Date: 16/1/18 2nd Test (3rd year) 01

Max^M Marks = 15

Q1 Find the moment of Resistance of T-beam having a web width of 240mm, effective depth of 400mm, flange width of 740mm and flange thickness equal to 100mm. The beam is reinforced with 5-16mm dia Fe-415 bars. Use M-20 Ans M.R = (134.94 kN-m)

Q2 (a) Write a short Note on deflection & development length of check in R.C.C structures?

(b)

Q3 An R.C.C. short column of size 400mm x 500mm is carrying a factored load of 3000kN. Design the column assuming $e_{min} < .05D$. Use M-20 & Fe-415

$A_{sc} = 3730.6$

Ans 1 Given data :-

Use
Fe-415
M-20

$A_{st} = 5 \times \frac{\pi}{4} \times 16^2$
$= 1005.3 mm^2$

In this Question (740 mm) ↓ effective width of flange.

Assume Case-(1) when $x_u < D_f$

$$x_u = \frac{.87 f_y A_{st}}{.36 f_{ck} b_f} = \frac{.87 \times 415 \times 1005.3}{.36 \times 20 \times 740}$$

$x_u = 68.1 mm < D_f$ Hence our Assumption is right

$x_{u\,lim} = .48 \times d$
$= .48 \times 400 = 192 mm.$

Because $x_{u\,lim} > x_{u\,actual}$ Hence it is under reinforced section.

Moment of resistance $M_u = .87 f_y A_{st} \times d \left(1 - .42 \frac{x_{u\,actual}}{d}\right)$

$= .87 \times 415 \times 1005.3 \times 400 \times \left[1 - \frac{1005.3 \times 415}{740 \times 400 \times 20}\right]$

$= 134953789.7 \; N-mm$

$M_u = 134.95 \; kN-m$

Ans-2 (i) Deflection check in R.C.C structure ⇒

To satisfied Deflection Limit state Beam condition the ratio of effective length to effective depth ratio should Not more than the following.

(1)

for span upto 10m length.

(1) Simply supported Beam

$$\frac{\text{Span}}{\text{Effective depth}} \not> 20$$

(2) cantilever beam $\not> 7$

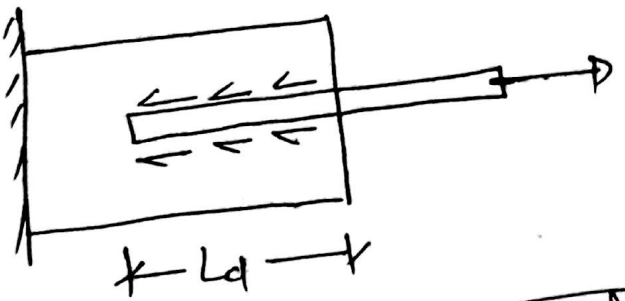
(3) Continouse Beam $\not> 26$.

for span above 10m length

above value should be multiplied by $\frac{10}{\text{span (m)}}$

except for cantilever is to be caculated the exact deflection.

(ii) Devlepment length ⇒



$$L_d \geq \frac{.87 f_y \phi}{4 \tau_{bd}}$$

L_d = @m bedded length of steel bar

f_y = yield stress length

τ_{bd} = Bond stress bet^n steel & Concrete.

ϕ = dia. of Bar.

Note:

(1) For deformed steel bar τ_{bd} is increased than that plain steel.

(2) For compression steel it (τ_{bd}) should be increase by 25%.

Ans-3 Given data

$b = 400\ mm$ $\quad f_{ck} = 25\ N/mm^2$

$D = 500\ mm$ $\quad f_y = 415\ N/mm^2$

$P_u = 3000\ kN$

$e_{min} < 0.05D$

Area of steel (A_{st})

$$P_u = .4 f_{ck} A_c + .67 f_y A_{sc}$$

$$A_c = A_g - A_{sc} = 400 \times 500 - A_{sc}$$

$$3000 \times 10^3 = 0.4 \times 25 (200000 - A_{sc}) + .67 \times 415 \times A_{sc}$$

$$268.05\ A_{sc} = 1000 \times 10^3$$

$$A_{sc} = 3730.6\ mm^2$$

Use - 25 mm ϕ bar $\quad A_\phi = \frac{\pi}{4} \times 25^2 = 490\ mm^2$

no. of bar required $= \frac{3730.6}{490} = 7.6 \approx 8$ nos.

Lateral ties

the dia. of ties should not less than

(i) $\frac{1}{4} \times 25 = 6.25$ mm

(ii) 6mm

Use 8mm dia. tie

The pitch of ties should not be less than following

(i) least lateral dimension = 400mm

(ii) $16 \times 25 = 400$ mm

(iii) 300mm