Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(CE)/SEM-7/CE-704/2012-13

2012

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.
The symbols and notations used have their usual meanings.
Assume reasonable values of any data if not given.
IS456, SP16, IS875, IS1893, IS3370 and IRC, codes 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 shape factor for a beam of circular section of radius *R* is

   a) 2·0 b) 1·698

   c) 1·72 d) 1·3.

   ii) The expression of factored load for the combination of D.L. & E.L. for limit state of collapse as per IS 456 is

   a) (D.L. + E.L.) b) 1·5 D.L. + E.L.

   c) 1·2 (D.L. + E.L.) d) none of these.

iii) For calculation of moments in cylindrical tank walls fixed at base and free at top, the coefficients as per IS code method depend on

a) $\frac{H^2}{D^2t}$ b) $\frac{H^2}{Dt^2}$

c) $\frac{H^2}{Dt}$ d) $\frac{D^2}{Ht}$.

iv) The impact factor for live load on a bridge is

a) directly proportional to span

b) inversely proportional to span

c) proportional to square of span

d) constant.

v) Design wind pressure (N/m^2) corresponding to design wind speed of 56·5 m/sec is

a) 1596·125 b) 1915·35

c) 1276·9 d) none of these.

vi) The minimum clearance $'f'$ between the outer edge of the wheel and the roadway face of the kerb is

a) 150 mm b) 130 mm

c) 110 mm d) 170 mm.

vii) Pigeaud's method is applicable in case of deck slabs for computing

a) bending moment b) shear force

c) torsional moment d) none of these.

viii) For medium soil sites, if $T = 0 \cdot 4$ sec, as per IS 1893, S_a / g is

a) 7 b) 3·4

c) 2·5 d) 4·4.

ix) The natural period of vibration for steel frame building as per IS 1893 is given by

a) $0 \cdot 075\ h^{0.75}$ b) $0 \cdot 085\ h^{0.75}$

c) $0 \cdot 075\ h^{0.85}$ d) $0 \cdot 085\ h^{0.85}$.

x) Delhi is located at seismic zone

a) I b) II

c) III d) IV

e) none of these.

xi) Relaxation in steel is

a) decrease of stress in steel at constant strain

b) increase in strain at constant stress

c) tensile stress that produce residual strain

d) none of these.

xii) Ductility factor will be maximum for

a) underreinforced section

b) balanced section

c) overreinforced section

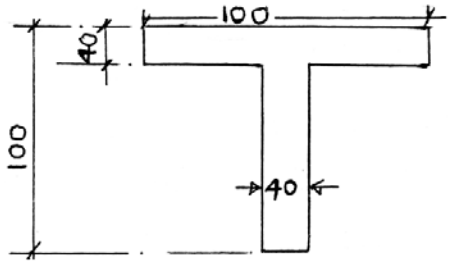
d) none of these.

GROUP – B

(Short Answer Type Questions)

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

2. Determine the shape factor for the *T*-beam section as shown below.



3. A 20 m high building is to be constructed at a place in Kolkata having basic wind speed of 50 m/s. Values of k_1 and k_3 are respectively 1·08 and 1·0 and thereof k_2 at heights of 10 m, 15 m and 20 m are 0·88, 0·94 and 0·98. Find the design wind pressure at heights of 10 m, 15 m and 20 m.

4. A rectangular concrete beam of cross-section 300 mm deep and 200 mm wide is pre-stressed by means of 8 nos. high tensile wires of 5 mm diameter stressed to 1200 N/mm^2. The wires are located at an eccentricity of 50 mm. Calculate the stress developed at the soffit of the beam.

5. Write short notes on : $2 \times 2\frac{1}{2}$

   a) Modal participation factor

   b) Plastic hinge.

6. Discuss on different types of losses in pre-stressed concrete post tensioned beams.

GROUP – C

(Long Answer Type Questions)

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

7. Design a solid slab bridge for IRC class *B* loading for the following data :

   i) Clear span = 5·5 m

   ii) Clean width of roadway = 6·8 m

   iii) Average thickness of wearing coat = 7·5 cm

   iv) Grade of concrete to be used = M 25

   v) Grade of steel reinforcement to be used = Fe-415

   vi) Width of kerb = 600 mm

   vii) g = 0·92 m, w = width of ground contact area = 380 mm, B = Breach of ground contact area = 200 mm, Axle load = 68 KN, F = distance of face of wheel from kerb (f) = 0·15 m, b = width of dispersion of load along span = 1200, b_{ef} = effective width of slab = 8 m.

   Calculate the depth of slab and reinforcement for bending moment.

8. Design a circular tank of capacity of 7,80,000 litre of water with rigid base and free at top. The depth of the tank is 4·0 m. A free board of 300 mm may be provided. Adopt M20 concrete and Fe 415 steel.

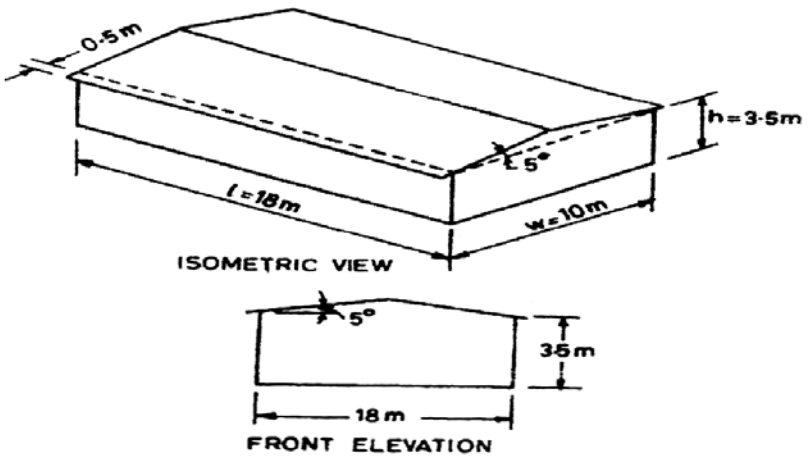
9. A rectangular factory building having pitched roof is located near Kolkata. Calculate the wind forces on roof and walls.

Physical Parameters :

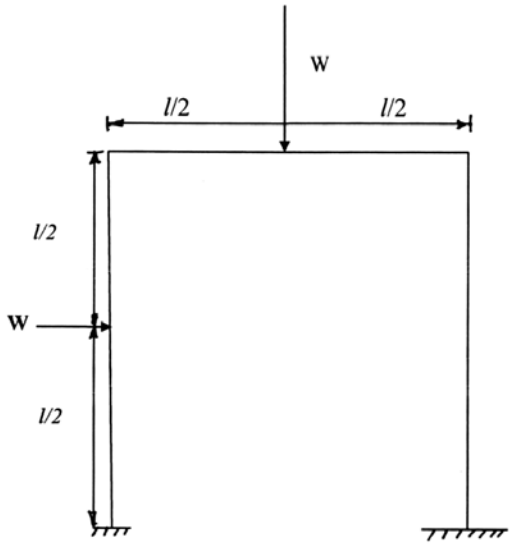
Height (h)	:	3·5 m
Width (w)	:	10·0 m (excluding the overhangs)
Length (l)	:	18·0 m
Roof angle (α)	:	5°
Overhang	:	0·5 m
Opening on sides	:	10 per cent of wall area
External surface of walls	:	Smooth

Flat ground

The isometric view and front elevation of the factory is shown below. Assume reasonable value of any data if required, may be assumed.



10. Find the collapse load for the frame shown below :



11. a) A pre-stressed concrete beam 250 mm × 400 mm has a span of 15 m. The beam is pre-stressed by steel wires of area 500 mm^2, provides at a uniform eccentricity of 60 mm with an initial pre-stress of 1250 N/mm^2. Determine the percentage loss of pre-stress in wires for both pre-tension and post-tension beams as per I.S. 1343. Assume relaxation loss of 5% of initial and anchorage slip = 1·35 mm and K = 0·0015 per m.

b) What are the advantages and disadvantages of pre-stressed concrete structures with respect to reinforced concrete structures ?

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