Code No: M0125 **R07** **Set No. 1**

IV B.Tech. I Semester Regular Examinations, November, 2011
EARTHQUAKE RESISTANT DESIGN
(Civil Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. a) Describe types and characteristics of typical dynamic loading with examples and essential characteristics of dynamic problem.
   b) Describe various methods of descretization of the analysis of dynamic system.

2. A vehicle of weight 1600 kg and its spring stiffness is defined by a test, which showed that adding 50 kg caused a deflection of 0.2 cm. The bridge profile is represented by a sine curve having wave length (girder span) of 12 m and an amplitude of 3 cm. Predict the steady state vertical motion in the car when it is traveling at a speed of 70 km /hr assuming that the damping is 40 percent of critical.

3. The following details are available for a multistory moment resisting building. Compute the lateral forces developed at various levels using I.S code 1893-1984. Number of stories = 6, Constant $\beta = 1.2$. Basic horizontal seismic coefficient $\alpha_o = 0.055$. Importance factor I = 1.0. Performance factor K= 1.0. Load at each i_{th} floor W_i = 500 KN. Height of each i_{th} floor H_i = 3.0 m

4. a) Derive expression for base shear for a single degree freedom system in the form of a mass spring damper subjected to ground acceleration x_g= a Sin wt
   b) Compute the value of base shear induced in bottom portion of the tank during earthquake with the following data. Weight of empty tank= 500kN. Weight of full tank = 2000kN. Spring factor for tank and tower= 90 kN / cm. Maximum ground acceleration = 0.05g. Ground motion = a Sin wt. Acceleration due to gravity = 981 cm/sec^2. Period of steady state ground motion = 1.5 sec.

5. a) Explain earthquake ground motion characteristics
   b) In what way is the earthquake resistance of a structure affected by
   (i) Non symmetry and (ii) elongated shape of the building

6. Explain typical reinforcement arrangement for beam column joint of reinforced concrete buildings to have resistance to earthquake forces.

7. a) Explain factors under consideration for earth quake resistant design.
   b) Discus effect of structural irregularities on the performance of RC buildings during earthquake

8. a) Explain concept of shear walls in high rise buildings.
   b) Explain various types of structural features resisting lateral shears and discuss their performance characteristics.

Code No: M0125 **R07** **Set No. 2**

IV B.Tech. I Semester Regular Examinations, November, 2011
EARTHQUAKE RESISTANT DESIGN
(Civil Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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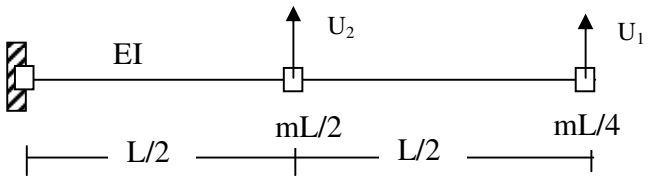
1. a) Describe types and characteristics of typical dynamic loading with examples and essential characteristics of dynamic problem.
   b) Explain D'Alembert's Principle. How it is useful in solving dynamics problems.

2. An empty elevated water tank is pulled by a steel cable by applying a 30KN force. The tank is pulled horizontally by 5cm. the cable is suddenly cut and the resulting free vibration is recorded. At the end of 5 complete cycles the time is 2 secs. And the amplitude is 2cm. determine the damping ratio, natural period of undamped vibration, Effective stiffness, Effective weight, and Damping coefficient for the given data.

3. Determine the natural frequencies and mode shapes of the system shown in *figure* .Verify the orthogonality of the modes.



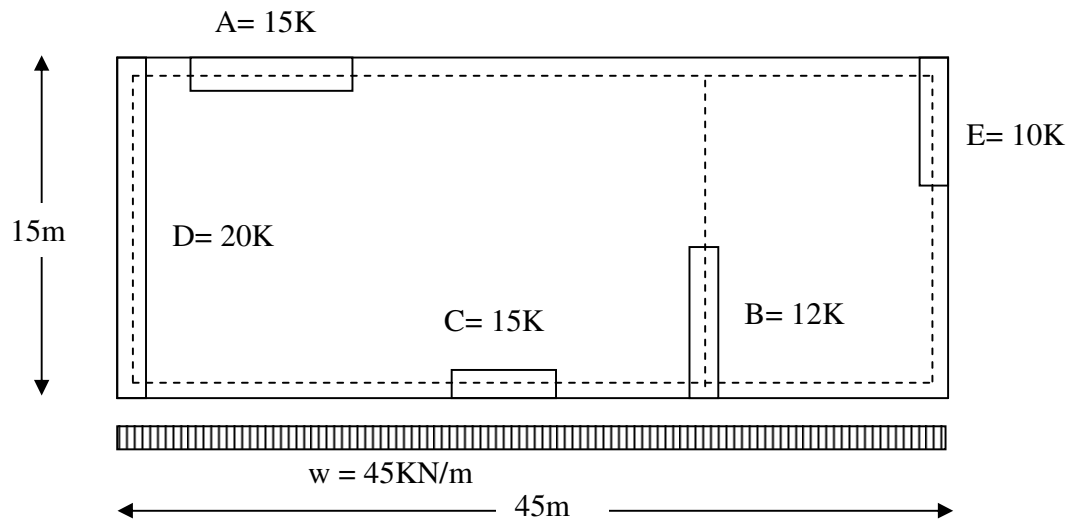
4. a) What is response spectra and explain the importance of in seismic design of a structure.
   b) The following details are available for a multistory moment resisting building. Compute the lateral forces developed at various levels using I.S code 1893-1984. Number of stories = 4, Constant $\beta = 1.2$. Basic horizontal seismic coefficient $\alpha_o = 0.055$. Importance factor I = 1.0. Performance factor K= 1.0. Load at each i_{th} floor $W_i = 500$ KN. Height of each i_{th} floor $H_i = 3.0$ m.

5. Explain the following earthquake terminology
   a) Source and Focus
   b) Epicenter and Plate tectonics
   c) Intensity and magnitude of the earthquake

6. Explain developments on designing earthquake resistant structures and modifications to RCC structures with reinforcement arrangement to incorporate ductile design to have resistance to earthquake forces.

7. a) Explain factors under consideration for earth quake resistant design.
   b) Discuss various earthquake resistant design methods
   c) List out and explain the various factors affecting the response of the building

8. A 40m ×15m building having 5 shear walls ABCDE as shown. A UDL of 50 kN/m is acting as shown in figure. Find load distribution on walls and angle of twist of the building.



Code No: M0125 **R07** **Set No. 3**

IV B.Tech. I Semester Regular Examinations, November, 2011
EARTHQUAKE RESISTANT DESIGN
(Civil Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. An empty elevated water tank is pulled by a steel cable by applying a 25KN force. The tank is pulled horizontally by 5cm. the cable is suddenly cut and the resulting free vibration is recorded. At the end of 6 complete cycles the time is 2 secs. And the amplitude is 2cm. determine the damping ratio, natural period of undamped vibration, Effective stiffness, Effective weight, and Damping coefficient for the given data.

2. A machine weighing 250 kg is mounted on a supporting system consisting of four springs and four dampers. The vertical deflection of the supporting system under the weight of the machine is measured as 0.8 cm, the dampers are designed for reducing the amplitude of vertical vibration to one eighth of the initial amplitude after two complete cycles of free vibration. Find the following properties of the system
   a) Undamped natural frequency
   b) Damping ratio
   c) Damped natural frequency

3. Explain
   a) Dynamic soil properties
   b) Settlement of dry sands
   c) Liquefaction
   d) Soil amplification

4. The following details are available for a water tank when it is full. Compute the base shears if the tank is located in zone III using response spectrum method. Weight of full tank = 2500 kN. Acceleration due to gravity = 981 cm/sec^2 spring factor K= 90 kN/cm consider Importance factor = 1.5 factor for soil foundation system = 1.2 assume 20% damping.

5. Explain
   a) Causes and effects of earthquake
   b) Seismograms and Accelerograms
   c) Elastic Rebound Theory

6. Explain ductile detailing considerations in flexural members typical reinforcement arrangement for beam column joint of reinforced concrete buildings with neat diagrams.

7. a) Explain factors various methods of seismic analysis
   b) List out and explain the various factors affecting the response of the building to lateral loads and explain ideal conditions.

8. a) Explain concept of shear walls in high rise buildings. Explain various types of structural features resisting lateral shears and discuss their performance characteristics.
   b) Explain design of shear walls

Code No: M0125 **R07** **Set No. 4**

IV B.Tech. I Semester Regular Examinations, November, 2011
EARTHQUAKE RESISTANT DESIGN
(Civil Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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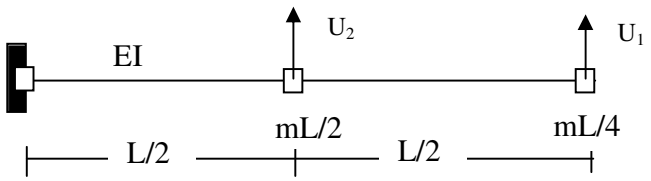
1. a) Describe types and characteristics of typical dynamic loading with examples and essential characteristics of dynamic problem.
   b) Describe various methods of descretization of the analysis of dynamic system.

2. Explain
   a) Damped free vibration
   b) Under damped / Over damped / Critically damped systems
   c) Derive expression relating the decay of motion associated with damping

3. A vehicle of weight 1500 kg and its spring stiffness is defined by a test, which showed that adding 50 kg caused a deflection of 0.2 cm. The bridge profile is represented by a sine curve having wave length (girder span) of 12 m and an amplitude of 3 cm. Predict the steady state vertical motion in the car when it is traveling at a speed of 75 km /hr assuming that the damping is 40 percent of critical.

4. Determine the natural frequencies and mode shapes of the system shown in *figure.* Verify the orthogonality of the modes.



5. a) What is response spectra and explain the importance of in seismic design of a structure.
   b) The following details are available for a multistory moment resisting building. Compute the lateral forces developed at various levels using I.S code 1893-1984.
   Number of stories = 8. Constant β = 1.2.
   Basic horizontal seismic coefficient α_o= 0.055. Importance factor I = 1.0.
   Performance factor K = 1.0 Load at each i_{th} floor W_i = 600 KN.
   Height of each i_{th} floor H_i = 3.0 m

6. a) Explain effect of earthquake forces on masonry structures
   b) Explain base isolation and list out various base isolation and vibration energy dissipating devises.

7. Explain the following with reference to Earth quake resistant reinforcement design
   a) Provisions in column and frame members subjected to bending and axial loads
   b) Provisions for longitudinal reinforcement
   c) Special confinement reinforcement

8. Explain
   a) Shear walls and performance of buildings with shear walls subjected to horizontal forces
   b) Behavior of tall shear walls