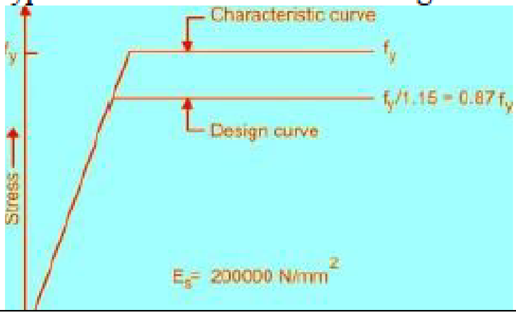
Maximum compressive stress in concrete =

$$0.67fck1.5$$

where fck= Characteristic strength of concrete.

(d) The tensile strength of the concrete is ignored.

(e) The stresses in the reinforcement are taken from the stress-strain curve for the type of steel used *as shown in Fig. 4.2.*



3.

$b = 230mm$

$M_u = 200 \, kNm = 200 \times 10^6 \, Nmm$

$f_y = 415 \, N/mm^2$

$\frac{d'}{d} = \frac{50}{500} = 0.1$

$f_{sc} = 353 \, N/mm^2$

miting moment of Resistance

$M_{u\,lim} = 0.36 \, f_{ck} \, b \cdot x_{u\,max} \, (d - 0.42 x_u)$

$x_u = 0.48d$

$M_{u\,lim} = 158658048 \, Nmm$

$M_{u_2} = M_u - M_{u\,lim}$

$= 200 \times 10^6 - 158658048$

Area of tension steel.

$A_{st} = A_{st_1} + A_{st_2}$

$A_{st_1} = \frac{M_{u\,lim}}{0.87 f_y \, (d - 0.42 x_{um})}$

$= 1100.7 mm^2$

$A_{st_2} = \frac{M_{u_2}}{0.87 f_y (d - d')} = 254.2 mm^2$

$\therefore$ Area of steel $= A_{st_1} + A_{st_2} = 1354.9 mm^2$

Provide 5-20mm dia tension steel.

S.N	Working Stress Method	Limit State Method
1	It is easy for calculation.	It require more calculation so it make some difficult to design.
2	Materials strengths are not fully utilized in designing the member of structure.	Materials strengths are fully utilized in designing the member of structure.
3	It does not gives idea about the excess load which a structure can carry beyond the working load without collapse.	It gives idea about the excess load which a structure can carry beyond the working load without collapse.
4	In this method, Concrete and steel are considered elastic and the strain curve is linear for both.	This method is based on the actual stress strain curves for steel and concrete. For concrete the stress strain curve is nonlinear.
5	No factor of safety is used for loads.	Design load are obtained by multiplying partial safety factors of load to the working loads.
6	This method gives uneconomical design of structure.	This method gives economical design of structure.
7	In this method actual load, permissible stresses are according to serviceability approach.	In this method actual load, permissible stresses are according to probabilistic approach.

5.

5)

$w = 25$ kN/m

$f_{ck} = 30$ N/mm²

$f_y = 415$ N/mm²

<u>Load</u>

$w_u = w \times 1.5$

$= 37.5$ kN

$M_u = \frac{w_u l^2}{8} = \frac{37.5 \times 5^2}{8} = 200$ kNm

<u>Limiting moment of resistance factor</u>

$\frac{x_{umax}}{d} = 0.48$

$R_u = 0.36 f_{ck} \frac{x_{umax}}{d} \left(1 - \frac{0.42 x_{um}}{d}\right)$

$R_u = 4.13$

minimum eff required. $b = 250$ mm

$d_{req} = \sqrt{\frac{M_u}{R_u b}} = 580$ mm

<u>Area of steel</u>

$A_{st} = \frac{M_u}{0.87 f_y (d - 0.42 x_u)} = 1927$ mm²

$A_b = \frac{0.85\, b \cdot d}{f_y} = \frac{0.85 \times 250 \times 540}{415}$

$A_s = 276.5$ mm²

∴ No of bars $= 4$ provide 4-25mm ϕ bar.

6a

One Way Slab	Two Way Slab
One way slab is supported by beams in only 2 sides.	Two way slab is supported by beams in all four sides.
The ratio of longer span panel (L) to shorter span panel (B) is equal or greater than 2. Thus, L/B >= 2	The ratio of longer span panel (L) to shorter span panel (B) is less than 2. Thus, L/B < 2.
Main reinforcement is provided in only one direction for one way slabs.	Main reinforcement is provided in both the direction for two way slabs.