

CBCS SCHEME



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15CV831

Eighth Semester B.E. Degree Examination, July/August 2021 Earthquake Engineering

Time: 3 hrs.

Max. Marks: 80

*Note: 1. Answer any FIVE full questions.
2. Use of IS 1893-2016 is permitted.*

- 1 a. Describe types and characteristics of faults with neat sketch. (08 Marks)
b. Describe the different types of waves generated by an earthquake. Which types of waves are the first to arrive at the site? How do velocities of Rayleigh and love waves vary with depth? Give the expressions for the velocities of P and S waves in terms of elastic constants. (08 Marks)
- 2 a. Calculate the wave velocity and epicenter distance of an earthquake. Data are as given below:
Energy released = 2.6 Ton/m³.
Modulus of elasticity of crustal rock = 60,000 MPa
 $\gamma = 0.25$. Assume Time gap = 15 sec. (08 Marks)
b. Discuss the characteristics of strong motion records with respect to amplitude, frequency and duration. (08 Marks)
- 3 a. Discuss free and forced vibration of SDOF system with neat sketch and expressions. (08 Marks)
b. Illustrate how to construct a response spectrum. Explain the tripartite plot with a typical sketch. (08 Marks)
- 4 Discuss numerical evaluation of response of SDOF system and list the steps involved in linear acceleration method. (16 Marks)
- 5 Discuss the types of damages to buildings observed during past earthquakes and also state seismic design philosophy. (16 Marks)
- 6 a. Discuss the effects of various configurations of multistoried buildings and their behavior during earthquake. (08 Marks)
b. Explain continuous load path and also explain the concept of soft storey, why is it problematic? How can this be remedied? (08 Marks)



- 7 a. A four storey reinforced concrete frame building as shown in Fig.Q7(a) is situated at Delhi. The height between the floors is 3.0m and total height 12m. The soil below the foundation is assumed to be hard rock. Assume building is intended to be used as an apartment. Determine the total base shear as per IS 1893-2016. Distribute the base shear along the height of the building. **(08 Marks)**

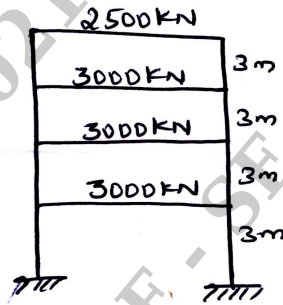


Fig.Q7(a)

- b. Discuss step by step procedures for seismic analysis of RC buildings using equivalent static lateral force method and response spectrum methods. **(08 Marks)**
- 8 Consider mass and stiffness matrix for the undamped free vibration of the system as below. Determine the lateral forces at each storey by response spectrum method use the eigen values given in the problem.

$$[M] = \begin{bmatrix} 64.45 & 0 & 0 & 0 \\ 0 & 64.45 & 0 & 0 \\ 0 & 0 & 64.45 & 0 \\ 0 & 0 & 0 & 37.08 \end{bmatrix} \text{ ton}$$

$$[K] = \begin{bmatrix} 71284.72 & -3564.36 & 0 & 0 \\ -3564.36 & 71284.72 & -3564.36 & 0 \\ 0 & -3564.36 & 71284.72 & -3564.36 \\ 0 & 0 & -3564.36 & 3564.36 \end{bmatrix} \text{ kN/m}$$

Eigen values $\omega_1^2 = 81$, $\omega_2^2 = 657$, $\omega_3^2 = 1475$, $\omega_4^2 = 2065$. **(16 Marks)**

- 9 Discuss failure modes of masonry structures during earthquake. Briefly describe codal recommendations to strengthen masonry buildings. **(16 Marks)**
- 10 Discuss typical failures of RC frame structures during earthquake. Briefly describe detailing of beam – column joints to enhance ductility. **(16 Marks)**
