GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2022

Subject Code:3160621   **Date:10/06/2022**
Subject Name:Earthquake Engineering
Time:10:30 AM TO 01:00 PM   **Total Marks: 70**
Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**
5. **Use of IS 1893 and IS 13920 is permitted.**

			MARKS
Q.1	**(a)**	Define Following terms: (1) Epicenter (2) Magnitude of Earthquake (3) Resonance.	**03**
	(b)	Differentiate between the following: (1) Magnitude & Intensity (2) Iso – seismal & Meizo – seismal.	**04**
	(c)	Derive the expression of displacement for free vibration of damped SDOF system with usual notations.	**07**
Q.2	**(a)**	Define Following terms: (1) Soft storey (2) Damping ratio (3) Ductility.	**03**
	(b)	Write short note on Short Column Effect.	**04**
	(c)	A spring mass model consists of 18 kg mass and spring of stiffness 25 N/mm was tested for viscous damped vibration. The test recorded two consecutive amplitude is 2.0 cm and 1.5 cm respectively. Determine (i) Natural frequency of un-damped system (ii) Logarithmic decrement (iii) Damping ratio (iv) Damping coefficient (v) Damped natural period.	**07**

OR

	(c)	A free vibration test is performed on the single degree-of-freedom system. The mass of the system is 300 kg which is displaced by 3 cm and suddenly released. The time required to complete 15 cycles of oscillations is 5 s. Calculate the stiffness of the system. Write the equation of motion for the system and calculate the displacement after 10 sec. Consider initial velocity as 1 m/sec.	**07**
Q.3	**(a)**	Explain the importance of ductility.	**03**
	(b)	Explain base isolation techniques in details.	**04**
	(c)	Write short note on liquefaction. Explain factors affecting liquefaction.	**07**

OR

Q.3	**(a)**	Enlist the different methods of structural control.	**03**
	(b)	Explain how soft storey problems can be eliminated in the existing buildings.	**04**
	(c)	Explain with sketches: Seismic waves and its types.	**07**
Q.4	**(a)**	Explain in detail (1) Rigid diaphragm.	**03**
	(b)	Explain importance of vibration analysis in detail.	**04**
	(c)	Philosophy of earthquake resistant design. Give four virtue of good earthquake resistant design.	**07**

OR

Q.4	**(a)**	What is centre of mass and centre of stiffness?	**03**
	(b)	Differentiate between the following: (1) Seismograph & Seismogram	**04**

          (2) Inter-plate & Intra-plate earthquakes.

(c) Explain ductile detailing of beam as per Indian standard 13920.   **07**

Q.5 **(a)** Enlist various codes of practice along with correct name related to earthquake engineering.   **03**

(b) Discuss the capacity design concept in ductile detailing.   **04**

(c) A two storied building has lumped floor weights from bottom to top as 95000 N & 78500 N with storey stiffness of 5 x 105 N/m and 4 x 105 N/m respectively. Perform the free vibration analysis & determine natural frequencies and corresponding mode shape coefficients. Also sketch the mode shapes.   **07**

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OR

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Q.5 **(a)** Explain various irregularities found in the civil engineering structures from earthquake point of view.   **03**

(b) Write short note on Logarithmic Decrement.   **04**

(c) Explain the criteria for earthquake resistant design & detailing of masonry structures.   **07**

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