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10CV834

**Eighth Semester B.E. Degree Examination, June/July 2019**  
**Earthquake Resistant Design of Structures**

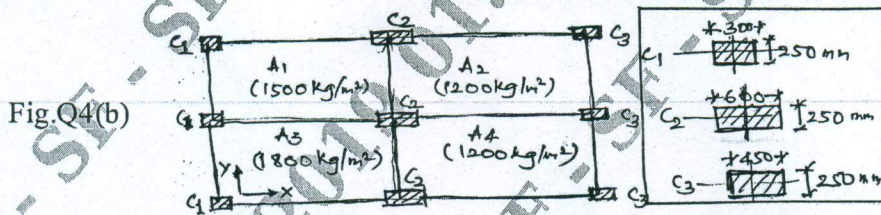
Time: 3 hrs.

Max. Marks:100

**Note:1. Answer any FIVE full questions, selecting atleast TWO questions from each part.**  
**2. Use of IS - 1893 - 2002 is permitted.**

**PART - A**

- 1
  - a. Explain interplate and intraplate earthquakes. (05 Marks)
  - b. What are the Seismic zones of India and their characteristics? (05 Marks)
  - c. Write a note on Seismic waves. (10 Marks)
- 2
  - a. Draw an indicative sketch of Response history and explain ground motion characteristics. (10 Marks)
  - b. Discuss the influence of following parameters namely :
    - i) Natural period
    - ii) Damping
    - iii) Type of soil stratum
 on the response acceleration coefficient ( $S_a/g$ ) as per IS - 1893 - 2002, with a neat sketch of Response acceleration Vs Natural period. (10 Marks)
- 3
  - a. Explain different methodologies to control the seismic response of building structures. (10 Marks)
  - b. Explain the seismic retro fitting techniques with sketches. (10 Marks)
- 4
  - a. What are the requirements of structures for good earthquake resistance? (08 Marks)
  - b. For a building plane shown in fig. Q4(b), locate its centre of mass and centre of stiffness. The mass of each area  $A_1$  to  $A_4$  and cross sections of each column types  $C_1$  to  $C_3$  are indicated. (12 Marks)



**PART - B**

- 5
  - a. Discuss the distinction (difference) between Equivalent lateral force procedure and Dynamic analysis procedure. (05 Marks)
  - b. The plan of a four storeyed RCC framed structure of special moment resisting frame type is shown if fig.Q5(b). Height of each floor is 3.2m. Live load on each floor and roof is  $2.5kN/m^2$ . The building is located is Shrinagar (J & K) and founded on hard soil. Consider the importance factor of 1.5 and damping of 6%. Evaluate the base shear and lateral force distribution on each floor using Equivalent lateral force procedure. Dimensions of beams (250mm × 400mm) , Columns (300mm × 300mm) , Thickness of slab = 100mm , thickness of wall : 230mm. (15 Marks)

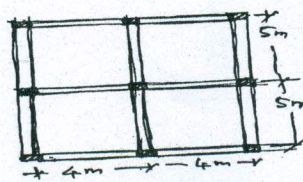


Fig. Q5(b)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
 2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.



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- 6 For a three storeyed residential RCC framed structure of special moment resisting type located in zone IV founded on medium soil, compute the seismic forces using dynamic analysis procedure. Refer fig. Q6. Along with following data : Damping 5%.

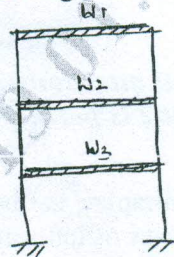


Fig.Q6

Seismic weights :  $W_1 = 300 \text{ kN}$  ,  $W_2 = 1600 \text{ kN}$  ,  $W_3 = 1100 \text{ kN}$ .

Natural frequencies :  $W_{n1} = 10.635 \text{ rad/s}$  ,  $W_{n2} = 40.347 \text{ rad/s}$  ,  $W_{n3} = 54.148 \text{ rad/s}$ .

Modes :  $\{\phi_1\} = \{1.00, 0.97, 0.76\}$

$\{\phi_2\} = \{1.00, 0.511, -1.811\}$

$\{\phi_3\} = \{1.00, -0.235, 0.075\}$ .

Combine the response of all three modes using SRSS rule.

(20 Marks)

- 7 a. Discuss the following issues with reference to earthquake resistant design of buildings.
- Concept of soft storey and design consideration for the same as per IS – 1893 – 2002.
  - Ductile detailing requirements for RC beam as per IS – 1893 – 2002. (15 Marks)
- b. Discuss the concept of seismic weight and load combinations to be adopted for earthquake resistant design. (05 Marks)
- 8 Write short notes on :
- Elastic properties of structural masonry.
  - Modes of failure of masonry structures. (20 Marks)

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