Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (OLD) - EXAMINATION – SUMMER 2017

Subject Code: 160605 **Date: 01/05/2017**

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. **Use of IS: 1893-2002(Part-1), IS: 13920-1993 and IS: 4326-1993 is permitted.**

Q.1 **(a)** Define following terms: **08**

1. Fault
2. Free Vibration
3. Storey Drift
4. Damping Ratio
5. Retrofitting
6. Dynamic Magnification Factor
7. Design Basis Earthquake
8. Intensity

(b) Differentiate between the following: **06**

1. Vibration and Oscillation
2. Centre of Mass and Centre of Stiffness
3. Flexural Failure and Shear Failure

Q.2 **(a)** Derive the expression of Amplitude for single degree free undamped vibration system with usual notations **07**

(b) A water tank is idealized as a single degree of freedom system having equivalent weight of 15000 kN, damping ratio as 5% and stiffness factor as 25000 kN/m. Calculate (1) the natural time period (2) the damped time period (3) damping constant and (4) the maximum horizontal displacement at the top of the water tank if it is excited by a seismic force equivalent to 25,000 sin (5t) N. **07**

OR

(b) A spring mass model consists of 10 kg mass and spring stiffness 8 N/mm and it was tested for viscous damped vibration. Test recorded two successive amplitudes 2.0 and 1.75. Determine (1) the natural frequency of undamped system (2) the logarithmic decrement (3) damping ratio (4) damping coefficient (5) damped natural period **07**

Q.3 **(a)** Write short note on different types of Seismic Waves generated during earthquakes. **07**

(b) Calculate natural frequencies and time period for the system shown in figure 1. **07**

OR

Q.3 **(a)** Enlist the common modes of failure of Masonry Buildings and explain any two mechanisms in detail. **07**

(b) Explain the importance of ductility of structure during its seismic performance and enlist different types of ductility. **07**

Q.4 **(a)** Explain the Short Column Effects in detail. **07**

(b) Explain the theory of Soil Liquefaction in detail. **07**

OR

Q.4	**(a)**	If a column of size 450 x 450 mm is having the longitudinal reinforcement of 2% of the gross cross sectional area, detail the longitudinal reinforcement of the column satisfying all criteria of IS 13920-1993 and workout the special confining hoop reinforcement as per the code along with neat sketch of longitudinal section. Take the clear height of the column = 4 m, Grade of Concrete M20, Grade of Steel Fe 415 and clear cover to longitudinal reinforcement is 40 mm.	**07**
	(b)	Explain degrees of freedom in detail with some examples.	**07**
Q.5	**(a)**	Explain Response Spectrum Method in detail.	**07**
	(b)	Explain Base Isolation Techniques in detail.	**07**
		OR	
Q.5	**(a)**	Explain in detail the Strong Column – Weak Beam Design approach used in earthquake resistance design of structure.	**07**
	(b)	Explain with neat sketches the techniques of Column Jacketing and Beam Jacketing.	**07**

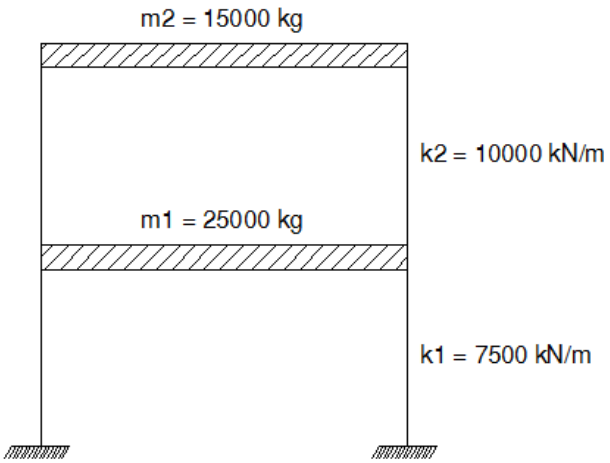

Figure 1

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