(vi) As per IS 875 (Part III):2015, open terrain with well scattered obstructions having height generally between 1.5m to 10m is
(a) Category 1 (b) Category 2
(c) Category 3 (d) Category 4.

(vii) Strouhal number as per IS 875 Part III 2015 for rectangular cross section is
(a) 0.2 (b) 0.25 (c) 0.1 (d) 0.15.

(viii) Percentage of imposed load up to and including 3.0kN/m^2, to be considered in calculation of seismic weight is
(a) 25% (b) 50% (c) 45% (d) 30%.

(ix) The stage when forcing frequency equals the natural frequency of the system is known as
(a) resonance (b) steady-state
(c) transient response (d) random response.

(x) The ratio of importance factor (I) and response reduction factor (R) shall not be
(a) less than unity (b) equal to unity
(c) greater than unity (d) less than or equal to unity.

Group – B

2. (a) Explain briefly the following (along with diagrams):
(i) Tube-in Tube Structure
(ii) Braced Frames

(b) Differentiate between Bundled Tube and Framed tube structure.

(4 + 4) + 4 = 12

3. Design an internal panel of flat slab for a Live Load of 7 kN/m^2. The slab is provided with a floor finish weighing 1.25 kN/m^2. The panels are 7 m × 5 m. Drops shall be provided. (Use M25 concrete and Fe 500 steel).

12

Group – C

4. Write short notes on any four: **(4 × 3) = 12**
(i) Gust
(ii) Vortex shedding
(iii) Galloping
(iv) Ovalling
(v) Fluttering.

5. Estimate the gust response factor at 50m, 60m and 80m level for a 90m high RCC Residential building using "Gust Response Factor" with plan dimension 6m × 6m, located at Kolkata as per IS 875 Part III: 2015 with Terrain category-I. (Use M25 grade of concrete, steel Fe500 steel).

12

Group – D

6. A two storey building (Figure.2) has the following details

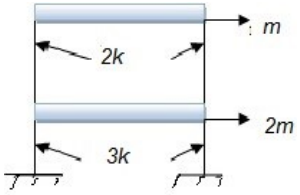

Figure 2

Evaluate the natural frequencies, mode shapes and modal participation factor. Also, determine the modal forces using response spectrum. Soil type to be considered is medium and Seismic zone-III. Assume m = 40,000 kg, $k = 6 \times 10^7$N/m.

12

7. Write short note on the following: **(4 × 3) = 12**
(i) Time history method of analysis
(ii) Lateral force and base shear
(iii) Fundamental time period
(iv) Mode participation factor.

Group – E

8. (a) A bar bell type shear wall shown in fig.(3) with central part 3600mm × 150mm and two 400mm × 400mm strong bands at each end is supported on a footing 8m × 4m, which rests on soil whose modulus is 30 × 10^3 kN/m^3. Determine the lateral stiffness of the wall. (Assume f_{ck}= *20 MPa and height of the wall is 14 m.).* The diagram is given below.

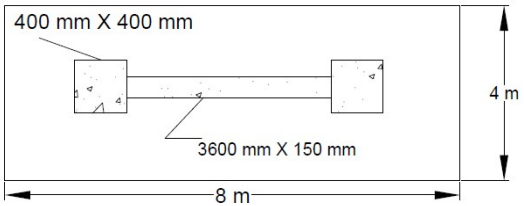

Figure 3

(b) Why shear walls are constructed in framed buildings?

10 + 2 = 12

9. (a) Provide some information on how to make buildings ductile for good Seismic Performance.

(b) State and explain the Earthquake Design Philosophy in details.

6 + 6 = 12

DESIGN OF TALL STRUCTURES
(CIVL 3233)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) If h = height of the building, building drift limit for buildings should be in the range of
(a) $(h/100)$ to $(h/200)$ (b) $(h/20)$ to $(h/100)$
(c) $(h/200)$ to $(h/300)$ (d) $(h/500)$ to $(h/600)$.

(ii) Framed Tube buildings is suitable for building height ranging between
(a) 100 m to 120 m (b) 50 m to 70 m
(b) 180 m to 200 m (d) 150 m to 170 m.

(iii) The minimum thickness of flat slab for end panels without drops is
(a) average length of panel/10 (b) average length of panel/30
(c) average length of panel/50 (d) average length of panel/32.

(iv)

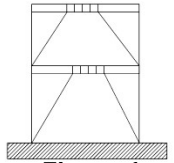

Figure 1

The bracing shown in fig. (1) represents
(a) cross-bracing (b) inverted V-bracing
(c) diagonal bracing (d) eccentrically Inverted-U bracing.

(v) As per ductile reinforcement necessary for seismic forces, the spacing of hoops in the middle portion of the column should not exceed
(a) (1/2) of least lateral column dimension
(b) (1/4) of least lateral column dimension
(c) (1/6) of least lateral column dimension
(d) (1/3) of least lateral column dimension.