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**CE412(CEEL12) (R20)**

B.TECH. DEGREE EXAMINATION, DECEMBER-2024

Semester VII [Fourth Year] (Regular & Supplementary)

# EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

Time: Three hours | Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:

| | | |
|---|---|---|
| (a) | Define earthquake. | CO1 |
| (b) | Classify earthquakes based on location. | CO1 |
| (c) | Define seismograph. | CO1 |
| (d) | Differentiate between P-waves and S-waves. | CO1 |
| (e) | Illustrate the factors affecting ground motion. | CO2 |
| (f) | Which foundation is best suitable for earthquake resistant structure? | CO2 |
| (g) | What is effect of type of soil in design of earthquake resistant structure? | CO2 |
| (h) | Define base shear. | CO3 |
| (i) | Discuss the types of damping. | CO3 |
| (j) | How mass irregularities differ from plane irregularities. | CO3 |
| (k) | Formulate the expression for time period as per IS:1893. | CO3 |
| (l) | Examine the factors affecting ductility. | CO4 |
| (m) | Define the modal participation factor. | CO4 |
| (n) | Explain the purpose of shear walls in earthquake resistant structures. | CO4 |

## UNIT – I

| | | | |
|---|---|---|---|
| 2. (a) | List out the causes of the earthquake and explain it briefly. | (7M) | CO1 |
| (b) | Explain the composition of the earth in detail. | (7M) | CO1 |

(OR)

3. Derive the solution for damped SDOF system with free vibration and explain under damped, over damped and critically damped systems. CO1

UNIT – II

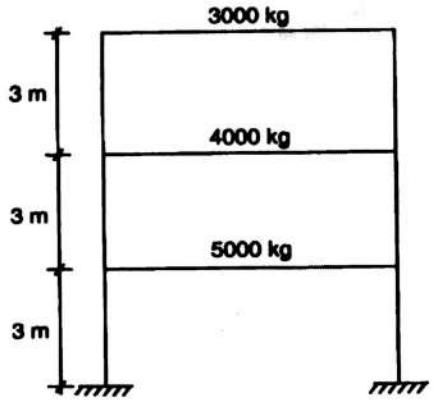
4. Classify seismic zoning of India as per IS 1893:2002. CO2

(OR)

5. Explain various building characteristics of seismic-resistant building in detail. CO2

UNIT – III

6. A three storey RC frame school building is located in Chennai as shown in figure. The total height of the building is 9 m. The dead load and live load is lumped at respective floor. The soil below the foundation is medium type. Determine the total base shear and draw the vertical distribution. CO3




(OR)



7. A three storied symmetrical RC school building situated at Bhuj with following data:
Plan dimension: 7 m
Storey height: 3.5 m
Total weight of beams in a storey: 130 kN
Total weight of slabs in a storey: 250 kN
Total weight of columns in a storey: 50 kN
Total weight of walls in a storey: 530 kN
Live load: 130 kN
Weight of terrace floor: 655 kN
The structure is resting on hard rock. Calculate the total base shear. CO3

UNIT – IV

8. Design the reinforcement for a column as per IS:13920-1993 for the following data: Size of column = 450 x 450 mm, Unsupported length = 3 m.

| Load | Dead load | Live load | Seismic load |
|---|---|---|---|
| Axial Load (kN) | 1000 | 800 | 550 |
| Moment (kNm) | 50 | 40 | 100 |

Use M25 grade concrete and Fe415 grade steel. CO4

(OR)

9. Explain the methods to assess slope stability under seismic loads. CO4

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**CE412(CEEL12) (R20)**

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**CE314(CEEL12) (R20)**

B.TECH. DEGREE EXAMINATION, JUNE-2023

Semester V [Third Year] (Supplementary)

# EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

Time: Three hours | Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) Define resonance. CO1
   (b) Define focus and epicentre. CO1
   (c) Sketch mass-spring-dashpot system. CO1
   (d) State response of a structure. CO2
   (e) Explain the importance of under-damping system. CO2
   (f) Define seismic zone. CO2
   (g) What are the major aspects involved in seismic-resistant building construction. CO3
   (h) Define mode shape. CO3
   (i) Define drift. CO3
   (j) The average acceleration coefficient is given by _____. CO4
   (k) What is the code used for ductile detailing of structure in India? CO4
   (l) Why beam column joints are so important in earthquake resistant design of structures? CO4
   (m) Define Liquefaction. CO4
   (n) State sliding blocking methods. CO4

## UNIT – I

2. (a) Define an earthquake and what are causes of earrthquake. (7M) CO1
   (b) Explain rigid base isolation technique. (7M) CO1

(OR)

3. (a) Distinguish between damped and undamped systems and also explain the characteristics of various damped systems. (7M) CO1
   (b) Explain the uses of response spectra. (7M) CO1

UNIT – II

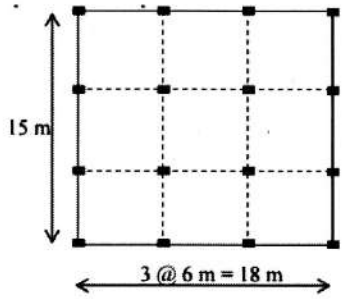
4. What are the various vertical irregularities and explain them with a neat sketch. CO2

(OR)

5. What do you understand by intensity of earthquake? Explain briefly different types of scales used to measure the intensity of earthquake. CO2

UNIT – III

6. Determine the design seismic load on each frame of a five-storeyed reinforced concrete telephone exchange building located in Vijayawada, the plan is as shown in figure. The soil condition is medium soil. The reinforced concrete frames are filled with brick masonry and the height of each storey is 3.6 m. The lumped weight due to dead load is 1 kN/sqm on floors and 2 kN/sqm on roof. The live load on the floors is 3 kN/sqm and 2 kN/sqm on roof.

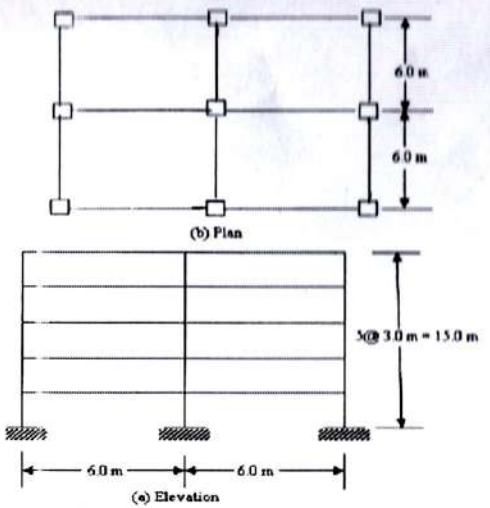



CO3

(OR)



7. For the typical 5 storey building shown in figure, calculate the lateral forces using seismic coefficient method for the following details:




Seismic zone: IV, Floor and roof slab thickness: 150 mm, Beam size: 300 x 450 mm, Column size: 400 mm x 400 mm, wall thickness: 230 mm (internal and external), dead load 3 kN/m$^2$ and Live load 4 kN/m$^2$. CO3

UNIT – IV

8. Draw the ductile detailing provisions of an RC beam as per the IS code of practice and also explain the salient features. CO4

(OR)

9. (a) Explain the various parameters influencing the ductility of RC structural components. (7M) CO4
   (b) Briefly discuss about liquefaction hazard mitigation. (7M) CO1

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**CE314(CEEL12) (R20)**

B.TECH. DEGREE EXAMINATION, MARCH-2023

Semester V [Third Year] (Regular)

# EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

Time: Three hours | Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) What is an earthquake? CO1
   (b) Define seismology. CO1
   (c) What are the earthquake parameters? CO1
   (d) Compare and contrast focus and epicentre. CO1
   (e) Formulate simple harmonic motion. CO1
   (f) Enumerate about zoning of earthquake. CO2
   (g) How can the intensity of earthquake measured? CO2
   (h) Define mode shape. CO2
   (i) Define response spectra. CO2
   (j) Discuss the types of damping. CO2
   (k) List the different types of irregularities in buildings. CO3
   (l) Define the term base shear. CO3
   (m) What is the use of shear wall in multi-storeyed structure? CO4
   (n) What is meant by liquefaction? CO4

## UNIT – I

2. (a) Discuss various causes and effects of an earthquake? (7M) CO1
   (b) Explain in detail the propagation of seismic waves. (7M) CO1

(OR)

3. Derive the equation of motion for damped and un-damped single degree of freedom system with free vibration. CO1

## UNIT – II

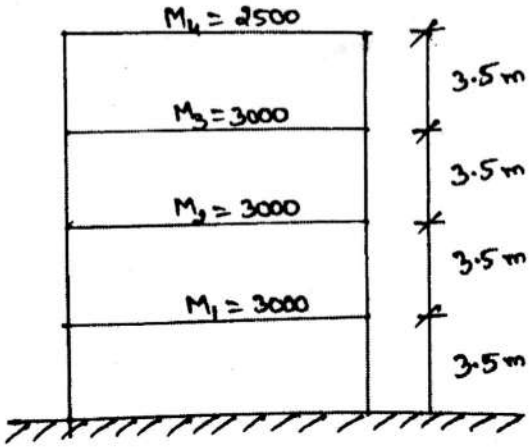
4. (a) Explain the difference between magnitude and intensity of Earthquake. (7M) CO2
   (b) Discuss different ground motion characteristics. (7M) CO2

(OR)

5. What are building configurations? Explain various problems associated with building configuration and suggest solutions with neat sketches. CO2

## UNIT – III

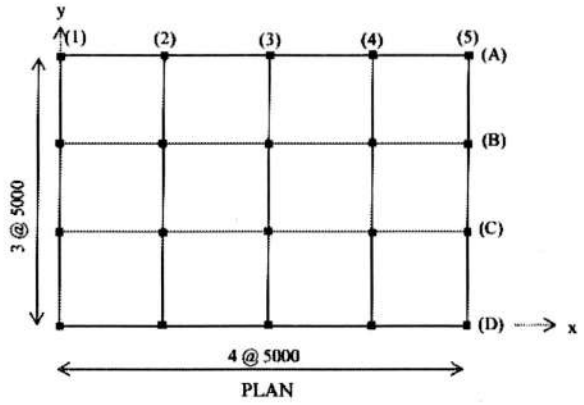
6. A four storey reinforced concrete frame building as shown in figure, is situated at Amritsar. The height between the floors is 3.5 m and the total height of building is 14 m. The dead load and normal live load is lumped at respective floor. The soil below the foundation is assumed to be hard rock. Assume the building is intended to be used as a hospital. Determine the total base shear as per IS 1893:2002. CO3




(OR)



7. The plan of a three-storeyed reinforced school building is shown below. The building is located in Roorkee. The type of soil encountered is medium stiff and entire building is supported on a raft foundation. It is proposed to design the building as a moment-resisting frame. The lumped weight due to dead loads is 12 kN/m$^2$ on floors and 10 kN/m$^2$ on the roof. The floors are to cater for a live load of 4 kN/m$^2$ on floors and 1.5 kN/m$^2$ on the roof. Determine design seismic load on the structure by static analysis. Storey height of each floor is 3 m. CO3




## UNIT – IV

8. (a) Explain the factors affecting the ductility in reinforced concrete structures. (7M) CO4
   (b) Write the ductile detailing considerations for longitudinal reinforcement in flexural members. (7M) CO4

(OR)

9. (a) Discuss the mitigation methods of liquefaction hazard. (7M) CO4
   (b) Explain the method of Pseudo-static analysis for evaluating the inertial slope stability. (7M) CO4

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