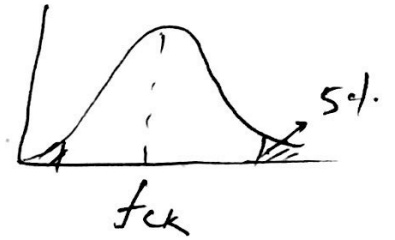


SOLUTION (DCS-E)

Name of Instructor : RASHID MUSTAFA

Q-1. (46.7%)

$$\begin{aligned} f_{avg} &= f_{ck} + 1.65\sigma \\ &= 25 + 1.65 \times 4 \\ &= 31.6 \text{ MPa} \end{aligned}$$



$$W/c \Big|_{\text{at } f_{avg} = 31.6 \text{ MPa}} = 50 - \left(\frac{50 - 45}{35 - 25} \right) \times (31.6 - 25)$$

$$W/c = 46.7 \%$$

Q-2. (12500 MPa)

$$E_{cL} = \frac{E_c}{1 + \theta}$$

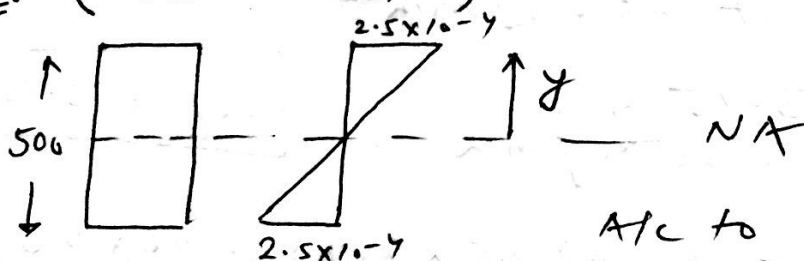
$$\theta = \text{Creep Coefficient} = \frac{\text{Creep strain}}{\text{Elastic strain}}$$

$$= \frac{(1000 - 500) \times 10^{-6}}{500 \times 10^{-6}} = 1$$

$$E_{cL} = \frac{5000 \sqrt{f_{ck}}}{1 + \theta} = \frac{5000 \sqrt{25}}{1 + 1}$$

$$= \boxed{12500 \text{ MPa}}$$

Q-3. ($1 \times 10^{-6} \text{ mm}^{-1}$)



Acc to Bending Eqⁿ

$$\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$$

$$\frac{1}{R} = \frac{\sigma}{E \cdot y} = \frac{\text{Strain}}{y}$$

$$\frac{1}{R} = \frac{2.5 \times 10^{-4}}{250} = \boxed{1 \times 10^{-6} \text{ mm}^{-1}}$$

Q-4 (Zero)

$$\mu = \frac{23 \times 4 + 28 \times 2 + 22.5 \times 5 + 31 \times 5 + 29 \times 4}{20}$$

$$\mu = 26.575 \text{ MPa}$$

$$\sigma = \sqrt{\frac{4(23-26.575)^2 + 2(28-26.575)^2 + 5(22.5-26.575)^2 + 5(31-26.575)^2 + 4(29-26.575)^2}{29}}$$

$$\sigma = 3.697 \text{ MPa}$$

$$\mu - 3\sigma = 26.575 - 3 \times (3.697) = 15.485 \text{ MPa}$$

Q-5 (0.17%)

$$A_{stmin} = \frac{0.85 b d}{f_y} = \frac{0.85 \times b d}{500} = 1.7 \times 10^{-3} b d$$

$$\% = \frac{1.7 \times 10^{-3} b d}{b d} \times 100 = \boxed{0.17\%}$$

Q-6 (3.15 m)

$$\text{Clear span } (L_c) = 3.3 - \left(\frac{W}{2} + \frac{W}{2}\right)$$

$$= 3.3 - 0.23$$

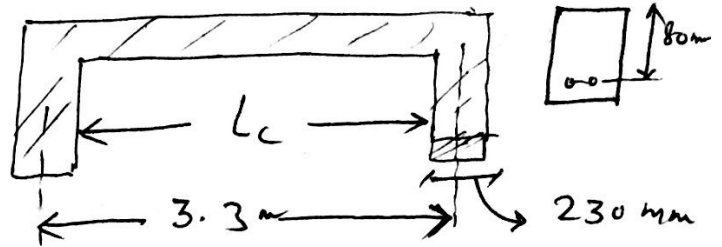
$$L_c = 3.07 \text{ m}$$

$$L_{eff} = \left. \begin{array}{l} L_c + d \\ L_c + W \end{array} \right\} \text{Min}^m$$

$$L_{eff} = \left. \begin{array}{l} 3.07 + 0.08 \\ 3.07 + 0.23 \end{array} \right\} \text{min}^m$$

$$= \left. \begin{array}{l} 3.15 \text{ m} \\ 3.30 \text{ m} \end{array} \right\} \text{min}$$

$$\boxed{L_{eff} = 3.15 \text{ m}}$$



Q-7 (05)

$$A_{stLim} = \frac{0.36 \times 25 \times 300 \times (0.46 \times 400)}{0.87 \times 500}$$

$$A_{stLim} = 1142.07 \text{ mm}^2$$

$$\text{No of bar} = \frac{1142.07}{\frac{\pi}{4} \times 25^2} = 5.68 \approx 05 \text{ (Provide)}$$

• Provide 5 bar (Underreinforced) ($X_u < X_{uLim}$)

Solution of class Test-I (DCS-I) ②

$$\text{No of bar} = \frac{1142.07}{\frac{\pi}{4} \times 16^2} = 5.68 \approx 6 \text{ (To make section Under surface)}$$

Q-8 (25) 25 MPa

Q-9 (204.82, 4000)

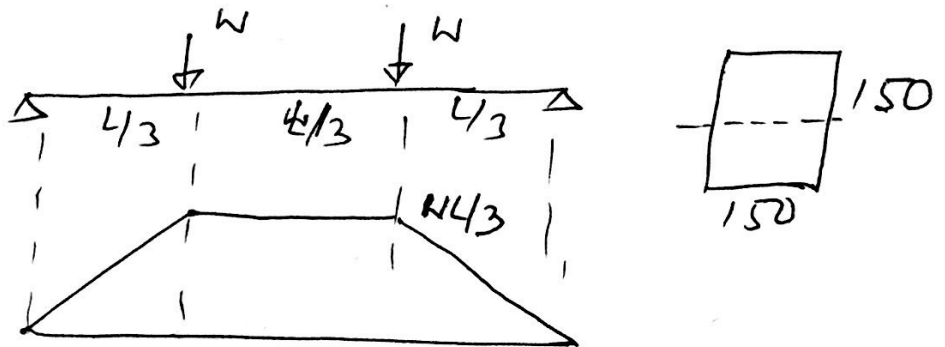
$$A_{st \min} = \frac{0.85 b d}{f_y} = \frac{0.85 \times 250 \times 400}{415}$$

$$= 204.82 \text{ mm}^2$$

$$A_{st \max} = 0.04 b D$$

$$= 0.04 \times 250 \times 400 = 4000 \text{ mm}^2$$

Q-10 (.3)



$$\text{MOR} = \sigma = \frac{M y}{I} = \frac{11.25 \times 10^3 \times 0.45}{3} \times \frac{0.075 \times 1}{0.15 \times 0.15^3}$$

$$= 3 \times 10^6 \frac{\text{N}}{\text{m}^2} = \boxed{3 \text{ MPa}}$$

Q-11 (12.5)

$$\frac{L}{d} = 20 \times \frac{10}{16} = 12.5$$

Q-12 (75) 1.5(DL + LL) = 1.5(50) = 75 kNm

$$1.5(20 + 10) = 45 \text{ kNm}$$

$$1.2(60) = 72 \text{ kNm}$$

$$\underline{Q-13} (2.76) \quad M_{ulim} = K b d^2$$

$$K = 0.138 f_{ck}$$
$$= 0.138 \times 20 = 2.76$$

$$\underline{Q-14} (4.39) \quad m = \frac{E_s}{E_c} = \frac{2 \times 10^5}{5000 \sqrt{20}} = 8.94$$

$$m = \frac{280}{3066} = \frac{280}{3 \times 7} = 13.33$$

$$\text{Diff} = 13.33 - 8.94 = 4.39$$

$$\underline{Q-15} (1500 \text{ mm}) \quad B_f = \frac{L_0}{6} + b_w + 6D_f$$
$$= \frac{3600}{6} + 300 + 6 \times 100$$
$$= 600 + 300 + 600$$
$$= 1500 \text{ mm}$$

END OF THE
PAPER