Code.No: 07A70104 | R07 | SET-1

IV B.TECH – I SEM EXAMINATIONS, NOVEMBER - 2010
EARTH QUAKE RESISTANT DESIGN
(CIVIL ENGINEERING)

Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks
- - -

1. Derive the equation of motion for an undamped free vibration of motion for Single degree of Freedom (SDOF) from first principles. Write the equations for maximum displacement amplitude and phase angle. [16]

2. Discuss the application of Model superposition method for finding the response of MDOF system. [16]

3. Determine the natural frequencies of vibration and corresponding mode shapes for a single bay three storied building of width 4 m and constant storey height of 3 m. The building has lumped floor masses and storey stiffnesses (Top to Bottom) as follows: m_1 = 0.1 kN sec^2 /mm; m_2 = 0.15 kN sec^2 /mm; m_3 = 0.2 kN sec^2 /mm; k_1 = 60 kN / mm ; k_2 = 120 kN / mm; k_3 = 180 kN / mm. [16]

4. a) For the building shown in Fig.1, locate the centre of mass. The building has non-uniform distribution of mass as shown in the Figure 1.

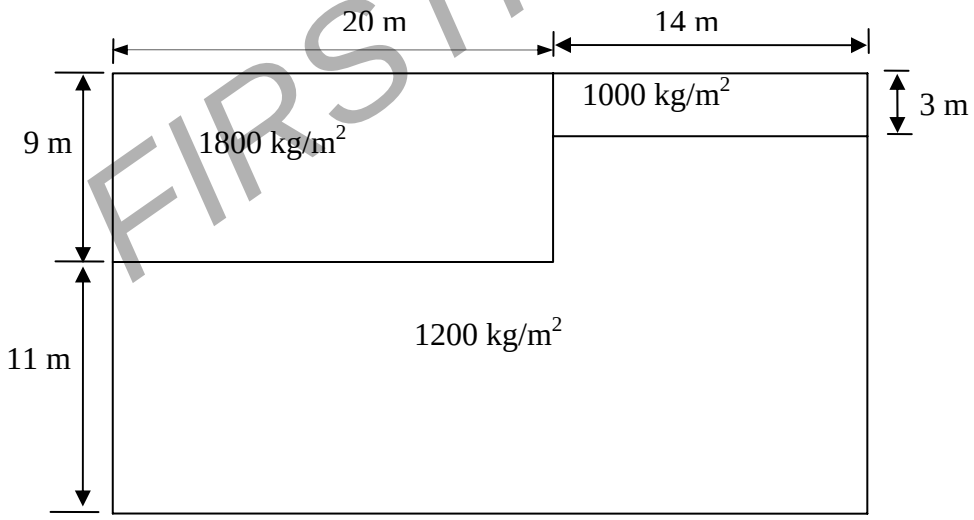

Figure 1: Plan of a Building

b) The plan of a one-storey building is shown in the Figure 2. All the columns and beams have the same cross-section. Obtain its centre of Stiffness. [8+8]

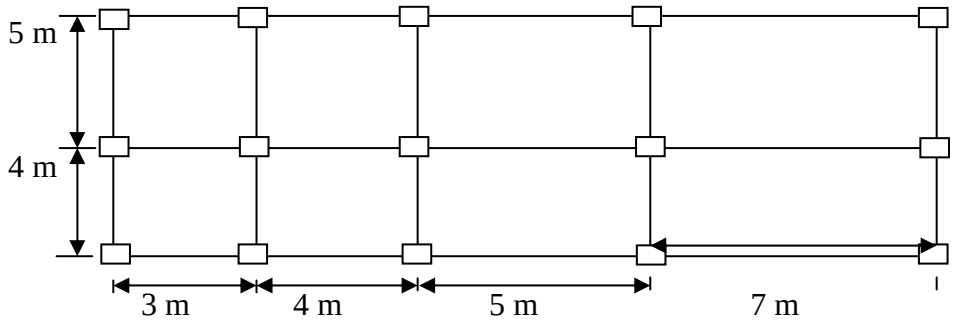

Figure 2: Plan of a Building

5. a) Write short notes on (i) Seismograph and (ii) Strong ground motion.
b) Explain the relation between local magnitude and the intensity of sustained at the epicenter. [16]

6. a) Discuss the direct and indirect effects of earthquakes.
b) Explain the '100% + 30% rule' for non-orthogonal systems and discuss the total number of design load combinations to be considered for complex structural systems such as 'nuclear reactor'. [16]

7. A beam AB is to be designed for positive and negative moments at the supports A and B . Moments at the supports A and B are, M_A= - 81 kNm and +27 kNm; M_B= - 92 kNm and +7 kNm. The characteristic dead and live loads are 12 and 7 kN/m respectively. The span of beam is 8m, beams are 300 × 550 mm with 150 mm slab. Assume M25 concrete and Fe 500 grade steel. The structure is situated in seismic zone III. Design both the flexure and shear reinforcement as per IS 13920. [16]

8. a) Discuss the strategies in the location of Structural walls in buildings with neat sketches.
b) Discuss the behaviour of Squat and Tall shear walls with neat sketches. [16]

*****

Code.No: 07A70104 | R07 | SET-2

IV B.TECH – I SEM EXAMINATIONS, NOVEMBER - 2010
EARTH QUAKE RESISTANT DESIGN
(CIVIL ENGINEERING)

Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks
- - -

1. A SDOF system is subjected to a harmonic loading defined by $P(t) = P_0 \sin \omega t$. Derive the expression for the dynamic displacement for the under damped vibrations. Sketch the response. [16]

2. Discuss the method by which the response of MDOF system is reduced to response of SDOF system. [16]

3. A beam AB is to be designed for positive and negative moments at the supports A and B. Moments at the supports A and B are, M_A= - 92 kNm and +25 kNm; M_B= - 86 kNm and +9 kNm. The characteristic dead and live loads are 14 and 9 kN/m respectively. The span of beam is 10 m, beams are 300 × 550 mm with 150 mm slab. Assume M30 concrete and Fe 500 grade steel. The structure is situated in seismic zone IV. Design both the flexure and shear reinforcement as per IS 13920. [16]

4. a) Explain causes of earthquake with the help of 'plate-tectonics' theory.
   b) An earthquake causes an average of 2.0 m strike-slip displacement over a 100 km long, 25 km deep portion of a transformed fault. Assuming the average rupture strength along the fault as 200kN/m^2, estimate the seismic moment, moment magnitude and seismic energy. [8+8]

5. a) Briefly explain various systems suitable to resist Lateral Loads
   b) Response Spectrum method with a neat sketch. [8+8]

6. a) For the building shown in Fig.1, locate the centre of mass. The building has non-uniform distribution of mass as shown in the Figure1.

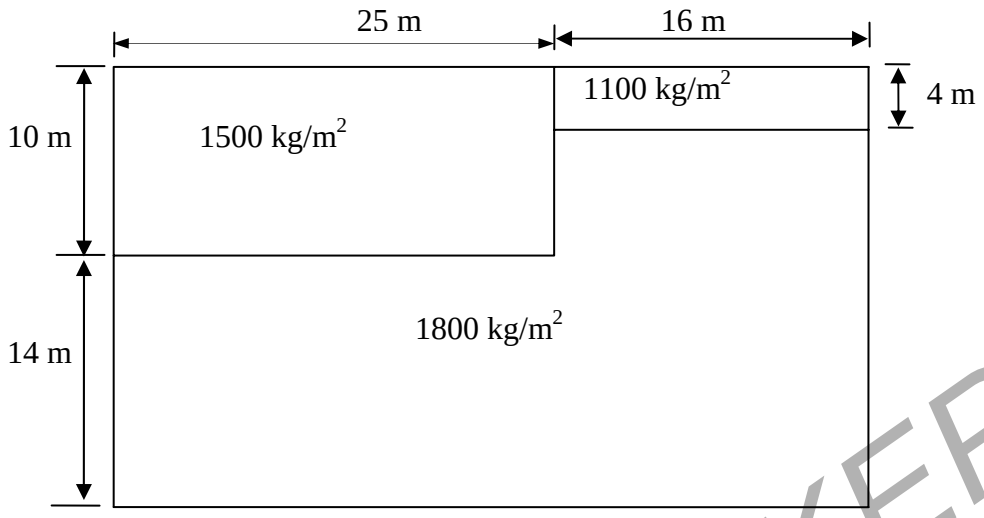

Figure1: Plan of a Building

b) The plan of a one-storey building is shown in the Figure 2. All the columns and beams have the same cross-section. Obtain its centre of Stiffness. [8+8]

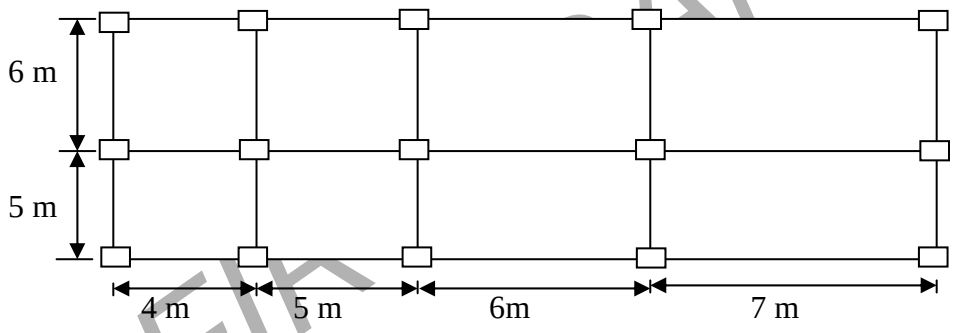

Figure 2: Plan of a Building

7. Determine the natural frequencies of vibration and corresponding mode shapes for a single bay three storied building of width 4 m and constant storey height of 3 m. The building has lumped floor masses and storey stiffnesses (Top to Bottom) as follows: m_1 = 0.2 kN sec^2 /mm ; m_2 = 0.3 kN sec^2 /mm; m_3 = 0.25 kN sec^2 /mm; k_1 = 70 kN / mm ; k_2 = 120 kN / mm; k_3 = 200 kN / mm. [16]

8. a) Discuss the strategies in the location of Structural walls in buildings.
b) Briefly explain how the 'member ductility' and 'structural system ductility' can be estimated for an RC structure. Explain the relation between them with a sketch. [8+8]

*****

Code.No: 07A70104 | R07 | SET-3

IV B.TECH – I SEM EXAMINATIONS, NOVEMBER - 2010
EARTH QUAKE RESISTANT DESIGN
(CIVIL ENGINEERING)

Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks
- - -

1. Derive the equation of motion for damped free vibration of motion for Single degree of Freedom (SDOF) from first principles. Write the equations for maximum displacement amplitude and phase angle. [16]

2. Discuss orthogonality property of normal modes a MDOF system. [16]

3. a) Define structural walls. How are they classified? Explain their structural behaviour with neat sketches.
   b) Discuss the concept of flanged shear wall with neat sketches. [8+8]

4. A beam AB is to be designed for positive and negative moments at the supports A and B. Moments at the supports A and B are, M_A= - 76 kNm and +31 kNm; M_B= - 100 kNm and +12 kNm. The characteristic dead and live loads are 11 and 7 kN/m respectively. The span of beam is 9 m, beams are 300 × 550 mm with 150 mm slab. Assume M25 concrete and Fe 415 grade steel. The structure is situated in seismic zone V. Design both the flexure and shear reinforcement as per IS 13920. [16]

5. a) What is an earthquake? What is meant by focus and epicenter of an earthquake?
   b) Discuss the main characteristics of seismic waves. [8+8]

6. a) Discuss the advantages and disadvantages of flexible and stiff structures.
   b) How does earthquake resistance of a structure affected by
      i) unsymmetry and
      ii) elongated shape of buildings. [8+8]

7. a) For the building shown in Figure 1, locate the centre of mass. The building has non-uniform distribution of mass as shown in the Figure1.

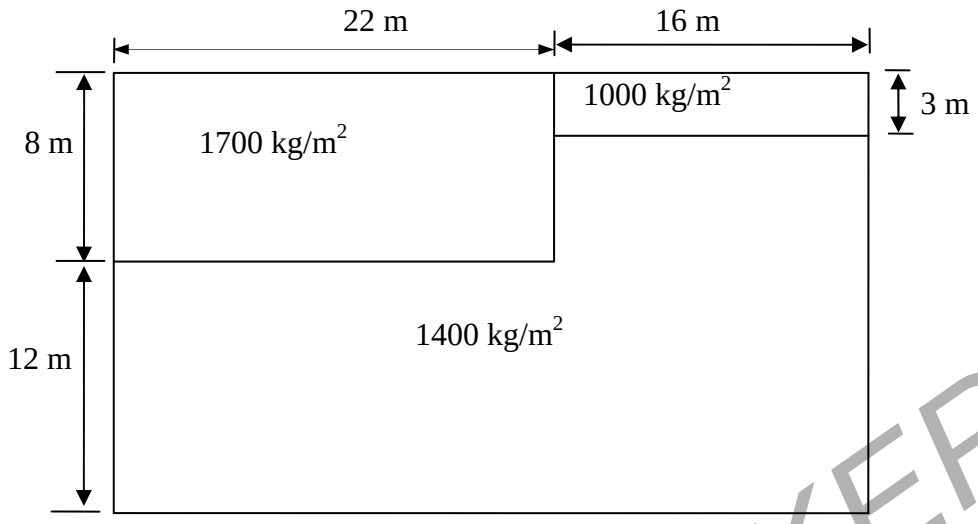

Figure 1: Plan of a Building

b) The plan of a one-storey building is shown in the Figure 2. All the columns and beams have the same cross-section. Obtain its centre of Stiffness. [16]

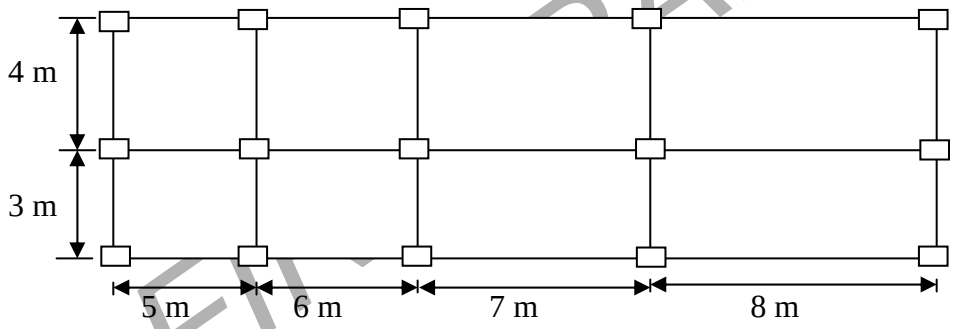

Figure 2: Plan of a Building.

8. Determine the natural frequencies of vibration and corresponding mode shapes for a single bay three storied building of width 4 m and constant storey height of 3 m. The building has lumped floor masses and storey stiffnesses (Top to Bottom) as follows: m_1 = 0.16 kN sec^2 /mm; m_2 = 0.28 kN sec^2 /mm; m_3 = 0.34 kN sec^2 /mm; k_1 = 80 kN / mm ; k_2 = 150 kN / mm; k_3 = 190 kN / mm. [16]

*****

Code.No: 07A70104 | R07 | SET-4

IV B.TECH – I SEM EXAMINATIONS, NOVEMBER - 2010
EARTH QUAKE RESISTANT DESIGN
(CIVIL ENGINEERING)

Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks
- - -

1. a) A mass of 5 kg is attached to a spring with a stiffness of 2.5 N/mm. Determine the critical damping coefficient.
   b) Derive the expression for the dynamic displacement of an SDOF system for the undamped free vibrations. Sketch the response. [8+8]

2. Determine the natural frequencies of vibration and corresponding mode shapes for a single bay three storied building of width 4 m and constant storey height of 3 m. The building has lumped floor masses and storey stiffnesses (Top to Bottom) as follows: m_1 = 0.25 kN sec^2 /mm; m_2 = 0.35 kN sec^2 /mm; m_3 = 0.4 kN sec^2/mm; k_1 = 75 kN / mm ; k_2 = 140 kN / mm; k_3 = 200 kN / mm. [16]

3. Discuss rigid base excitation of SDOF system from first principles. [16]

4. a) Explain causes of earthquake with the help of 'plate-tectonics' theory.
   b) An earthquake causes an average of 3.0 m strike-slip displacement over a 120 km long, 35 km deep portion of a transformed fault. Assuming the average rupture strength along the fault as 210 kN/m^2, estimate the seismic moment, moment magnitude and seismic energy. [8+8]

5. a) Discuss plan irregularities in buildings with neat sketches.
   b) Explain how torsion gets induced in buildings, with sketches. [8+8]

6. A beam AB is to be designed for positive and negative moments at the supports A and B. Moments at the supports A and B are, M_A= - 85 kNm and +30 kNm; M_B= - 96 kNm and +8 kNm. The characteristic dead and live loads are 15 and 6 kN/m respectively. The span of beam is 10 m, beams are 300 × 550 mm with 150 mm slab. Assume M20 concrete and Fe 415 grade steel. The structure is situated in seismic zone IV. Design both the flexure and shear reinforcement as per IS13920. [16]

7. Discuss the design procedure for squat shear wall as per IS 13920. [16]

8. a) For the building shown in Figure 1, locate the centre of mass. The building has non-uniform distribution of mass as shown in the Figure1.

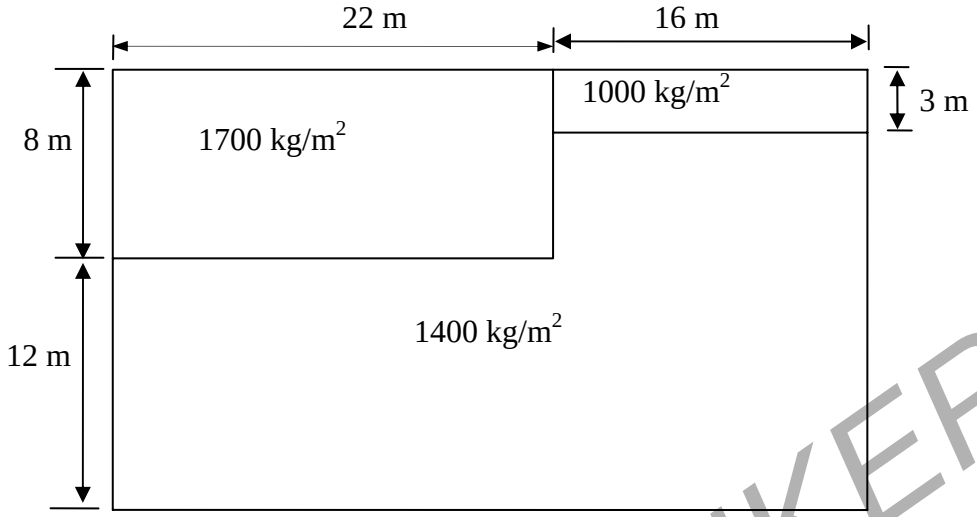

Figure1: Plan of a Building

b) The plan of a one-storey building is shown in the Figure 2. All the columns and beams have the same cross-section. Obtain its centre of Stiffness. [16]

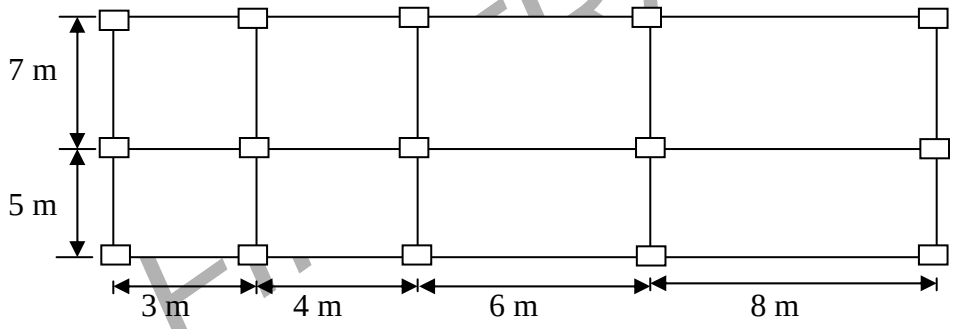

Figure 2: Plan of a Building

*****