

CVL243: REINFORCED CONCRETE DESIGN
MINOR TEST I

Maximum marks = 20
All questions compulsory

Time allowed = 1 hr
IS 456:2000 not allowed

Details: Width $b = 250\text{mm}$ effective depth $d = 400\text{mm}$ Gross depth = 430mm
Materials: Fe 415 steel and M60 concrete Cover to compression steel $d' = 30\text{mm}$
Permissible stresses: $\sigma_{st} = 230\text{ MPa}$ and $\sigma_{cbc} = 20\text{ MPa}$

1. Relevant Design Code recommends that, for Limit State Design of reinforced concrete beams, the design strength (f_d) of concrete shall be determined from the following expression: $f_d = 0.67f_{ck}/\gamma_m$ Here, f_{ck} = Characteristic strength of concrete and partial material safety factor for concrete ($\gamma_m = 1.5$). Justify this Codal recommendation.

4 marks

2. Using Working Stress Design Method as recommended by the Design Code, (a) Determine the neutral axis depth (x_b), maximum allowable moment (M_{bal}) and area of tension steel (A_{st})_{bal} required for the BALANCED rectangular singly-reinforced section with above details.

(b) Design the above beam section to safely resist the applied Design Moment (M) equal to ($1.5 M_{bal}$).

4 + 4 = 8 marks

3. Using Limit State Design Method as recommended by the Design Code, (a) Determine the maximum neutral axis depth ($x_{u,max}$), limiting value of moment of resistance ($M_{u,lim}$) and area of tension steel (A_{st})_{bal} required for the BALANCED rectangular singly-reinforced concrete section with above details.

(b) Design the above beam section to safely resist the applied Design Moment (M_u) equal to ($0.5 M_{u,lim}$).

4 + 4 = 8 marks