B.Tech. 7th Semester (Civil Engg.) Examination, December–2011

ELEMENTS OF EARTHQUAKE ENGINEERING

Paper–CE–411–E

Time allowed : 3 hours] *[Maximum marks : 50*

Note : *Attempt five questions in all. All questions carry equal marks. Neat diagrams must be drawn wherever necessary. Your answers will be valued as a whole. Use of logarithmic tables, unprogrammable electronic pocket calculator is allowed. Assume missing data if any, suitably. Use of I.S. Codes (latest) are allowed.*

1. (a) Define Seismology and Lateral Loads.

   (b) Classify and describe with suitable sketches different types of waves generated by an earthquake and their effects on structure.

   4+6=10

2. (a) What is intensity of earthquake ? Describe Modified Mercalli Earthquake Intensity scale and Magnitude of earthquake.

(b) Give details of expected damages by earthquake in structures with (i) Soft Storeys and (ii) Unsymmetric Plan. 6+4=10

3. Single bay two storey portal frames are used for a building. Height of columns in each storey is 5 m and span of the beams is 8 m. The frames are 5 m c/c along length of the building. Calculate lateral forces induced at each beam level due to earthquake force acting along direction of beams. Building is in zone IV. Dead load on each floor is 5 kN/m^2 and carry Imposed load of 3 kN/m^2. Assume other data. 10

4. (a) For a single degree damped free vibration system, derive the expression for damped frequency and critical damping.

or

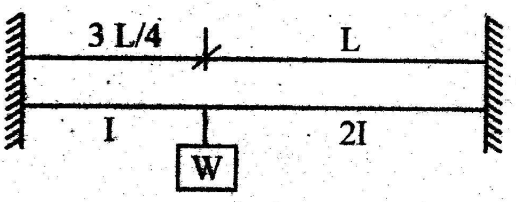
(b) Explain transient and steady state vibrations.

(c) A roof of one storey building has a mass of 1500 kg. All columns supporting roof together offer lateral stiffness of 20,000 N/m. The viscous

damping coefficient is 5000 N/m/s. Calculate undamped natural frequency, damped frequency and period. 4+6=10

5. Calculate the normal frequency and mode shapes of a three storey building having equal floor masses and uniform stiffness of columns in each storey. The building consists of one bay only. 10

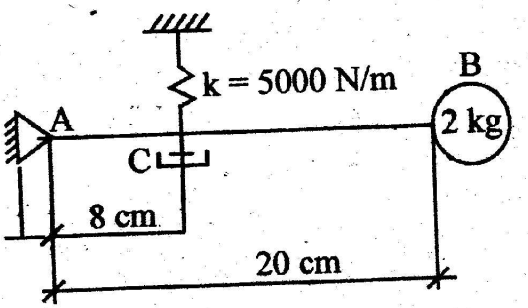
6. (a) A fixed beam is subjected to a weight W as shown below :



(b) State and prove orthogonality principle of normal modes. 6+4=10

7. (a) Differentiate between dynamic and static load.

(b) What is response spectrum ? Explain how is it created. 2+3=5

(c) Determine the critical damping coefficient for the system.

Shown in figure below. The mass less rod is hinged at A. +5=10