1T00617 - B.E.(CIVIL)(SEM VII) (CBSGS) Limit State Method for Reinforced Concrete Structures

[3hrs] **[80 marks]**

N. B. (1) Question No. **1** is **compulsory**.
(2) Solve any **three** questions from remaining questions.
(3) Assume suitable data wherever required and state them clearly.
(4) Use of IS 456 not permitted.

1. Attempt any FOUR

(a) Compare Ultimate load method and Limit state method. Draw neat stress block diagram for both methods. **5**

(b) Why factor of safety is applied to material strength and loads? Draw idealized stress- strain curve for steel and concrete showing the variation after application of factor of safety. **5**

(c) Explain the conditions to be satisfied by a beam to design it as a T beam. State the advantages of T beams over the rectangular beams. **5**

(d) State the L/D ratios for simply supported, continuous and cantilever case. Why depth of the slab is governed by deflection criteria than the bending moments? **5**

(e) What do you understand by P_u - M_u interaction diagram? Explain the procedure to design bi-axial column using interaction diagram. **5**

2 (a) Explain the conditions when the beam shall be designed as a doubly reinforced beam. Draw stress block for doubly reinforced section and derive the formula to find moment of resistance from compressive forces. **4**

(b) Find MR for a beam 230 x 450 effective, reinforced with 3 bars of 25 mm dia. Also, find a safe load the beam can carry over a span of 5 m. Use M 20 and Fe 415. **6**

(c) Design shear reinforcement using combination of vertical stirrups and bent-up bars, (bent is at 45 degree) for a beam 230 x 500 effective carrying a factored load of 40 kN/m over a span of 8 m. It is reinforced with 5 bars of 20 mm dia. Use M 20 and Fe 415. **10**

p_t	≤0.15	0.25	0.50	0.75	1.0	1.25	1.50	1.75	2.00
τ_c	0.28	0.36	0.48	0.56	0.62	0.67	0.72	0.75	0.79

3 (a) Design reinforcement for a RC beam 230 mm wide to carry a load of 50 kN/m over a simply supported span of 6 m if the effective depth is restricted to 500 mm. Use M 20 and Fe 415. **10**

d' / d	0.05	0.10	0.15	0.20
f_{sc} (N/mm^2)	355.1	351.9	342.4	329.2

(b) A T beam with effective flange width 1200 mm and slab thickness 120 mm is reinforced with 5 bars of 25 mm dia. The width of the beam is 280 mm and effective depth is 550 mm. Calculate MR for the beam if M 20 and Fe 415 is used. **10**

4. (a) Design simply supported slab for a room 4.5 x 4.8 m of a residential building using M 20 and Fe 415. The slab is supported on all sides by a wall of 230 mm thickness. Check the slab for shear using table given in Q.2 c. Sketch the reinforcement details. **14**

Ly/Lx	1.1	1.2	1.3	1.4	1.5	1.75	2.0
α_x	0.074	0.084	0.093	0.099	0.104	0.113	0.118
α_y	0.061	0.059	0.055	0.051	0.046	0.037	0.029

(b) Design a short column of circular cross section to carry an axial load of 2000 kN. Use M 20 and Fe 415. **6**

5 (a) Design isolated rectangular pad footing for a column 230 x 400 mm carrying an axial load of 1000 kN. Take SBC of the soil as 220 kN/sq.m. Use M 20 and Fe 415. Sketch the reinforcement details. **16**

b) Explain major and minor axis of the column. Also, explain the reason for providing lateral ties in the column. **4**

6 (a) Two columns, A and B, carry the loads of 600 kN and 700 kN respectively, are spaced at 3 m c/c. Design combine footing for the columns if SBC of the soil is 180 kN/sq.m. Use M 20 and Fe 500. **20**

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