Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2024

Subject Code:3160621 Date:24-05-2024

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-Part 1(2016), IS 13920 (2016), IS 4326(2013), IS 13827 (R2006), IS 13828 (R2008) IS 875 Part I-V are permitted.**

			MARKS
Q.1	**(a)**	What are the known causes of earthquake? Explain in terms of Plate Tectonic theory.	**03**
	(b)	(i) Differentiate between Magnitude & Intensity of earthquake. (ii) Discuss the significance of MSK 9 Intensity earthquake.	**04**
	(c)	Explain the Philosophy of earthquake resistant design. Give four virtue of good earthquake resistant design.	**07**
Q.2	**(a)**	Define Following terms: (1) Soft storey (2) Centre of Rigidity (3) Ductility	**03**
	(b)	What is regular and irregular building according to IS 1893. Describe any two vertical irregularities with neat sketches.	**04**
	(c)	In an experiment on a certain structure modelled as an SDOF system, the amplitude of free vibration decreased from 10 mm to 4 mm. If the logarithmic decrement was 0.1018 and undamped natural frequency is 40 rad/s, determine the damping ratio, damped period, and number of cycles completed.	**07**
		OR	
	(c)	Write the equation of motion for damped forced vibration and derive the expressions for the displacement.	**07**
Q.3	**(a)**	Differentiate the following terms 1. Storey drift and storey shear 2. Importance factor and response reduction factor	**03**
	(b)	Enlist required conditions for liquefaction. Also suggest remedial measures for the same.	**04**
	(c)	Differentiate between static and dynamic analysis for earthquake loading. Explain the procedure of Response spectrum method as per Indian Standards.	**07**
		OR	
Q.3	**(a)**	Differentiate the flexible and Rigid Diaphragm.	**03**
	(b)	Explain with neat sketches the techniques of Column Jacketing.	**04**
	(c)	Determine the free vibration response of an SDOF system shown in Fig. 1 at time t = 0.20 s for the following data: Natural circular frequency ω= 12 rad/s; Damping factor ξ = 0.15; Initial velocity $\dot{x}$ (0) = 10 cm/s Initial displacement x(0) = 5 cm	**07**

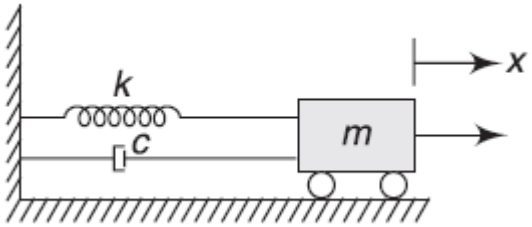

Fig. 1

Q.4 **(a)** State the reasons for the poor performance of masonry buildings in seismic areas. **04**

(b) A three storeyed public building is shown in Fig 2. Consider that the service block is separately provided with no structural connection with this building. Consider 230 mm thick peripheral walls throughout the height of the building with 0.9m high parapet at terrace. Determine the seismic weights of the building components and determine the base shear. Also check whether equivalent static method of earthquake analysis can be applied and if yes, calculate the earthquake forces at all levels. **10**

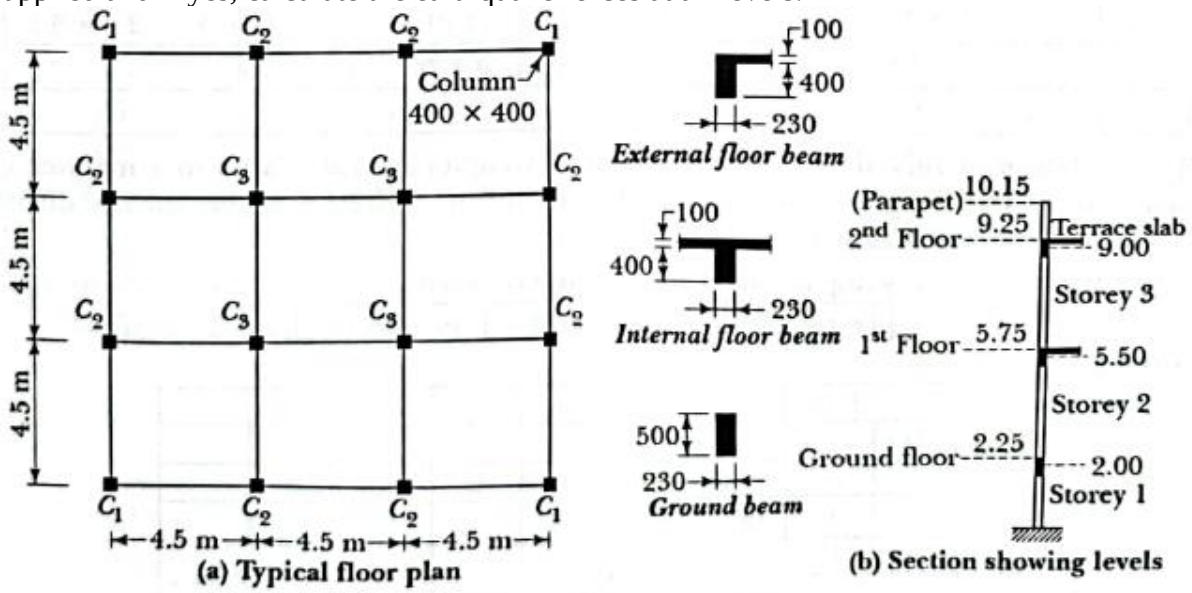

Fig. 2

OR

Q.4 **(a)** How design eccentricity is calculated as per IS: 1893 (1) -2016? **04**

(b) A typical floor plan of an intermediate storey of multi-storeyed building is shown in Fig. 3. Floor masses acting on various columns are also shown in the same figure. All columns have 500 mm X 500 mm size and cast in M25 grade concrete. The floor is subjected to seismic load of 480 kN in the principal directions. The floor height is 5 m. Determine (i) Center of Mass and Center of Gravity; (ii) accidental eccentricities and torsion induced in floor. **10**

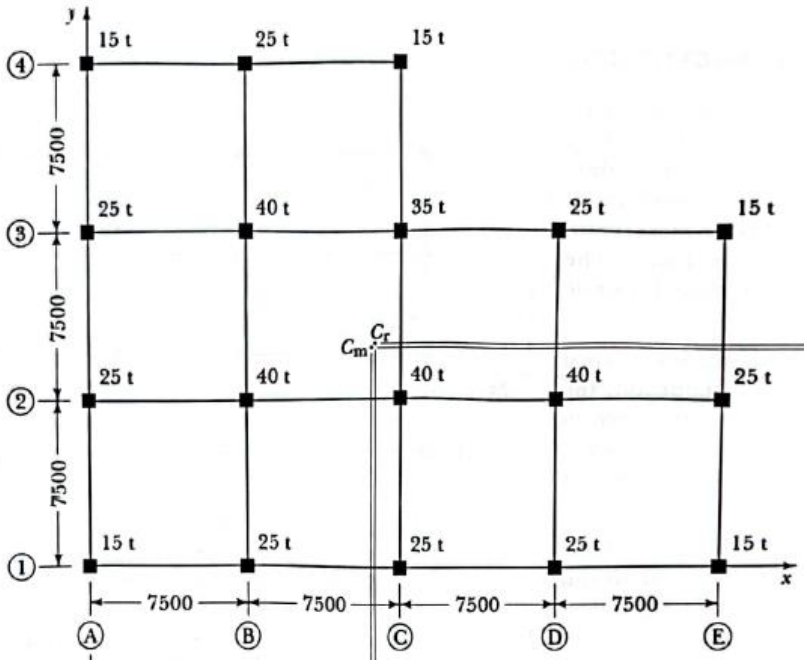

Fig. 3

Q.5 **(a)** Write short note on Logarithmic Decrement. **03**

(b) Distinguish between centre of mass and centre of stiffness. **04**

(c) What are plate tectonics and how are they related to continental drift and sea floor spreading? **07**

OR

Q.5 **(a)** Give assumptions made in cantilever method of lateral load analysis. **03**

(b) Explain base isolation techniques in details. **04**

(c) Explain importance of various bands in masonry buildings? Support the answer with suitable sketches. **07**

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