



Name :

Roll No. :

Invigilator's Signature :

CS/B.Tech (CE)/SEM-4/CE-405/2010
2010
STRUCTURAL DESIGN – I

Time Allotted : 3 Hours

Full Marks : 70

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)

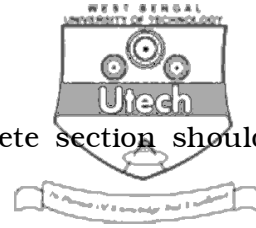
1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10

i) According to IS : 456-2000, the modulus of elasticity of concrete E_c (in N/mm^2) is

- | | |
|-------------------------|-------------------------|
| a) $5700 \sqrt{f_{ck}}$ | b) $500 \sqrt{f_{ck}}$ |
| c) $5000 f_{ck}$ | d) $5000 \sqrt{f_{ck}}$ |

ii) Lever arm coefficient in working stress method depends on

- | | |
|---|-----------------------|
| a) σ_{cbc} only | b) σ_{st} only |
| c) both of σ_{cbc} and σ_{st} | d) none of these. |



- iii) 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.
- iv) The minimum percentage of tension reinforcement in RCC beam is
- a) $0.85/f_y$
 - b) 0.4
 - c) 4.0
 - d) $40 S_v/f_y d$.
- v) The main reinforcement in RCC cantilever member is placed at
- a) top fibre
 - b) bottom fibre
 - c) side fibre
 - d) top and bottom fibre.
- vi) Concrete cover for longitudinal reinforcing bars in a beam for moderate exposure is
- a) diameter of bar
 - b) 30 mm
 - c) both (a) & (b)
 - d) 5 mm more than maximum nominal size of aggregate.



- xi) Maximum diameter of reinforcing bars in slabs should be restricted to
- a) 10 mm
 - b) 12 mm
 - c) 1/6 of slab thickness
 - d) 1/8 of slab thickness.
- xii) Uniformly distributed live load on floors of dwelling houses is generally taken as
- a) 1 kN/m²
 - b) 2 kN/m²
 - c) 3 kN/m²
 - d) 4 kN/m².
- xiii) The expression for factored load for the combination of D.L & L.L for Limit state of collapse is
- a) (D.L + L.L)
 - b) 1.5 D.L + L.L
 - c) 1.2 (D.L + L.L)
 - d) None of these.
- xiv) The development Length L_d for deformed bars of steel grade Fe 415 when used with M20 grade concrete is
- a) 47 Φ
 - b) 64.47 Φ
 - c) 71.8 Φ
 - d) 75.2 Φ .
- (' Φ ' denotes the diameter of the deformed bars)
- xv) According to IS : 456-2000, slenderness ratio for a short column is
- a) less than 3
 - b) between 3 and 12
 - c) more than 12
 - d) none of these.



GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.

3 × 5 = 15

2. Calculate the moment capacity of the rectangular beam of M25 grade of concrete and Fe 415 grade of steel. Cross section of beam is 250 × 400. Beam is provided with 3 nos. 16 mm. dia bars.
3. What are the basic differences between limit state and working stress method of design ?
4. Find out the moment resisting capacity of the T-beam section of following sectional properties :

Width of flange = 1250 mm, Thickness of flange = 125 mm,
Width of the web = 250 mm, Effective depth = 650 mm, Area
of steel = 2000 mm².

Assume M20 grade of concrete and Fe 415 grade of steel.

5. Find out the load carrying capacity of a column of 250 × 450 size, having an effective length of 4 m. Column is reinforced with 4 nos. 16 Tor bars.
6. Define limit state of a structure. What are different limit states ?
7. Differentiate between balance, under and over reinforced section with the help of stress diagram.



GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

8. Design a rectangular beam for an effective span of 6 m. The superimposed load is 50 kN/m and the size of the beam is limited to 30 cm \times 50 cm overall. Use M-20 grade concrete, Fe 415 grade HYSD steel bars and support width = 300 mm each.
9. A 3-span continuous RC slab of clear span 3 m each, supported on 250 mm thick masonry walls. The slab is subjected to a live load of intensity 4 kN/m² and a dead load (due to floor finish, ceiling plaster, partitions etc.) of 1.5 kN/m² in addition to its self weight. Using suitable coefficients, determine critical BM(s) & design the slab only in flexure. Consider mild exposure condition and M-20 & Fe 415 grade material. Show the reinforcement details in neat sketch. Apply any method of design.
10. Design a floor slab with clear internal dimensions 3 m \times 5 m, discontinuous on two adjacent edges and supported by 250 mm thick load bearing walls all round, is to be designed by IS code limit state method.

Assume live load = 4.0 kN/m², use M-20 and Fe 415.



11. Design a reinforced concrete column, 400 mm^2 to carry an ultimate load of 1000 kN at an eccentricity of 160 mm. Use M 20 & Fe 415. Show the reinforcement details in neat sketch. Apply IS method.
12. Design a square footing for a column of ($250 \text{ mm} \times 250 \text{ mm}$) to carry an axial load of 1200 kN. The footing is placed on a soil having bearing capacity of 100 kN/m^2 . Use M-20 & Fe-415 grade materials.
13. Design a dog-legged staircase with a space of 2.4×4.6 (clear dimensions) for a RC framed residential building having floor to floor height = 3 m. Assume live load is 4 kN/m^2 . Use M-20 & Fe-415 and any method of design.

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