Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI EXAMINATION – Summer 2015

Subject Code:160605 **Date:12/05/2015**

Subject Name: Earthquake Engineering

Time:10.30AM-01.00PM **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)** For a two storey Steel framed railway station building with concentric bracing and without infill wall, find the seismic base shear, using equivalent lateral load method. Consider following data. **(i)** Location : Ahmedabad **(ii)** Soil condition : Medium soil **(iii)** Plan dimensions : 3 bays of 4 m each along X direction and 4 bays of 3 m each along Y direction. The intensity of dead load including column, beam and slab is 12 kN/m^2. Consider Live load on floor 3 kN/m^2. Consider 20 % damping. Height of floor is 3m.Also plot lateral load distribution diagram. **09**

(b) **Answer following questions.** **05**

1. Define Resonance.
2. Evaluate with reason: For very stiff system PGA is equal to ZPA.
3. In which type of wave propagation volume of the medium changes but shape does not change? Explain.
4. Give difference between accelerogram and accelerogroph.
5. What are the basic elements of any mathematical model in Earthquake engineering? Give the equation of forced damped vibration for SDOF system.

Q.2 **(a)** For a square column of size 400 mm X 400 mm work out the diameter of the special confining hoop reinforcement as per IS:13920-1993. Take the concrete grade M 25 and steel grade Fe 415. Clear cover to longitudinal reinforcement is 40 mm. **07**

(b) Derive the equation of damped free vibration of single degree of freedom system. **07**

OR

(b) Define Logarithmic decrement, how it is measured and derive the equation of Logarithmic decrement. **07**

Q.3 **(a)** A two storey single bay RC frame is supported by four corner columns. Building is located in Surat has lumped floor weights of 200 kN & having storey stiffness 80 kN/m at every floor level. Perform free vibration analysis and determine all natural frequencies & sketch all mode shape. **09**

(b) An acceleration response spectrum for SDOF system having 5% damping is shown in figure 1. Calculate maximum base shear and moment if the time period of the system is 0.5 sec. Take mass 8000 kg and height 4 m. What is the peak ground acceleration for this ground motion? **05**

OR

Q.3 **(a)** A spring mass model consists of 10 kg mass and spring with stiffness 7 N/mm, was tested for viscous damped vibration. Test recorded two successive amplitudes 2and 1.5 Determine the natural frequency of undamped system, the logarithmic decrement, damping ratio, damping coefficient, damped natural period. **07**

	(b)	Set up the equation of motion for the following damped SDOF system without external force and solve for the response under given condition. K=320 N/m, m= 5 kg, c= 4 N-s/m, x(0)=1 and $\mathring{x}(0)$=7.6.	**07**
Q.4	**(a)**	Explain earthquake resistant features of masonry structures.	**07**
	(b)	Give difference between (i) magnitude and intensity (ii) Soft storey and weak storey.	**07**
		OR	
Q.4	**(a)**	Write short note on (i) Types of waves (ii) Earth interior.	**07**
	(b)	Explain elastic rebound theory in detail.	**07**
Q.5	**(a)**	Analyze the three bay two storeys RC frame by Portal method. Lateral force of 200 kN & 120 kN is acting at first & second floor respectively. Height of first and second storey is 4 m and 3 m respectively. Bay width of each bay is.4 m. Draw axial force, shear force and bending moment diagram.	**07**
	(b)	Write short note on liquefaction. Explain factors affecting liquefaction.	**07**
		OR	
Q.5	**(a)**	Explain in detail (i) Rigid floor Diaphragm effect (ii) Torsionally coupled and uncoupled system	**07**
	(b)	Enlist the different methods of structural control and explain any one in detail.	**07**

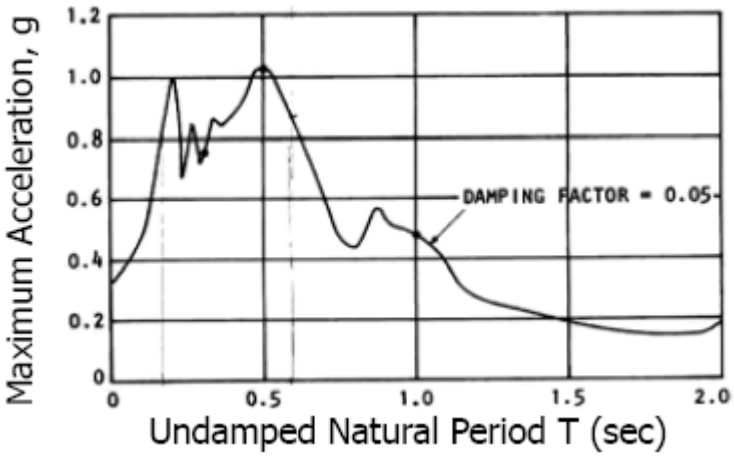

Figure-1

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