R.C.C Design.

TIME – One Hours. IInd mid term. Max. Marks → 15

CE 303

Q. No-1 Design a Beam of 5.7 mtr. span is subjected to a load of 25 $\frac{kN}{m}$ including the self weight use M-20 & fy-415

Ans. Step-1 calculate the B.M & factor B.M.

$$M_u = \frac{WL^2}{8} = \frac{25 * 5.70^2}{8} = 101.53 \text{ kN-M.}$$

$$F.B.M = 101.53 * 1.50 = 152.295 \text{ kN-m.}$$

Step-2 Calculate the width & depth for Balanced section

For fy-415 $M_{lim} = 0.138 f_{ck} bd^2$

$$M_{um} = 0.138 * 20 * \frac{d}{2} * d^2$$

$$d = 479.66 \text{ mm.}$$

Adopt $d = 500$ mm

$D = 550$ mm

$b = 250$ mm.

Step-3 calculate the Area of reinforcement

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

$$152.295 * 10^6 = 0.87 * 415 * A_{st} \left(500 - \frac{415 * A_{st}}{20 * 250}\right)$$

$$152.295 * 10^6 = 361.05 A_{st} (500 - 0.083 A_{st})$$

$$0.83 A_{st}^2 - 500 A_{st} + 421811.38 = 0$$

$$A_{st} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$A_{st} = \frac{-(-500) \pm \sqrt{500^2 - 4 * .083 * 421811.38}}{2 * .083}$$

$$A_{st} = 1014.45, \quad 5009.63 \text{ mm}^2$$

Step-4 Check for minimum $A_o = \frac{0.85 bd}{f_y} = \frac{0.85 * 250 * 500}{415} = 256.02$ mm

OK

Step-5 Check for maximum. $A_{max} = 0.04 bD$

$A_{max} = .04 * 250 * 550 = 5500 \text{ mm}^2$

OK

Step-6 provided $4-16\phi + 2-12\phi = 1026 \text{ mm}^2 > 1014 \text{ mm}^2$

Rajkumar 9/01/18

Q.No.2 Design a R.C.C Beam of 250 * 400 mm effective depth has a clear span 4.2 mtr. and carry a factor load 50 kN/m the calculate the reinforcement required for Beam

Step.1 Calculate B.M & factor B.M.

$$F.B.M = \frac{wl^2}{8} = \frac{50 * 4.20^2}{8} = 110.25 \text{ kN-m.}$$

Step.2 Types of Beam.

For Balanced section.

Fy - 415 $M_u = M_{lim} = .138 f_{ck} b d^2$

$$M_{lim} = .138 * 25 * 250 * 400^2$$

$M_{lim} = 138$ kNm. $> M_u$

This Beam design as a single Reinforced Beam

Step.3 Calculate Area of Reinforcement

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

$$110.25 * 10^6 = 0.85 * 415 A_{st} \left(400 - \frac{415 * A_{st}}{25 * 250}\right)$$

$$110.25 * 10^6 = 361.05 A_{st} (400 - .066 A_{st})$$

$$.066 A_{st}^2 - 400 A_{st} + 305359.36 = 0$$

$$A_{st} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$A_{st} = \frac{-(-400) \pm \sqrt{400^2 - 4 * .066 * 305359.36}}{2 * .066}$$

$A_{st} = 895.80 \text{ mm}^2$ , $5164.79 \text{ mm}^2$

Step.4 check for minimum. $A_{min} = \frac{0.85 b d}{f_y} = \frac{.85 * 250 * 400}{415} = 204.8$ mm

Step.5 check for maximum Area of Reinforcement.

$$A_{max} = .04 bD = .04 * 250 * 450 = 4500 \text{ mm}^2$$

Step.6 provided 5 Nos 16 $\phi$ = 1000 $\text{mm}^2$ > 895 $\text{mm}^2$

OK

IVth R.C.Dev 19/01/18