Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS / B. TECH (CE) / SEM-7 / CE-704 / 2010-11

2010-11

STRUCTURAL DESIGN - III

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.

(Use of IS 456, 875, 3370, 1343 and IRC 6, 21 (2000) is permitted)

GROUP – A

(Multiple Choice Type Questions)

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

$10 \times 1 = 10$

i) The expression of the factored load for the combination of D.L., L.L. & W.L. for the limit state of collapse is

a) (D.L.+L.L+W.L) b) 1 7 (D.L.+L.L.+W.L)

c) 1 3(D.L.+L.L.+W.L) d) None of these.

ii) The number of possible independent mechanism, n is determined from which of the following relationships ?

a) $n = N - r$ b) $n = N + r$

c) $n = 2N - r$ d) $n = 2N + r$.

iii) The shape of factor of an isosceles triangle for bending about the axis parallel to the base is

a) 1 34 b) 1 64

c) 2 34 d) none of these.

iv) Loss due to elastic shortening in post-tensioned pre-stressed concrete members is

a) equal to that for pre-tensioned case

b) always zero

c) equal to half that of pre-tensioned case

d) zero when all the cables are stretched simultaneously.

v) In pre-stressed concrete members, The steel is under

a) Compression b) Tension

c) Torsion d) None of these.

vi) The design wind speed is 74 m / sec. The design wind pressure in N/m^2 will be

a) 1325.40 b) 1300.20

c) 1310.50 d) 1315.20.

vii) For medium soil sites, if T = 0.4 sec, Sa/g is

a) 7 b) 3.4

c) 2.50 d) 4.4.

viii) The design horizontal seismic co-efficient $A_h < Z/2$ if T

a) ≤ 0.2 sec b) ≥ 0.3 sec

c) ≤ 0.1 sec d) None of these.

ix) For general buildings, the importance factor I is equal to

a) 1 5 b) 1 0

c) 1 2 d) none of these.

x) The natural period of vibration for steel frame buildings is given by

a) $0.075\,h^{0.75}$ b) $0.085\,h^{0.75}$

c) $0.075\,h^{0.85}$ d) $0.085\,h^{0.85}$.

xi) The axle load in case of IRC class B loading is

a) 114 kN b) 70 kN

c) 68 kN d) 40 kN.

GROUP – B

(Short Answer Type Questions)

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

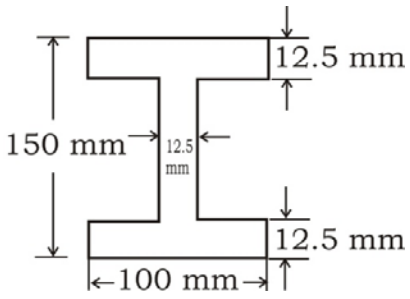
2. A beam fixed at both ends has a span of 9m carries two point loads of 60 kN and 120 kN at 3m and 6 m respectively from the left hand support. Taking the yield stress as 250 N/mm^2, design the section allowing a load factor of 1 15.

3. A reinforced framed building is 45 m × 15 m in plan and 60 m high, consisting of storey 4 m in height. Determine the design wind force on the framed building as per IS 875. Assume that the building is situated in terrain category 3 with basic wind speed of 50 m/sec. Assume any other data required.

4. Design a section of wall in case of water tank to resist a direct tensile force of 150 kN/m width. Use M20 grade of concrete and Fe 415 grade of steel.

5. A concrete beam 150 mm × 300 mm is pre-tensioned by 7 wires of 7 mm φ at initial stress of 1000 N/mm^2 with their centroid located at an eccentricity of 50 mm. Find the loss of pre-stress due to elastic shortening, creep and shrinkage of concrete if there is a relaxation of 4% of steel stress. Use creep coefficient = 1 6 and M40 grade of concrete.

6. Determine the shape factor for the beam section shown in fig. Find also the fully plastic moment of the beam section. Take $f_y = 250\text{N/mm}^2$.



GROUP – C

(Long Answer Type Questions)

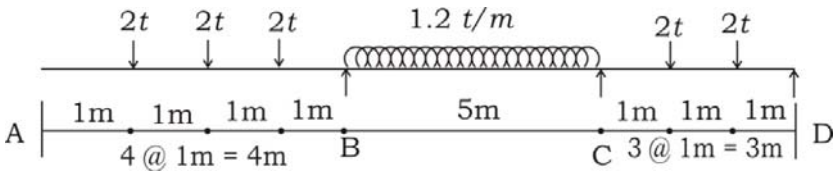
Answer any *three* of the following. $3 \times 15 = 45$

7. Determine M_p for the following continuous beam loaded at ultimate. The beam is of uniform section. The beam consists of three spans *AB* = 4m, *BC* = 5 m and *CD* = 3 m. End *A* is fixed and end *D* is simply supported.

   Loading on *AB* : 2*t*, 2*t* and 2*t* at interval of 1m from end *A*

   Loading on *BC* : u.d.l. of 1.2*t* / m over the entire span

   Loading on *CD* : 2*t* at interval of 1m from end *C*.

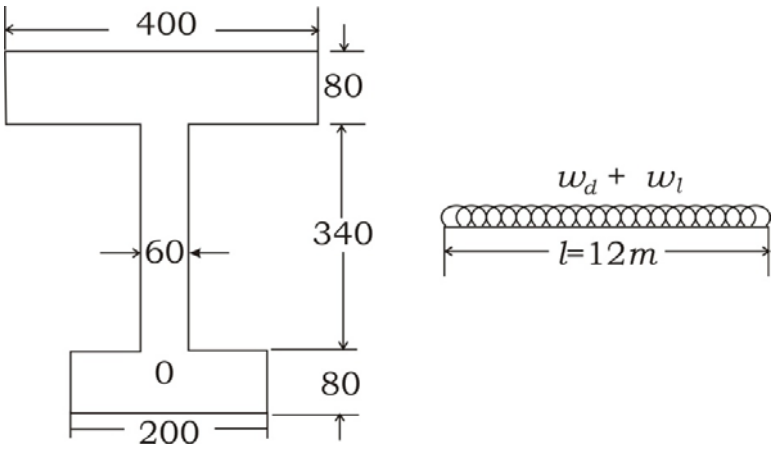


8. A portal frame *ABCD* consists of columns *AB* and *CD* and beam *BC*. Each member is of 5 m length. The columns are fixed at the bases *A* and *D*. All the members have same fully plastic moment M_p.

   The frame is subjected to a vertical point load of 120 kN acting at 3 m from *B* and a horizontal sway force of 40 kN acting at *B* in the direction *BC*. Find the plastic moment required.

9. Design the long wall of a rectangular water tank resting on the ground and having a capacity of 130 kl. Overall height of the tank is restricted to 4 m with a free board of 300 mm. The materials to be used are M 25 grade concrete and HYSD reinforcement of grade Fe 415. Check all necessary stresses.

10. A pre-stressed concrete beam of '*I* ' section is used for a simply supported beam of 12 m span. The section of the beam is shown in fig. Calculate the maximum uniformly distributer = *d* load that the beam can safely carry. Also calculate the pre-stressing force and eccentricity of the pre-stressing load. Assume losses of pre-stress is 20%. Allowable compressive stress in concrete at transfer and during service condition are 18 N / mm^2 and 14 N / mm^2 respectively and that is tension bending zero at each case.



11. A reinforced concrete simply supported slab is required for the deck of a road bridge having the data given below :

    Carriage way – two lane – 7 5 m wide

    Foot path – 1 2 m on either side

    Clear span – 6 m

    Wearing coat – 80 mm

    Width of bearing – 0.4 m

    Materials – *M* 30 grade and Fe 415 grade HYSD reinforcement.

    Loading – IRC class *AA* tracked vehicle.

    Design the *RC* deck slab and sketch the details of reinforcement in the longitudinal and cross-section of the slab.

    Use of the design charts is permissible.

12. The floor plan and the elevation of grid (5) of a typical public cum office building is shown in fig. The building is situated at Ahmedabad. Calculate the seismic load at different floor levels for grid (4).

    The other data are as follows :

    Thickness of external wall 250 mm

    Thickness of internal wall 150 mm

    size of columns 500 × 400

    Size of beams of 6 m span 550 × 250 contd...

Size of beams of 5 m span 450 × 250

Thickness of floor slab and roof slab 150 mm

Height of parapet wall 1 0 mm

Thickness of parapet wall 125 mm

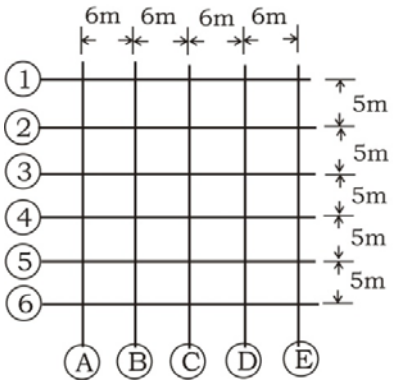
Sp. weight of infill wall 20 kN/ m^3

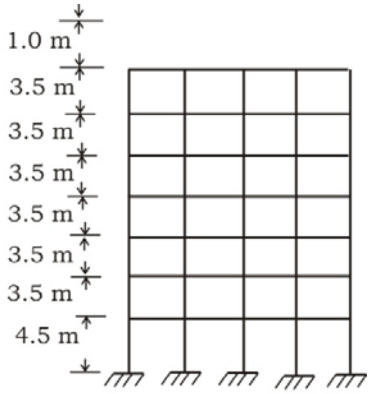
Thickness of roof treatment work 30 mm

Live load on floor slab 4 0 kN/ m^2

Live load on roof 1 5 kN/ m^2

Type of soil – medium hard.





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