Chapter 4

Q1. What are the factors influencing response spectra?

Q2. Enlist and explain the errors encounter in the evaluation of response spectra?

Q3. Explain various modal combination rules used in seismic analysis.

Q4. Consider a SDOF system with mass, $m = 3 \times 10^3$ kg, stiffness, $k = 70$ kN/m and damping, $c = 1.3$ kN.sec/m. Using the response spectra of El-Centro, 1940 earthquake, compute (a) Maximum relative displacement, (b) Maximum base shear and (c) Maximum strain energy.

Q5. A 4-story building is to be constructed in the area of seismic zone II having medium soil. The dimension of the building is 10m × 20m. The height of each story is 3.6m. The live and dead load on each floor is 2.4 kN/m^2 and 8 kN/m^2, respectively. The live and dead load on the roof is 1.5 kN/m^2 and 4.5 kN /m^2, respectively. Take importance factor as 1 and response reduction factor as 5. Determine the seismic shear force in each story and overturning moment at the base as per IS: 1893 (Part 1)-2002. Take the value of Z=0.16 for Zone III and spectral acceleration for medium soil from IS: 1893 (Part 1)-2002 as

$$\frac{S_a}{g} = \begin{cases} 1+15T \ \ for \quad 0 \le T \le 0.1 \\ 2.5 \qquad 0.1 \le T \le 0.55 \\ 1.36/T \quad 0.55 \le T \le 4 \end{cases}$$

Q6. A 2-degrees-of-freedom system (Figure below) is subjected to horizontal earthquake excitation of El-Centro, 1940 earthquake. Take the flexural rigidity, $EI = 10^6$ N.m^2 and length, L = 1.5m. The each lumped mass is 150 kg. Determine the maximum displacement of the two masses and base shear. Take 2% damping in each mode of vibration.