Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(CE)/SEM-7/CE-704/2011-12

2011

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.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

   i) Value of importance factor for school building from seismic design consideration is given as

   a) 1·0 b) 1·5

   c) 2·0 d) 6·0.

   ii) S_a / g value for seismic design is dependent on

   a) importance of structure

   b) natural period of vibration

   c) seismic zone

   d) none of these.

iii) Plastic hinges generally occur at points of action of

a) point loads

b) fixed ends

c) at section of sudden change in geometry

d) all of these.

iv) Kolkata is located at seismic zone

a) I b) II

c) III d) IV.

v) As per IS 1343-1980, the grade of concrete for post tensioned members shall not be less than

a) M25 b) M30

c) M35 d) M40.

vi) 0·2% proof stress for high tensile wires should not be less than

a) 60-65% b) 70-75%

c) 80-85% d) none of these.

vii) Relaxation in steel is

a) decrease of stress in steel at constant strain

b) increase of strain at constant stress

c) tensile stress that produces residual strain

d) none of these.

viii) Initial prestress in steel should not exceed

a) 60% b) 70%

c) 80% d) 90%.

ix) Shape factor S of a steel beam is given by

a) Z / Z_p b) Z_p / Z

c) Z_p , Z d) $\sqrt{(Z_p / Z)}$.

where Z is the elastic section modulus and Z_p is plastic section modulus.

x) If the factor of safety is 1·65, shape factor is 1·12; load factor Q is nearest to

a) 1·80 b) 1·85

c) 1·88 d) 2·03.

xi) The design wind speed is 40 m/sec. The design wind pressure in N/m^2 will be

a) 960 b) 1000

c) 1600 d) 800.

xii) Cracking of RCC walls in water retaining structure is

a) permitted

b) not permitted

c) not permitted on water face

d) permitted to a limited value.

GROUP – B

(Short Answer Type Questions)

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

2. Find out the differences of dispersion of live load by Piegeaud's Method with any other rational method.

3. Discuss about the preliminary elastic method of design of prestressed concrete beams using an example.

4. 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 there of 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.

5. Show with a neat reinforcement diagram the various components (Superstructure) of a typical RCC bridge.

6. Derive the relation between cost of superstructure and that of substructure for the economical span of an RCC bridge.

7. Design a circular tank according to the following particulars : (i) Diameter of tank = 3·50 metre, (ii) Depth of water = 3 metre. The tank rests on ground and the walls and base slab are not monolithic with each other. Use M20 and Fe250 steel.

GROUP – C

(Long Answer Type Questions)

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

8. Draw a sketch of a Steel Bridge to suit the following data :

   Effective span = 30 m, Road Way = 7·5 m, Kerbs = 600 mm, Loading IRC-Class AA Tracked vehicle, the truss will be 'Warren Truss' of height = 5 m.

   Draw the cross-section of Deck showing the stringer beam spaced at 1·875 m interval and cross girders at 5 m interval provided at nodal point.

   Design Stringer Beam taking into consideration Live load 350 kN (as per IRC-Class AA Tracked vehicle) spread over 3·6 m and thickness of the deck slab as 200 mm with a wearing cost as 100 mm.

9. Design a RC slab culvert for a National Highway with the following data :

   Clear Span = 7·5 m

   Width of the footpath = 1m on either side

   Wearing Coat = 100 mm thick asphaltic concrete

   Kerbs = 600 mm

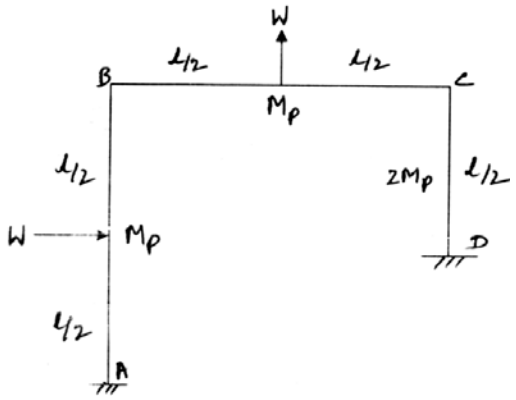
   Condition of exposure = Moderate

   Loading — IRC Class A.

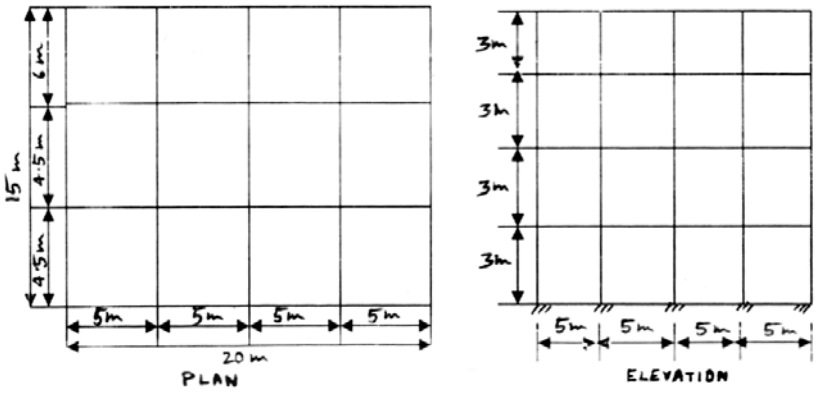
   Use M25 grade of concrete and Fe415 grade of steel.

   Assume any suitable data if required.

10. Determine the value of the collapse load W for the portal frame as shown in the figure.



11. A four storey reinforced concrete building built in medium soil site has a ground plan 20 × 15 m and its elevation as shown in the figure. The imposed load on the roof is 1·5 kN/m^2 and that on the floor is 3 kN/m^2. Determine the seismic load on frame by IS 1893 (2002). The building is unbraced. The roof and floor slabs are 150 mm thick. The size of the beam is 250 × 400 mm and the columns 400 × 500 mm. The height of floors is 3 m. Assume location in zone III.



12. a) A pre-stressed concrete beam 250 mm × 360 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 IS 1343. Assume relaxation loss of 5% of initial and anchorage slip = 1·35 mm and K = 0·0015 per m.

b) "A pre-stress structure is weightless." Explain.

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