

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATIONS- 2026

M.Tech-II Semester (SE)

COURSE CODE (CREDITS): 25M1ICE212 (3)

MAX MARKS: 25

COURSE NAME: Earthquake Resistant Design of Structures

COURSE INSTRUCTOR: Mr. Chandra Pal Gautam

MAX. TIME: 1 Hour 30 Min

Note: (a) All questions are compulsory.

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

(c) Use of calculator is allowed

Q.No	Question	CO	Marks																				
Q1	A 3 story RC building frame is located in Seismic zone V. Plan, elevation and building data is given below: PLAN ELEVATION • Infill wall thickness: 200 mm • Live load: 4 kN/m² (roof: 1.5 kN/m²) • Concrete: M25, Steel: Fe500 • Column size: 300 × 500 mm • Beam size: 300 × 450 mm • Slab thickness: 125 mm • Soil type: Medium soil • Importance factor (I): 1.2 • Response reduction factor (R): 5 Find following values by using Static Analysis: (i) Seismic weight of all floors and building. (ii) Design base shear on the building (iii) Vertical distribution of base shear.	CO-2	5+3+4 = 12																				
Q2	Data from response spectrum of the building mentioned in question 1 is given below: <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th></th><th>Mode 1</th><th>Mode 2</th><th>Mode 3</th></tr> </thead> <tbody> <tr> <td>Natural Period</td><td>0.42</td><td>0.35</td><td>0.112</td></tr> <tr> <td>Roof</td><td>1</td><td>1</td><td>1</td></tr> <tr> <td>2nd Floor</td><td>0.804</td><td>0.23</td><td>-0.024</td></tr> <tr> <td>1st Floor</td><td>0.212</td><td>-0.42</td><td>-0.33</td></tr> </tbody> </table>		Mode 1	Mode 2	Mode 3	Natural Period	0.42	0.35	0.112	Roof	1	1	1	2 nd Floor	0.804	0.23	-0.024	1 st Floor	0.212	-0.42	-0.33	CO-3	4+3+4+2 = 13
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	(i) Find the modal mass of the building. (ii) Find the modal participation factor. (iii) Find lateral load on each floor using dynamic analysis (iv) Find external applied load on each floor		
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b) For use in response spectrum method
[see Fig. 2(b)]

a) For use in equivalent static method
[see Fig. 2(a)]:

$$\frac{S_a}{g} = \begin{cases} \text{For rocky or hard soil sites} & \begin{cases} 2.5 & 0 < T < 0.40 \text{ s} \\ \frac{1}{T} & 0.40 \text{ s} < T < 4.00 \text{ s} \\ 0.25 & T > 4.00 \text{ s} \end{cases} \\ \text{For medium stiff soil sites} & \begin{cases} 2.5 & 0 < T < 0.55 \text{ s} \\ \frac{1.36}{T} & 0.55 \text{ s} < T < 4.00 \text{ s} \\ 0.34 & T > 4.00 \text{ s} \end{cases} \\ \text{For soft soil sites} & \begin{cases} 2.5 & 0 < T < 0.67 \text{ s} \\ \frac{1.67}{T} & 0.67 \text{ s} < T < 4.00 \text{ s} \\ 0.42 & T > 4.00 \text{ s} \end{cases} \end{cases}$$

$$\frac{S_a}{g} = \begin{cases} \text{For rocky or hard soil sites} & \begin{cases} 1+15T & T < 0.10 \text{ s} \\ 2.5 & 0.10 \text{ s} < T < 0.40 \text{ s} \\ \frac{1}{T} & 0.40 \text{ s} < T < 4.00 \text{ s} \\ 0.25 & T > 4.00 \text{ s} \end{cases} \\ \text{For medium stiff soil sites} & \begin{cases} 1+15T & T < 0.10 \text{ s} \\ 2.5 & 0.10 \text{ s} < T < 0.55 \text{ s} \\ \frac{1.36}{T} & 0.55 \text{ s} < T < 4.00 \text{ s} \\ 0.34 & T > 4.00 \text{ s} \end{cases} \\ \text{For soft soil sites} & \begin{cases} 1+15T & T < 0.10 \text{ s} \\ 2.5 & 0.10 \text{ s} < T < 0.67 \text{ s} \\ \frac{1.67}{T} & 0.67 \text{ s} < T < 4.00 \text{ s} \\ 0.42 & T > 4.00 \text{ s} \end{cases} \end{cases}$$

Table 3 Seismic Zone Factor Z
(Clause 6.4.2)

Seismic Zone Factor (1)	II (2)	III (3)	IV (4)	V (5)
Z	0.10	0.16	0.24	0.36