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17CV831

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

Time: 3 hrs.

Max. Marks: 100

- Note :** 1. Answer any FIVE full questions.
2. Use of IS 1893 – 2002 and IS13920 is permitted.
3. Assume any missing data if any.

1. a. Explain with neat sketches, details of different types of Seismic waves and their propagation. (12 Marks)
b. Distinguish between magnitude and intensity of earthquake. (08 Marks)
2. a. What is Plate tectonic theory of origin of earthquakes? Explain associated type of movement at the plate boundaries. (10 Marks)
b. How are earthquakes classified based on different aspects? (06 Marks)
c. Describe Seismic zonation of India as per codal provisions. (04 Marks)
3. a. What is Response Spectrum? Explain the procedure of constructing a Response spectrum. (08 Marks)
b. What is Seismic Retrofitting? Explain its importance. (06 Marks)
c. What is Base Isolation? Discuss briefly the principles of base isolation. (06 Marks)
4. a. Describe the different types of Structural models. (08 Marks)
b. Evaluate the natural frequency and natural periods for the structural systems shown in Fig. Q4(b), when $L = 3.6m$, $E = 22000 \text{ MPa}$, $I = 1.2 \times 10^4 \text{ m}^4$, $K = 40 \text{ kN/m}$, $M = 10 \text{ kN}$. (12 Marks)

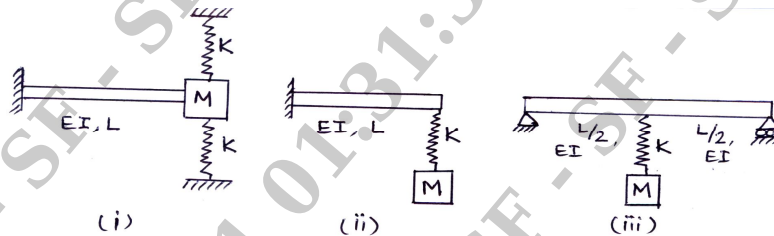
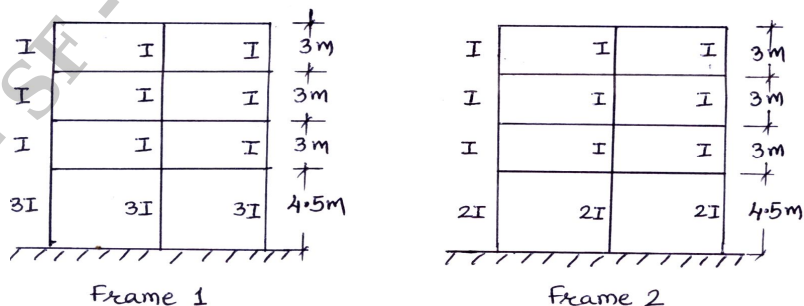


Fig. Q4(b)

5. a. Explain briefly about different types of plan and vertical irregularities and their consequences. (12 Marks)
b. Write the step – by – step procedure for seismic analysis of R.C. building by Response Spectrum method. (08 Marks)
6. a. Investigate whether the following building frames has soft storey or extremely soft storey. The masonry infill of the cross – section of each column of the frame is shown in Fig. Q6(a). (12 Marks)

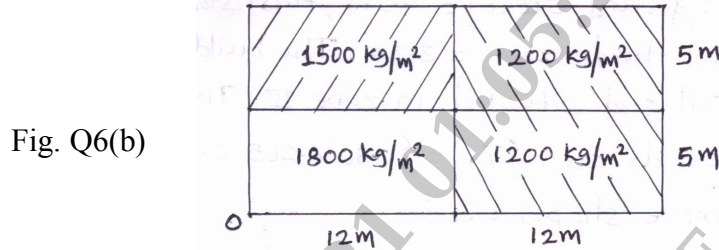
Fig. Q6(a)



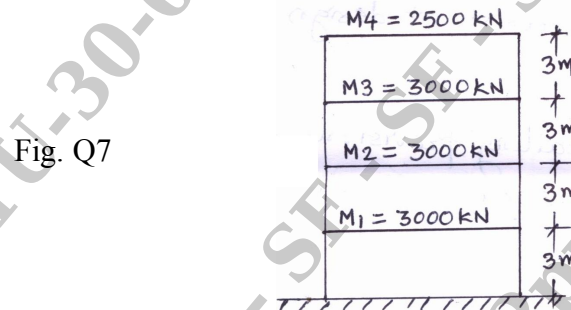
Frame 1

Frame 2

- b. A building having a non – uniform distribution of mass is shown in Fig. Q6(b). Locate its centre of mass. **(08 Marks)**



7. A four storey RC frame building as shown in Fig. Q7(a), below is situated at Roorkee. The total Dead load and live load is lumped at respective floor as shown. The soil below the foundation is hard rock. Determine the total base shear as per IS 1893 – 2002 and distribute the base shear along the height of the building. **(20 Marks)**



8. For an RCC (SMRF conforming to ductile detailing) building frame for office ($I = 1$), the seismic weights on the floors are : W_1 (roof) = 3000 kN , $W_2 = W_3 = W_4 = 4200$ kN. The storey heights are ground storey = 4.2m , first storey = 3.2m , second storey = 3.2m and third storey = 3.2m. The building is founded on hard soil and situated in zone IV. The first three natural periods are : $\{T_n\} = \{0.86 \ 0.265 \ 0.145\}$ sec and the first three mode shapes are :

$$\{\phi_1\} = \{1.00 \ 0.904 \ 0.716 \ 0.441\}$$

$$\{\phi_2\} = \{1.00 \ 0.216 \ -0.701 \ -0.921\}$$

$$\{\phi_3\} = \{1.00 \ -0.831 \ 0.574 \ 1.016\}$$

Determine the seismic forces by dynamic analysis procedure. **(20 Marks)**

9. a. Write short note on various load combinations to be considered for seismic resistant design of RCC structures. **(08 Marks)**
 b. What are the ductile detailing provisions for beams for flexure and shear? Explain with neat sketches. **(12 Marks)**
10. a. Explain the lessons learnt from the failure of masonry structures during the past earthquakes. **(10 Marks)**
 b. What are the special measures to make the masonry structures earthquake resistant? **(10 Marks)**

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