

**COLLEGE OF ENGINEERING, PUNE**

Shivaji Nagar, Pune

**End - Semester Examination**

**(CE 404) Introduction to Earthquake Engineering**

Programme: B. Tech Civil Engg.

Duration: 180 minutes

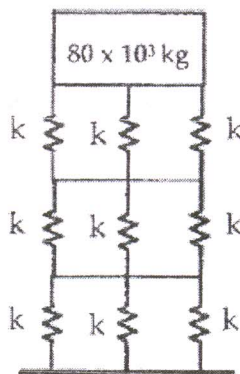
Year: 2012-13;

Max. Marks:50

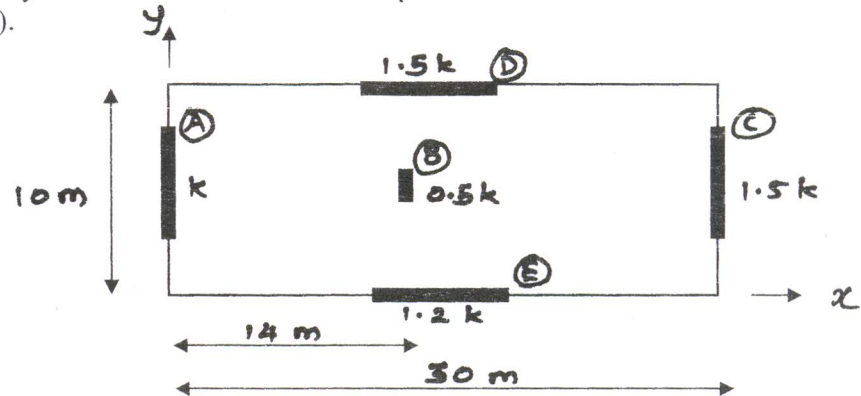
Instructions:

1. All Questions are compulsory.
2. Use of IS 456, IS 1893, IS13920 is permitted.
3. Assume suitable data wherever required and state it clearly.
4. Use of non-programmable calculators is allowed.

- Q.1 (a) What is an underdamped system? (2)
- (b) What are factors affecting ductility of a structure. (2)
- (c) What is the difference between weak storey and soft storey? (2)
- (d) Shear walls are employed for increasing stiffness and are uniformly distributed in both principal directions. Comment. (2)
- (e) What is pounding? Explain with sketch. (2)
- Q.2 (a) Describe with suitable sketches, different types of body waves generated by earthquake and their effects on structure. (4)
- (b) What are boundary elements? Explain with sketch. (3)
- (c) An elevated water tank of mass  $80 \times 10^3$  kg is modeled as shown in the figure. Determine the natural frequency, if  $k = 475 \times 10^5$  N/m. (3)



- Q.3 (a) Calculate the lateral force in the shear walls of the one-storey building due to lateral force of 200 kN applied in y direction and passing through the centre of mass. The roof diaphragm is rigid in its own plane, and mass at the roof is uniformly distributed. Use the torsion provisions of 2002 edition of IS 1893 (Part 1). (7)



- (b) A vibrating system consists of a mass 15 kg, spring of stiffness 150 N/m and a damper with damping coefficient of 5 N-s/m. Determine: (a) damping factor; (b) logarithmic decrement; (c) ratio of two successive amplitudes. (3)

- Q.4 (a) Determine the lateral forces at different storey levels by dynamic analysis for the three storeys OMRF school building located in zone 5 whose mode shapes and frequencies are given below. Consider the effect of all three modes. (8)

	Weight (kN)	Mode 1	Mode 2	Mode 3
Period (s)		0.36	0.16	0.1
Roof	640	1.000	1.000	1.000
2 <sup>nd</sup> floor	688	0.716	-0.444	-2.366
1 <sup>st</sup> floor	688	0.407	-0.579	2.7

- (b) Explain with sketch, the working of metallic dampers. (2)

- Q.5 (a) Explain the concept and need of isolation? When the base isolation is effective? (5)

- (b) A circular column 300 mm diameter is reinforced with 8 bars of 20 mm diameter as main reinforcement and 10 mm diameter stirrups at 100 mm spacing. Assuming M25 concrete, 40 mm clear cover and Fe415 grade steel, design the special confining reinforcement and show the detailing for a floor height 3.5 m. (5)

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*Best of Luck!*