Roll No												

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST 1

Winter Semester: 2021 - 22
Course Code: CIV 310
Course Name: Elements of Earthquake Engineering
Program & Sem: B.Tech. (Civil) & VI Sem (DE-III)

Date: 26 April, 2022
Time: 01.30pm to 02.30pm
Max Marks: 30
Weightage: 15%

Instructions:
(i) Read the all questions carefully and answer accordingly.

Part A [Memory Recall Questions]

Answer both the Questions. Each question carries FOUR marks. (2Qx 4M= 8M)

1. Give a schematic showing Focus and Epicentre of an earthquake. [4 M](C.O.No.1) [Knowledge]

2. List and briefly explain the characteristics of strong ground motion? [4M](C.O.No.1) [Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each question carries SIX marks. (2Qx6M=12M)

3. The quantitative and qualitative measure of an earthquake may be different. Justify this statement.

[6M](C.O.No.1) [Comprehension]

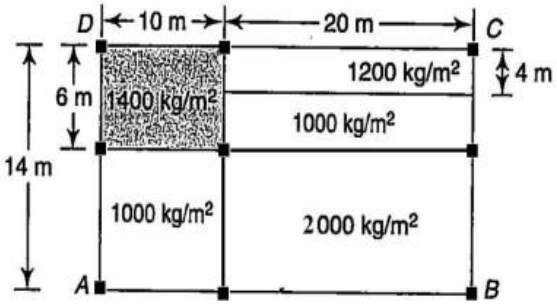
4. As a structural engineer, you went to check the seismic performance of a building. Before entering the structure, you did a thorough visual inspection of the elevation of the building. What are the possible problems you could identify that makes the structure more earthquake prone?

[6M](C.O.No.1) [Comprehension]

Part C [Problem Solving Questions]

Answer the Question. The question carries TEN marks. (1Qx10M=10M)

5. Locate the center of mass of the building shown in figure. Also obtain its center of stiffness if all the columns and beams have the same stiffness. [10M](C.O. No. 2) [Application]



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SCHOOL OF ENGINEERING

TEST 2

Winter Semester: 2021 - 22
Course Code: CIV 310
Course Name: Elements of Earthquake Engineering
Program & Sem: B.Tech. (Civil) & VI Sem (DE-III)

Date: 1 June, 2022
Time: 01.30pm to 02.30pm
Max Marks: 30
Weightage: 15%

Instructions:

(i) Read the all questions carefully and answer accordingly.

Part A [Memory Recall Questions]

Answer both the Questions. Each question carries three marks. (2Qx 3M= 6M)

1. List the various plan configuration problems in a structure. (C.O.No.2) [Knowledge]

2. What are the engineering properties influencing the response of the structure?

(C.O.No.3) [Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each question carries six marks. (2Qx6M=12M)

3. To resist lateral loading, lateral load resisting systems are provided. Every type of lateral load resisting system has pros and cons. Give details about any 2 lateral load resisting system with a sketch (C.O.No.2) [Comprehension]

4. During an earthquake, earthquake itself doesn't kill people, but badly designed building does. What are the requirements of an efficient earthquake resistant building?

(C.O.No.2) [Comprehension]

Part C [Problem Solving Questions]

Answer the Questions. The question carries twelve marks. (1Qx12M=12M)

5. A four-storey RCC residential building have seismic weight W1 = W2 = W3 = 4200kN and W4 (roof) = 3000kN. The storey height for ground floor is 4.2m and for all the other floors is 3.2m. The building is located in seismic zone IV. The type of soil encountered is hard and it is proposed to design the building with a special moment resisting frame without infill. Determine the design seismic loads on each floor of the structure by static analysis. (C.O. No. 3) [Application]

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END TERM EXAMINATION

Winter Semester: 2021 - 22
Course Code: CIV 310
Course Name: Elements of Earthquake Engineering
Program & Sem: B.Tech (Civil), VI Sem (DE)

Date: 30th June 2022
Time: 9:30AM to 12:30PM
Max Marks: 100
Weightage: 50%

Instructions:

(i) Read the all questions carefully and answer accordingly
(ii) Question paper consists of 3 parts.
(iii) Scientific and Non-programmable calculators are permitted.
(iv) Data Sheet is attached for reference

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries TEN marks. (3Q x 10M = 30M)

1. What is Plate Tectonic Theory? Explain with neat sketch. (C.O.No.1) [Knowledge]

2. Determine the center of mass and center of stiffness for the plan shown in Fig 1. All the columns have same stiffness (C.O.No.2) [Comprehension]

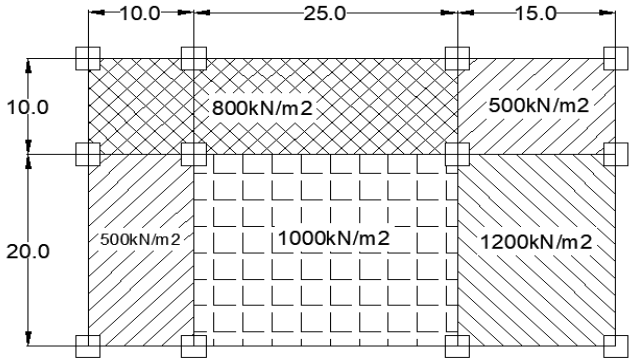

Fig 1

3. Describe design response spectrum with a neat sketch. (C.O.No.3) [Knowledge]

Part B [Thought Provoking Questions]

Answer all the Questions. Each question carries FIFTEEN marksS. (3Qx15M = 45M)

4. As an intern at the National Centre for Seismology, you have been asked to study all the past earthquakes that occurred in India and classify them. What are all the possible ways to do that? (C.O.No.1) [Comprehension]

5. Irregular structures have certain physical discontinuities either in plan or in elevation or both which affect the performance of the structure subjected to seismic loads. During the initial planning of a high-rise residential complex, what all irregularities you have to check with respect to plan as well as elevation? (C.O.No.2) [Comprehension]

6. A four-storey RCC school building has a plan as shown in Fig 2 and the typical storey height is 3.5m. The building is located in seismic zone V. The type of soil encountered is medium stiff and it is proposed to design the building with a special moment resisting frame with infill. The intensity of DL is 10kN/m^2 and LL is 3kN/m^2 on all floors. Determine the design seismic loads on each floor of the structure by static analysis. (C.O.No.3) [Application]

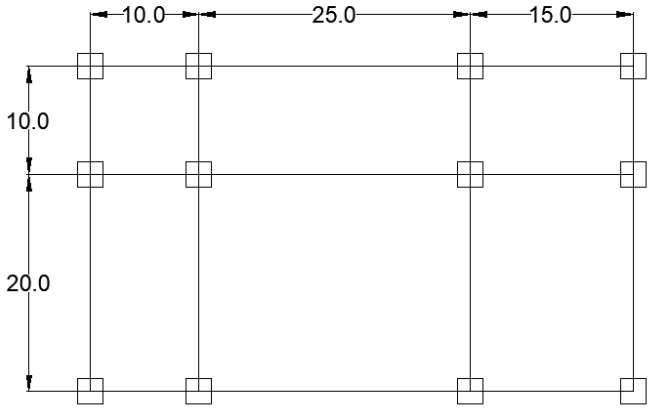

Fig 2

Part C [Problem Solving Questions]

Answer the Question. The question carries twenty FIVE marks. (1Qx25M=25M)

7. A three-storey RCC school building has a plan area of 8m x 8m and the typical storey height is 3.5m. The building is located in seismic zone V. The type of soil encountered is medium stiff and it is proposed to design the building with a special moment resisting frame with infill. The intensity of DL is 10 kN/m^2 and LL is 3 kN/m^2 on all floors. Determine the design seismic loads on each floor of the structure by dynamic analysis. (C.O.No.3) [Application]

Storey level	Natural period (s)	Mode 1	Mode 2	Mode 3
3	0.134	1.00	1.00	1.00
2	0.191	–2.038	–0.489	0.81
1	0.533	1.611	–1.223	0.45

DATA SHEET

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

Sl No.	Structure	*I*
(1)	(2)	(3)
i)	Important service and community buildings or structures (for example, critical governance buildings, schools), signature buildings, monument buildings, lifeline and emergency buildings (for example, hospital buildings, telephone exchange buildings, television station buildings, radio station buildings, bus station buildings, metro rail buildings and metro rail station buildings), railway stations, airports, food storage buildings (such as warehouses), fuel station buildings, power station buildings, and fire station buildings), and large community hall buildings (for example, cinema halls, shopping malls, assembly halls and subway stations)	1.5
ii)	Residential or commercial buildings [other than those listed in Sl No. (i)] with occupancy more than 200 persons	1.2
iii)	All other buildings	1.0

Sl No.	Lateral Load Resisting System	R
(1)	(2)	(3)
i)	**Moment Frame Systems**	
	a) RC buildings with ordinary moment resisting frame (OMRF) (*see* Note 1)	3.0
	b) RC buildings with special moment resisting frame (SMRF)	5.0
	c) Steel buildings with ordinary moment resisting frame (OMRF)(*see* Note 1)	3.0
	d) Steel buildings with special moment resisting frame (SMRF)	5.0

For Static Method

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

Table 10 Percentage of Imposed Load to be Considered in Calculation of Seismic Weight

(*Clause* 7.3.1)

Sl No.	Imposed Uniformity Distributed Floor Loads kN/m²	Percentage of Imposed Load
(1)	(2)	(3)
i)	Up to and including 3.0	25
ii)	Above 3.0	50

b) For use in response spectrum method [*see* Fig. 2(b)]

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