

MANIPAL UNIVERSITY JAIPUR
School of Civil and Chemical Engineering (SCCE)
Department of Civil Engineering
End Semester Examination, Dec - 2016
1st Semester M.Tech (Structural Engineering)
CV 2151 Earthquake Resistant Design of Structures
CLOSE BOOK EXAMINATION

Duration: 3 hour

Max. Marks: 100

Note: 1. Answer any five full questions.

2. Any Missing data may be suitably assumed.

3. Use of IS 1893:2002 & IS 13920-1993 is permitted.

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|------|-----|--|------|
| Q 1. | i | Explain the Phenomenon of earthquake. | [10] |
| | ii | Explain elastic rebound theory. | [10] |
| Q 2. | i | Derive an equation for damped free vibration. Use suitable diagrams wherever necessary. | [15] |
| | ii | In IS 1893 it has been assumed that wind and earthquake do not come to a structure together. What could be the possible reasons behind this assumption. Support your answer taking reference of safety, economy etc. | [5] |
| Q 3. | i | Consider a situation in which the infilled walls of a building is replaced with shear walls. What will be the response of the structure during an earthquake? | [10] |
| | ii | Based on the data in figure 2, calculate and plot a probable response spectra for all the three SDF systems including all three types of response spectrum. | [10] |
| Q 4. | i | Why do you need to reduce the response of a structure while calculating base shear using equivalent static analysis method? | [5] |
| | ii | In case of RSA plotting why is the term pseudo used. | [3] |
| | iii | What are two types of non-linearity in a structural element possible? Also list the different types of irregularities in a building. | [7] |
| | iv | Briefly explain Pushover analysis and define the term performance point. | [5] |
| Q 5. | i | What are the three types of damping in a structure? Give examples for each type of damping along with graph? | [4] |
| | ii | Derive the expression for logarithmic decay of motion for underdamped case. | [6] |

- iii A free vibration test is conducted on an empty elevated water tank. A cable attached to the tank applies a lateral (horizontal) force of 81 kN and pulls the tank by 75 in. The cable is then suddenly cut and the resulting free vibration is recorded. At the end of six complete cycles, the time is 3 sec and amplitude is 38 mm. From these data compute the following : a) damping ratio b) natural period of undamped vibration c) stiffness d) weight e) damping coefficient and (f) number of cycles required for the displacement amplitude to decrease to 5.08 mm. [10]

Q 6.

Consider the following data :

Given structure: (a) 3-storeyed building (b) Location : Hyderabad (c) Soil type : Medium soil (d) Purpose : Residential (e) Structure type: Ordinary moment resisting frame with brick infill (f) Story height : 3m (g) Column dimensions: 230 mm x 230 mm (h) Beam dimensions : 230 mm x 230 mm (i) Slab dimensions 6 m x 6 m x 0.12 (j) Number of columns: 9 (k) Number of beams: 6 (l) Unit weight of concrete: 25 kN/m³ (m) Unit weight of brick : 18 kN/m³ (n) Live load is 2 kN/m² (o) Stiffness of each floor: 20858.116 kN/m. Use the above building data and Fig 1 Calculate :

- Distribution of Base shear using the method given in IS 1893:2002 [15]
- Calculate Eigen values of the MDOF system. [5]

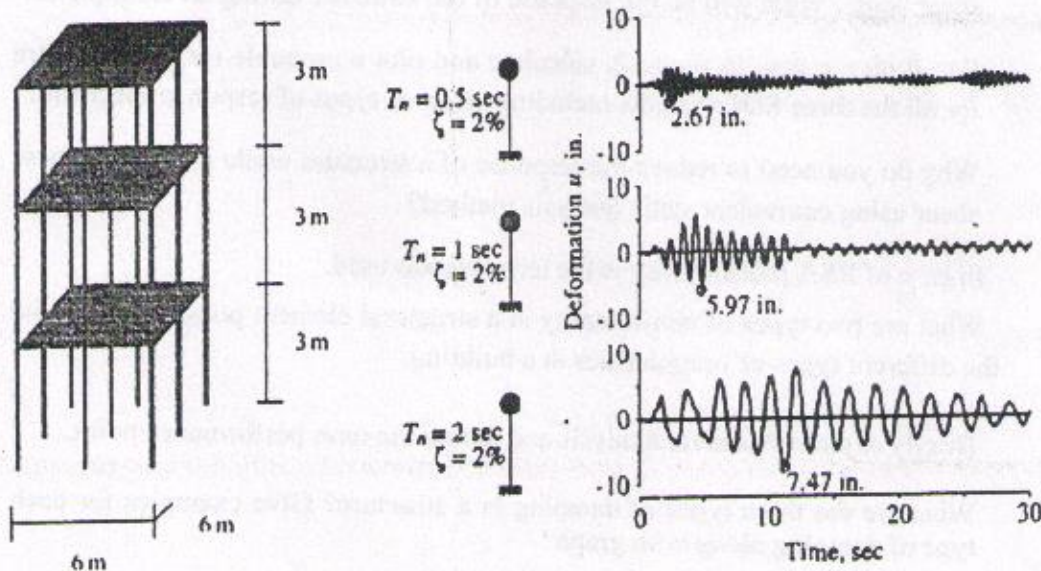


Figure 1: For Question no-6

Fig for Q.2 (ii): Response of three SDF systems.