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Question Paper Code	13931
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**B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025**

Seventh Semester

**Civil Engineering**

**20CEEL702 - STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING**

Regulations - 2020

( Use IS1893, IS4326 & IS13920 code books permitted)

Duration: 3 Hours

Max. Marks: 100

**PART - A (MCQ) (10 × 1 = 10 Marks)**

Answer ALL Questions

	<i>Marks</i>	<i>K-Level</i>	<i>CO</i>
1. In D'Alembert's principle, the inertia force is represented as: (a) $m\ddot{x}$ (b) $-m\ddot{x}$ (c) $c\dot{x}$ (d) $kx$	1	K2	CO1
2. The force transmissibility in a vibratory system is influenced by: (a) Mass only      (b) Frequency ratio and damping (c) Damping only      (d) External force amplitude	1	K1	CO1
3. The number of natural frequencies in an n-degree of freedom system is: (a) n+1      (b) n      (c) 2n      (d) 1	1	K2	CO2
4. The general form of the equation of motion for a MDOF system is: (a) $m\ddot{x} + kx = 0$ (b) $m\dot{x} + Kx = 0$ (c) $m\ddot{x} + c\dot{x} = f$ (d) $m\ddot{x} - c\dot{x} = 0$	1	K2	CO2
5. The focus of an earthquake is also known as: (a) Epicenter      (b) Hypocenter      (c) Seismogram      (d) Fault plane	1	K1	CO3
6. Seismic hazard analysis requires: (a) Seism tectonic data and ground motion records      (b) Painting of buildings (c) Load testing of steel      (d) Estimating dead load only	1	K2	CO3
7. As per IS:1893 – 2002, the design seismic coefficient depends mainly on: (a) Load factor only      (b) Dead load only (c) Type of cement used      (d) Zone factor, importance factor, and response reduction factor	1	K2	CO4
8. The response spectrum is most useful in: (a) Elastic modulus determination      (b) Seismic design of structures (c) Load distribution in beams      (d) Soil compaction tests	1	K2	CO4
9. RCC structures primarily resist earthquake forces through: (a) Bending      (b) Shear      (c) Both bending and shear      (d) None	1	K2	CO5
10. Which IS code specifying ductile detailing of reinforced concrete structures? (a) IS 13920 – 1993      (b) IS 1893 – 2002      (c) IS 456 – 2000      (d) IS 800 – 2007	1	K2	CO6

**PART - B (12 × 2 = 24 Marks)**

Answer ALL Questions

11. Define damping.	2	K1	CO1
12. Write a short note on single degree of freedom (SDOF) systems with equation.	2	K2	CO1
13. Define Eigen vectors and Eigen values.	2	K1	CO2
14. How frequency is affected in the free vibration of a shear frame?	2	K2	CO2
15. Identify the causes of earthquake.	2	K2	CO3
16. Distinguish between seismograph and seismogram.	2	K2	CO3
17. Identify the different effects of liquefaction.	2	K2	CO4
18. Compare mass irregularities from plane irregularities.	2	K2	CO4
19. Describe the major damages occur in the RC structures during earthquake.	2	K2	CO5
20. What is meant by re-entrant corners of irregular buildings?	2	K1	CO5
21. How will you assess the causes of damage in RC and Masonry buildings?	2	K2	CO6

*K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create*

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22. What are the methods available for lateral load analysis of rigidly jointed frames? 2 K1 CO6

**PART - C (6 × 11 = 66 Marks)**

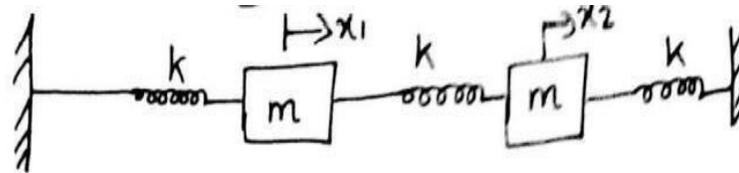
Answer ALL Questions

23. a) A harmonic motion has a maximum velocity of 6m/s and it has a frequency of 12cps. Determine its amplitude, its period and its maximum acceleration. 11 K2 CO1

**OR**

- b) List and explain the different types of vibration in a structural dynamic problem in detail. 11 K2 CO1

24. a) Determine the natural frequencies and modes of the system shown in figure. 11 K2 CO2



**OR**

- b) Determine the natural frequency and mode shapes of the following: The storey masses are  $M_1=2$ ,  $M_2=1.5$ ,  $M_3=1$  and storey stiffness are  $k_1=900$  N/m  $k_2=600$  N/m  $k_3=300$  N/m. 11 K2 CO2

25. a) Analyze how the intensity is measured using MMI scale as per codal provisions. 11 K2 CO3

**OR**

- b) Identify the focus and epicenter of an earthquake with examples, and explain the types of body waves with the help of a neat sketch. 11 K2 CO3

26. a) Explain the step-by-step procedure to analyze a frame by equivalent static lateral load method. 11 K2 CO4

**OR**

- b) Identify the seismic damages in RC buildings during Bhuj earthquake. 11 K2 CO4

27. a) Briefly explain the salient features of earthquake resistant provisions as per IS 4326. 11 K2 CO5

**OR**

- b) Write briefly about (a) Special confining reinforcement (b) Principle of capacity design. 11 K2 CO5

28. a) Identify why the ductility consideration is very important in earthquake resistant design of RC building? Explain the ductile detailing considerations in flexural members as per IS 13920-1993. 11 K3 CO6

**OR**

- b) For a four storeyed RCC office buildings located in zone V and resting on hard rock, compute the seismic forces as per IS-1893-2002 equivalent static procedure. Height of first is 4.2 m and the remaining three stories are of height 3.2 m each. Plan dimensions (length and width) of the structure are 15 m x 20 m. The RCC frames are infilled with brick masonry. Dead load on floor  $12 \text{ kN/m}^2$  on floors and  $10 \text{ kN/m}^2$  on roof. Live  $4 \text{ kN/m}^2$  on floors and  $1.5 \text{ kN/m}^2$  on roof. 11 K3 CO6