Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– VI (NEW) EXAMINATION – WINTER 2021

Subject Code:3160621 Date:04/12/2021

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 – 2002 and IS 13920 – 1993 is permitted.**

			MARKS
Q.1	**(a)**	Define (i) Damping (ii) Focus (iii) Epicenter	**03**
	(b)	(i) Differentiate between magnitude and intensity. (ii) State whether following statements are true or false. If false write correct statement. (a) Over damped system comes to rest, faster than critically damped system. (b) Compression waves are also known as Rayleigh waves.	**04**
	(c)	Explain four virtues of earthquake resistant design.	**07**
Q.2	**(a)**	Define tectonic plates. Discuss plate tectonic theory.	**03**
	(b)	Differentiate between inter plate and intra plate earthquake	**04**
	(c)	Write the equation of motion for damped free vibration and derive the expressions for the displacement.	**07**
		OR	
	(c)	A SDOF vibrating system is consisting of a mass = 150 kg, spring stiffness = 150 N/m, and c = 40 N-sec/m. determine (i) Natural frequency of damped vibration (ii) Damping ratio (iii) logarithmic decrement (iv) Ratio of two successive amplitudes.	**07**
Q.3	**(a)**	Name the major plates of the earth.	**03**
	(b)	Discuss the strong column – weak beam concept.	**04**
	(c)	Explain importance of various bands in masonry buildings?	**07**
		OR	
Q.3	**(a)**	Enlist and explain in details the factors that affect the natural time period / natural frequency of a structure.	**03**
	(b)	Explain Time History Analysis method.	**04**
	(c)	A three storeyed building has a size of 20 m x 20 m. it is located in Bhuj and resting on hard soil. The weight of each floors are 2000 kN, 2100 kN, 2500 kN respectively. The height of floors is 3 m, 3 m and 3m respectively.	**07**

Assuming the building as special moment resisting office building, calculate the horizontal shear force by seismic coefficient method.

Q.4	**(a)**	List assumptions made in Portal frame method of lateral load analysis.	**03**
	(b)	Distinguish between centre of mass and centre of stiffness.	**04**
	(c)	Explain 'rigid diaphragm' and 'Flexible diaphragm'.	**07**

OR

Q.4	**(a)**	Give assumptions made in cantilever method of lateral load analysis.	**03**
	(b)	How design eccentricity is calculated as per IS: 1893 (1) -2002?	**04**
	(c)	Discuss the expected damages by Earthquake in structures having i) Unsymmetrical plan ii) Floating columns iii) Soft storey iv) Building frames without shear panels v) Short Column.	**07**
Q.5	**(a)**	Enlist requirements of shear wall as per IS 13920-2016.	**03**
	(b)	Explain soil liquefaction in detail.	**04**
	(c)	Discuss the capacity design concept in ductile detailing.	**07**

OR

Q.5	**(a)**	Explain crack repair by grouting.	**03**
	(b)	What is base isolation? Discuss briefly about base isolation.	**04**
	(c)	Discuss in detail the concepts of the ductile detailing in Beams as per IS: 13920-2016.	**07**

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Seat No.: _____ Enrolment No._____

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**

OR

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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