

**MAULANA ABUL KALAM AZAD UNIVERSITY OF
TECHNOLOGY, WEST BENGAL**

**Paper Code : CE-502
DESIGN OF R.C. STRUCTURES**

Full Marks: 7

Time Allotted: 3 Hours

*The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words
as far as practicable.*

Group – A

(Multiple Choice Type Questions)

✓ Choose the correct alternatives of the following.

✓ (i) Lever arm co-efficient in working stress method depends on

- (a) σ_{cbc} only (h) σ_{st} only
(c) Both σ_{cbc} and σ_{st} (d) None of these

(ii) The shear reinforcement in RCC is provided to resist

- (a) Vertical shear (b) Horizontal shear
(c) Diagonal compression (d) Diagonal tension

✓ (iii) As per IS 456-2000, the strain E_{st} in tension reinforcement shall not be less than

- (a) $\frac{f_y}{1.15E_s} + 0.02$ (b) $\frac{f_y}{1.15E_s} + 0.002$
(c) $\frac{f_y}{1.15E_s} + 0.0002$ (d) None of these

✓ (iv) Limit state of serviceability of concrete section should satisfy

- (a) cracking, deflection, maximum compression (b) cracking only
(c) deflection and cracking (d) deflection and maximum compression

1×10=

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- ✓ (v) Which of the following options gives the partial safety factor for D.L. and W.L. for limit state of collapse when stability against overturning is critical
- (a) 1.5 DL + 1.5 WL (b) 1.2 DL + 1.2 WL
(c) 0.9 DL + 1.5 WL (d) 1.4 DL + 1.6 WL
- (vi) Design of RCC cantilever beams, is based on the resultant force at
- (a) fixed end (b) free end
(c) mid-span (d) mid-span and fixed support
- (vii) Side face reinforcement should be provided when the depth of beam exceeds
- (a) 550 mm (b) 750 mm
(c) 650 mm (d) 850 mm
- ✓ (viii) A RCC roof slab is designed as a two slab if
- (a) it supports live load in both directions.
(b) the ratio of spans in two directions is less than two.
(c) the slab is continuous over two supports.
(d) the slab is discontinuous at edges.
- (ix) As the percentage of steel increases
- (a) depth of neutral axis decreases. (b) depth of neutral axis increases.
(c) lever arm increases. (d) lever arm decreases.
- (x) Dog legged stairs are designed similar to
- (a) one way slab (b) two way slab
(c) T-beams (d) rectangular beams

Group - B

(Short Answer Type Questions)

Answer any three of the following.

5×3=15

2. Distinguish between Working Stress and Limit State method of design of RCC member.

3. A RCC beam section 250×350 mm is reinforced with 2-16 mm and 2-12 mm HYSD bars at its tension face and 3-12 mm HYSD bars at its compression face with an effective cover of 40 mm. Find load carrying capacity of the beam over a simply supported span of 4m. Use M25 grade of concrete and Fe 415 grade of steel. Apply Working stress method of design.

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4. A RCC slab panel $3.5\text{ m} \times 5.0\text{ m}$ and 110 mm thick is subjected to a factored design load of 18 kN/m^2 . One long edge of the slab is discontinuous and other edges are continuous. Calculate design Bending Moments for the slab by IS Code method.
5. Find the factored load carrying capacity of an axially loaded short column $450\text{ mm} \times 450\text{ mm}$ reinforced with 8 nos 20 mm dia HYSD bar with an effective cover of 40 mm . Use M 25 grade of concrete and Fe 500 grade steel.
6. Write a short note on under reinforced, balanced and over reinforced section.

Group - C

(Long Answer Type Questions)

Answer any three of the following.

15×3=45

7. Design a RCC slab of dimension $4\text{ m} \times 5\text{ m}$ whose adjacent edges are continuous and remaining two edges are discontinuous, against a live load of 4.5 kN/m^2 . Use M20 grade concrete and Fe415 grade steel. Apply limit state method of design as per IS 456-2000.
8. A R.C. beam, located inside a building in coastal town, is simply supported 230 mm thick and 5 m apart masonry wall (centre to centre). The size is limited to $250\text{ mm} \times 400\text{ mm}$, the beam has to carry, in addition to its own weight, a distributed load 14 kN/m and a concentrated load of 30 kN placed at the mid span point. Assume Fe 415 steel and M 20 mix. Design the beam by using IS: 456 (2000) for both flexure and shear. Show the reinforcement details.
9. Design a stair case to be provided in a residential building in two straight opposite flight of 1 m width connected by a landing for a floor height of 3.3 m . The landing which is 1 m wide span in the same direction as the stair slab. The rise and trend shall be 150 mm and 270 mm , respectively. The weight of finishes is 1 kN/m^2 , the LL is 4 kN/m^2 . Use M 20 grade concrete and Fe 415 grade steel. Assume the stair to be supported on 230 mm thick masonry walls at the outer edges of the landing, parallel to the risers. Show reinforcement details.
10. Design a column subjected to an axial working load of 1775.77 kN and biaxial bending of 24.07 kN-m , 327.6 kN-m . The column has an unsupported length of 3 m and is braced against side sway in both directions. Adopt M-20 Grade concrete and Fe-415 HYSD bars. Show reinforcement details.
11. Design an isolated footing for a square column, 400×400 reinforced with 8 - 20 mm bars, and carrying a service load of 2000 kN . Assume soil with a safe bearing capacity (gross) of 300 kN/m^2 at a depth of 1.5 m below ground. Assume M 20 and Fe 500 steel for the footing and M 25 concrete and Fe 500 steel for column.