Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH (CE-N)/SEM-5/CE-502/2012-13

2012

DESIGN OF R.C. STRUCTURES

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.
The symbol and notations used have their usual meanings. Assume reasonable values of any data if not provided. IS456 and SP16 are allowed 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) The value of the maximum strain in concrete under bending compression in outermost fibre, as per IS 456:2000, for Limit state method of design is

a) 3·5 b) 0·35

c) 0·035 d) 0·0035.

ii) As per IS 456:2000, the total deflection due to all loads including the effects of temperature, creep and shrinkage should not normally *exceed*

a) span/200 b) span/300

c) span/250 d) span/350.

iii) As per IS 456:2000, the strain ε_{st} in tension reinforcement should not normally *exceed*

a) $\frac{f_y}{1\cdot 15E_s}+0\cdot 02$ b) $\frac{f_y}{1\cdot 15E_s}+0\cdot 002$

c) $\frac{f_y}{1\cdot 15E_s}+0\cdot 0002$ d) none of these.

iv) $\frac{x_{u,\max}}{\mathrm{d}}$ as per IS 456:2000, depends on

a) area of steel b) grade of concrete

c) grade of steel d) none of these.

v) The minimum number of longitudinal bars provided in a circular column shall be

a) 6 b) 8

c) 10 d) 12.

vi) The maximum compressive strain in concrete in axial compression, as per IS 456:2000, for Limit state method of design is

a) 0·2 b) 0·02

c) 0·002 d) 0·0002.

vii) If a column has an unsupported length l and its effectively held in position at both ends, but not restrained against rotation, then the relation between its length l and its effective length l_e, as per IS 456:2000, is

a) $l_e = l$ b) $l_e = 0 \cdot 8l$

c) $l_e = 1 \cdot 2l$ d) $l_e = 2l$.

viii) Partial safety factor for steel as recommended in IS 456 for Limit State method design is

a) 1·5 b) 1·2

c) 1·15 d) 1·3.

ix) Which one of the following section expected to be more ductile ?

a) Balanced section

b) Over-reinforced section

c) Under-reinforced section

d) Non-prismatic section.

x) V_{us} / d depends on

a) A_{sv}

b) spacing of shear reinforcement

c) grade of concrete

d) all of these.

xi) The minimum number of bars in a circular column should be

a) 4 b) 6

c) 8 d) none of these.

xii) 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).

GROUP – B

(Short Answer Type Questions)

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

2. How do you define a balanced section applying the recommendations of IS 456 for 'working stress method of design' as well as 'Limit state method of design' ?
3. A RC beam section 300 × 700 mm is reinforced with four 25 mm θ bars, placed 30 mm from the soffit of the beam. Calculate the maximum concrete stress and steel stress, if the said section is subjected to a bending moment of 130 KN-m. Consider m = 13. Apply 'working stress method' as per IS 456.
4. Calculate the ultimate moment of resistance of a RCC T-beam section having the following sectional properties :

   Distance between points of zero moments in the beam = 3·0 m

   Width of flange = 1·8 m

   Thickness of flange = 150 mm

   Breadth of the web = 200 mm

   Effective depth = 600 mm

   Reinforcement = 4 nos. 20 mm diameter Fe500 TOR steel bars at bottom only.

   Grade of concrete = M25.
5. Calculate the load carrying capacity of a RCC column of dimension 250 × 400 reinforced with 8 nos 16 Fe415 HYSD bars. Effective length of the column = 5m. Apply 'working stress method of design' as per IS 456.

6. Calculate the bending moment coefficients of a two-way RCC slab of dimension 4 m × 5·2 m whose adjacent edges are discontinuous and remaining two edges are continuous. Use IS 456.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. Design a RCC column section against an axial compressive force = 1000 KN and bending moments M_x = 10 KN-m and M_y = 8 KN-m. Partial safety factor against load = 1·5. Use M20 concrete and Fe415 HYSD bars. Effective length of the column may be considered = 2·5 m. Apply 'Limit state method of design' as per IS 456. Both the ends of the column may be considered fixed.

8. Design a RCC slab of dimension 4 m × 5 m whose adjacent edges are continuous and remaining two edges are discontinuous, against a live load of 3·5 KN/m^2 M20 concrete and FE415 grade steel should be used. Apply 'Limit state method of design' as per IS 456.

9. A dog-legged staircase is to be designed between intermediate floors of a residential building, within a stair hall having clear dimensions 5·4 m × 2·5 m. The stair hall has 4 columns at its corners measuring 250 mm × 400 mm each. The beams at the ends may be considered 250 mm × 350 mm each. Consider floor to floor height = 3·3 m, intensity of live load = 3 KN/m^2 on plan area. Riser 150 mm, width of

landing and width of flight both = 1200 mm. Show general arrangement of the stair case and design the flights of the staircase. M20 concrete and Fe415 grade of steel should be used. Apply 'Limit state method of design'. Show detail of reinforcements through neat sketches.

10. Design a square footing of a column of size 300 mm × 300 mm carrying an axial compressive force. The footing will be placed on a soil having bearing capacity of 120 KN/m^2. Use M20 concrete and Fe415 grade steel. Apply 'Working stress method of design' as per IS 456.

==========