



Name :

Roll No. :

Invigilator's Signature :

CS/B.Tech (CE-OLD)/SEM-4/CE-405/2013

2013

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.*

*Only IS 456-2000 & SP16 are permitted to
use in the Examination Hall.*

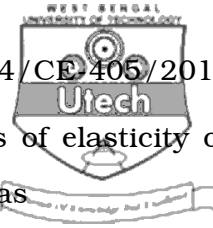
GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$
- i) Concrete cover for longitudinal reinforcing bars in a beam under moderate exposure condition should not be less than
 - a) 30 mm
 - b) diameter of the bar
 - c) both (a) & (b)
 - d) 5 mm more than maximum nominal size of aggregate.
 - ii) Longitudinal spacing of stirrups in beams of effective depth d should not be more than
 - a) 0.5 times d
 - b) 0.75 times d
 - c) 300 mm
 - d) smaller of (b) & (c).



- iii) The percentage of longitudinal steel based on gross cross-sectional area of a column can have a value between
- a) 0.12 & 0.8 b) 0.15 & 8
c) 0.2 & 6 d) 0.8 & 6.
- iv) Uniformly distributed live load on floors on dwelling houses is generally taken as
- a) 1 kN/m² b) 4 kN/m²
c) 3 kN/m² d) 2 kN/m².
- v) The minimum number of bars in a circular column is
- a) 4 b) 6
c) 8 d) none of these.
- vi) The minimum size of reinforcement bars in RCC column is
- a) 6 mm b) 8 mm
c) 10 mm d) 12 mm.
- vii) Maximum area of tension reinforcement in beams shall not exceed
- a) 0.04 bD b) 0.02 bD
c) 0.08 bD d) 0.10 bD.



viii) According to IS 456-2000, the modulus of elasticity of concrete E_c (in N/mm^2) can be taken as

- a) $5700 \sqrt{f_{ck}}$
- b) $570 \sqrt{f_{ck}}$
- c) $5000 \sqrt{f_{ck}}$
- d) $5000 f_{ck}$.

ix) Effective flange width for T -beam can be represented as

- a) $b_f = \frac{l_0}{6} + b_w + 6D_f$
- b) $b_f = \frac{l_0}{12} + b_w + 3D_f$
- c) $b_f = \frac{l_0}{12} + b_w + 6D_f$
- d) $b_f = \frac{l_0}{24} + b_w + 3D_f$

x) Modular ratio m can be written as

- a) $\frac{280}{3\sigma_{cbc}}$
- b) $\frac{250}{3\sigma_{cbc}}$
- c) $\frac{250}{3\sigma_t}$
- d) $\frac{250}{2\sigma_{cbc}}$.

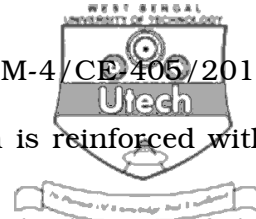
xi) Wind load can be calculated by use of the code

- a) IS 456:2000
- b) IS 875 (Part I)
- c) IS 875 (Part III)
- d) IS 800.

- GROUP – B**

Answer any *three* of the following. $3 \times 5 = 15$

- 4



5. A section of RC beam 300 mm \times 700 mm is reinforced with four 25 mm ϕ bars, placed 30 mm from the bottom of the beam. The beam is subjected to a bending moment of 130 Kn-m. Find the stresses set up in concrete & steel, if $m = 18.66$.
6. Find the neutral axis of a *T* beam of effective depth 400 mm & flange width 1200 mm. Assume slab thickness to be 100 mm. Tensile steel consists of four 18 mm ϕ bars. $b_w = 200$ mm & $m = 13.33$.
7. Distinguish between “One way slab and Two-way slab”.
8. A *T*-Beam of flange width 1000 mm. Flange thickness 100 mm, rib width 250 mm has an effective depth of 500 mm. The beam is reinforced with 4 bars of 20 mm diameter. Find the ultimate moment of resistance of the beam. Use M20 concrete and Fe 415 grade of steel.



GROUP – C

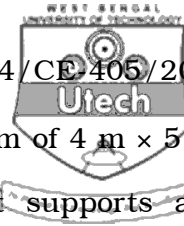
(Long Answer Type Questions)

Answer any *three* of the following.

3 × 15 = 45

9. Design a simple supported beam of clear span 5.5 m with an udl of 15 kN/m (including self weight of beam) over the span (by any method). Use M20, Fe 415, support wall thickness = 300 mm each.
10. Design with neat sketch a R.C. column to carry a load of 800 kN with unsupported length of 3.2 m (one end is hinged & other fixed). Use M20, Fe 415.
11. A doubly reinforced beam 250 mm & 600 mm deep overall has to resist an external bending moment of 95 kN-m. Find the amount of tensile & compressive steel required, if cover to the centre of steel on both sides is 50 mm.

$$\sigma_{cbc} = 5 \text{ N/mm}^2, \sigma_{st} = 140 \text{ N/mm}^2 \text{ \& } m = 18.66.$$



12. An R.C.C. slab has to be provided over a room of $4\text{ m} \times 5\text{ m}$. The slab is continuous over two adjacent supports and discontinuous at the other two supports. The live load on the slab is 3.5 kN/m^2 . Design the slab by using M20 concrete and Fe415 grade of steel.
13. A dog-legged staircase is to be designed for intermediate floor of a multistoried residential building, within a stair hall having clear dimensions $5.4\text{ m} \times 2.5\text{ m}$. The stair hall has 4 columns at its 4 corners measuring $250\text{ mm} \times 400\text{ mm}$ each and beams at longitudinal ends of the flight measuring $250\text{ mm} \times 350\text{ mm}$ each. Take
- i) Floor to floor height of the building = 3.3 m
 - ii) Intensity of live load = 2.5 kN/m^2 of plan area
 - ii) Rise of steps is 150 mm
 - iv) Width of landing = width of flight = 1200 mm .

Show general arrangement of the staircase and design and detail both the flights of the stair, assume maximum comfort to the users, M20 concrete and Fe 415 grade of steel.

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