OCTOBER 2019 / INSEM (T1) [P119-112 CT1]

FYMTECH. (CIVIL - STRUCTURES) - Sem-I

Course - Critical Review of Design of Concrete Structu

Course Code : CVPB11182

Pattern 2018 (R1) Max Marks - 20

Q.1. (a) Stress-strain curve for concrete - (02)
HYSD steel - (02) } = (04)

(b) Each durability aspect = 01 × 6 = (06)

Q.2. (a) Each parameter = 01 × 4 = (04)

(b) Each failure mode = (02) × 3 = (06)

Q.3. (a)

(1) $A_{st} = 603\ mm^2$

$\sigma_{cbc} = 7\ N/mm^2$

$\sigma_{st} = 230\ N/mm^2$

$m = 280/3\sigma_{cbc}$

$= 13.33.$ ---------- (01)

(2) Critical neutral axis (n_c)

$\frac{m\sigma_{cbc}}{\sigma_{st}} = \frac{n_c}{d-n_c}$

$n_c = 144.13\ mm$ ---------- (01)

(3) Actual neutral axis (n)

$\frac{bn^2}{2} = m A_{st} (d-n)$

$n = 139.1\ mm$ ---------- (01)

(4) As $n_c > n$, The section is under reinforced. ---------- (01)

(5) Moment of resistance

$M_r = \sigma_{st} \cdot A_{st} \cdot (d - \frac{n}{3})$

$= 62.91\ kNm$ ---------- (01)

(6) $BM = \frac{wl^2}{8} = 62.91$

$w = 31.455\ kN$

$w = w_d + w_i$

$31.455 = 0.3 \times 0.5 \times 25 + w_i$

$\therefore w_i = 27.705\ kN$ ---------- (01)

= 06

Q.3. (b) (1) Actual NA (n)

$A_{st} = 4 \times 491 = 1964\ mm^2$

$\frac{bn^2}{2} = m \cdot A_{st} (d-n)$

PTO-

$n = 222.32$ mm. — — — — — — (01)

(2) Moment of resistance

$M_r = \sigma_{st} A_{st} \left(d - \frac{n}{3}\right) = \sigma_{st} \times 1964 \left(600 - \frac{222.32}{3}\right)$

$= 1031931.804\, \sigma_{st}$ N mm. — — — — — — (01)

(3) Stress in steel (σ_{st})

$M = M_r$

$150 \times 10^6 = 1031931.804\, (\sigma_{st})$

$\therefore \sigma_{st} = 145.36$ N/mm^2 — — — — — — (01)

(4) Stress in concrete (σ_c)

$\frac{\sigma_c}{n} = \frac{\sigma_{st}/m}{d-n}$

$\sigma_c = \frac{145.36 \times 222.32}{13.33\ (600 - 222.32)}$

$\therefore \sigma_c = 6.42$ N/mm^2 — — — — — — (01)

= (04)

Q. 4. (1) $b = 350$ mm

$d = 700 - 50 = 650$ mm

$\sigma_{cbc} = 7$ N/mm^2

$\sigma_{st} = 140$ N/mm^2

$m = \frac{280}{3 * 7} = 13.33$ — — — — — — — — — — 02

(2) Design constants.

$K = \frac{m \sigma_{cbc}}{m\sigma_{cbc} + \sigma_{st}} = 0.29$, $j = 1 - \frac{k}{3} = 0.90$

$R = \frac{1}{2} \sigma_{cbc} kj = 0.91$

$n = kd = 188.5$ mm — — — — — — — — — — 02

(3) MR of balanced section $= M_1$

$M_1 = Rbd^2 = 134.566$ kNm.

As $M > M_1$, design section as doubly reinforced

$M_2 = M - M_1 = 50.433$ kNm — — — — — — — — — — 02

(4) Ast - tension steel

$A_{st1} = \frac{M_1}{\sigma_{st}\, jd} = 1000.12$ mm^2

$A_{st2} = \frac{M_2}{\sigma_{st}\,(d-d')} = 365.5$ mm^2

$A_{st} = A_{st1} + A_{st2} = 1365.62$ mm^2 — — — — — — 02

(5) Compression steel (A_{sc})

$A_{sc} = \frac{m A_{st2} (d-n)}{(1.5m - 1)(n - d')}$

$= 197.3$ mm^2 — — — — — — — — 02

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