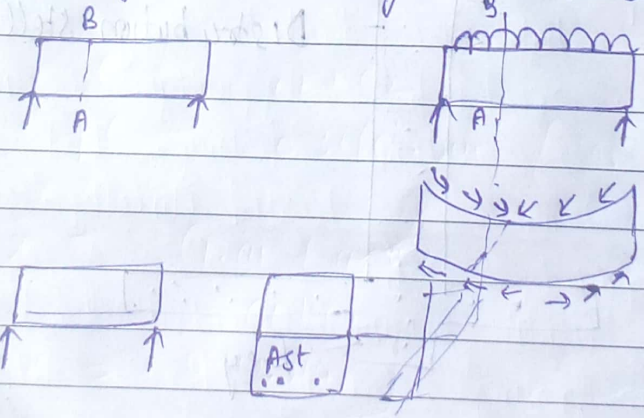
Distribution Bar	Main Bar
① Distribution bars placed on top of the main bars.	Main Reinforcement is placed on the shorter direction.
② Distribution bars placed in longer span direction	It placed in shorter dir
③ We know that is main reinforcement bar and distribution reinforcement bar.	Main Reinforcement b are used to transfer the bending moment. at the bottom of the

Ques 7(i) Limit state method of collapse :- Flexure -

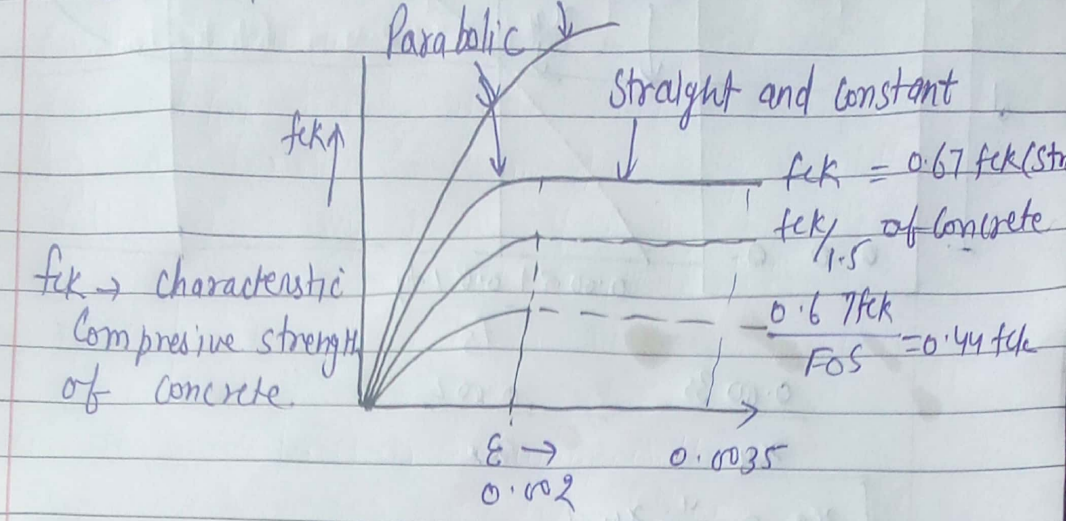
Assumptions — ① The plane Section remain plane before and after the bending



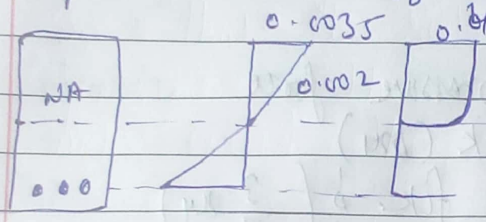
① That means strain variation is linear Is 456 : 2000.

② The maximum Compressive strain in the

Concrete shall be taken as 0.0035 under flexural condition.



(iii) The stress block is parabolic from Neutral axis to the strain 0.002 and Rectangular upto the strain of 0.0035.

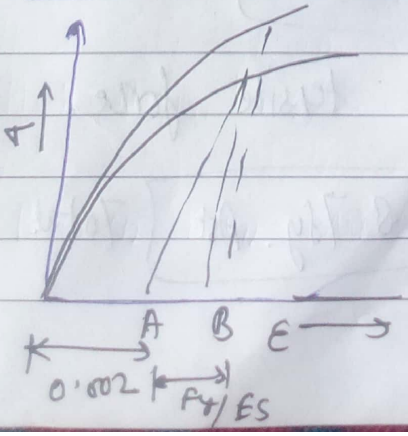


(iv) The tensile strength of Concrete shall be ignored

(v) FoS Concrete — 1.5 $(FoS)_c > (FoS)_{steel}$
Steal — 1.15

(vi) The maximum strain in the tensile steel shall not be less than $0.002 + \frac{f_y}{1.15 E_s}$

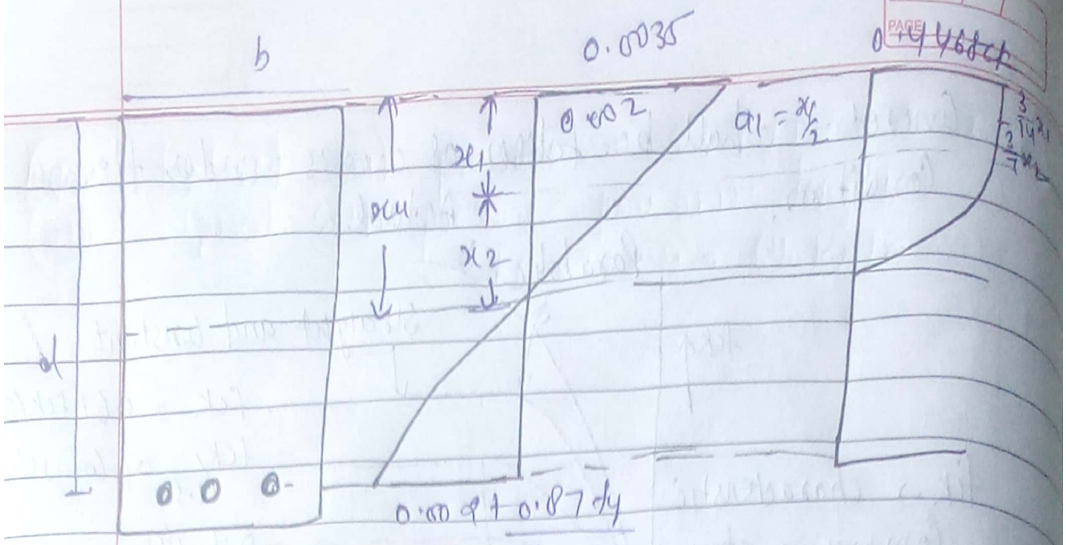
$$E_{steel} = 0.002 + \frac{0.87 f_y}{E_s}$$



OA = 0.002

$OB = \frac{0.87 f_y}{E_s}$

$E_{steel} = OA + AB$



$$\frac{0.0035}{x_u} = \frac{0.002}{x_2}$$

$$\boxed{x_2 = \frac{4}{7} x_u}$$

$$\therefore x_1 + x_2 = x_u$$

$$\boxed{x_1 = 3/7 x_u}$$

Analysis of Compressive force

$$C_1 = 0.446 f_{ck} (b x_u)$$

$$C_1 = 0.446 f_{ck} b \left(\frac{3}{7} x_u\right)$$

$$C_2 = 0.446 f_{ck} \times \frac{2}{3} \times b \times \frac{4}{7} x_u$$

$$C = C_1 + C_2$$

$$\boxed{C = 0.36 f_{ck} x_u}$$ Total Compression.

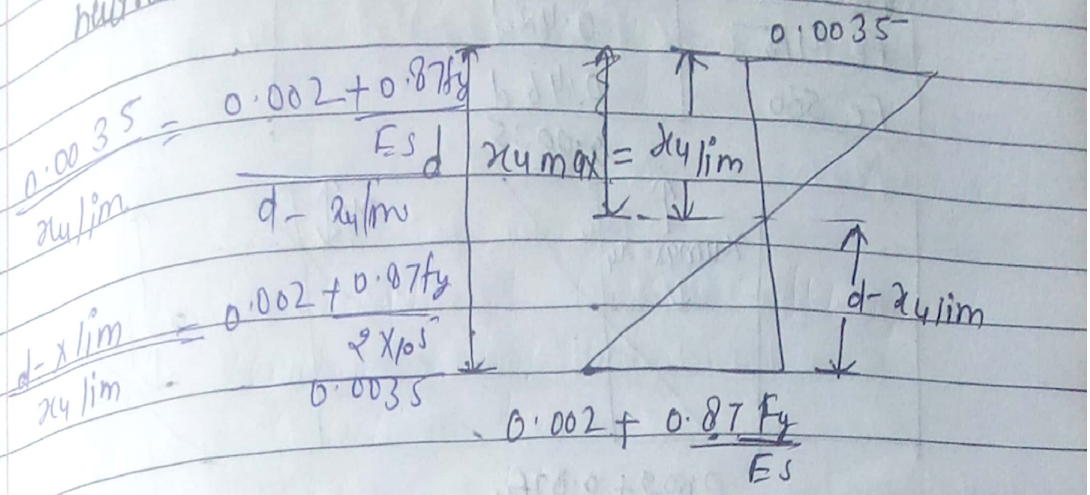
$$\bar{x} = \frac{C_1 a_1 + a_2 C_2}{C_1 + C_2}$$

$$\boxed{\bar{x} = 0.42 x_u}$$

Analysis of tensile force.

$$\boxed{T = 0.87 f_y A_{st}}$$ Total tensile force

Limiting depth of neutral axis or max depth of neutral axis



$$\frac{0.0035}{x_u lim} = \frac{0.002 + \frac{0.87 f_y}{E_s}}{d - x_u lim}$$

$$\frac{d - x_u lim}{x_u lim} = \frac{0.002 + \frac{0.87 f_y}{2 \times 10^5}}{0.0035}$$

$E_s = 2 \times 10^5 N/mm^2$

$$\frac{d - x_u lim}{x_u lim} = \frac{0.002 + \frac{0.87 f_y}{2 \times 10^5}}{0.0035}$$

$$\frac{d}{x_u lim} - 1 = \frac{0.002 + \frac{0.87 f_y}{2 \times 10^5}}{0.0035}$$

$$\frac{d}{x_u lim} = \frac{0.002 + \frac{0.87 f_y}{2 \times 10^5}}{0.0035} + 1$$

$$x_u lim = \left(\frac{0.0035}{0.002 + \frac{0.87 f_y}{2 \times 10^5}} + 1 \right) \times d$$

$$x_u lim = \frac{700}{1100 + 0.87 f_y} \cdot d$$

$x_u lim = k \cdot d$

Where k = Neutral Axis Constant

$$\boxed{k = \frac{700}{1100 + 0.87 f_y}}$$