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

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) - EXAMINATION – SUMMER 2017

Subject Code: 2170612 **Date: 29/04/2017**

Subject Name: Earthquake Engineering(Departmental Elective - II)

Time: 02.30 PM to 05.00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **IS 1893 & IS 13920 are permitted**

Q.1	**(a)**	Explain four virtues of earthquake resistant design.	**07**
	(b)	Explain damped free vibration system in detail. Also derive the expression for displacement.	**07**
Q.2	**(a)**	Explain mathematical modelling using appropriate examples. Also list dynamic parameters of model.	**07**
	(b)	A cantilever rod having span 1.2m is subjected to a point load of 98.1 N at its free end. The cross section of beam is square having 12mm side. The system initially at rest was displaced through 40mm and released to vibrate. Determine following 1. Undamped and damped natural frequencies 2. Amplitude after 2 cycles 3. Number of cycles when amplitude reaches to 2mm Take damping coefficient as 15 N.S/m and modulus of elasticity as 210 GPa.	**07**
		OR	
	(b)	Explain earthquake resistant features of masonry structures.	**07**
Q.3		Using static coefficient method, calculate lateral forces at each floor level for an SMRF hospital building frame having following data. (a) No. of storey: 10 (b) Thickness of slab: 160 nun (c) Size of Beam & column: 600mm x 600mm (d) Bays @ x and y direction : 4 (e) Bays width: 4 m (f) Storey height: 3 m (g) Finished wall thickness is 250mm for exterior wall (h) Live load : 4 kN/m^2 Take floor finish as 1 kN/m^2. Water proofing of load 1.5 kN/m^2 has been provided at terrace. Assume any additional data if required for the building frame and neglect the weight of interior infill wall panels. Building is situated in Ahmedabad.	**14**
		OR	
Q.3	**(a)**	Differentiate the following terms 1. Storey drift and storey shear 2. Soft storey and weak storey 3. Importance factor and response reduction factor	**06**
	(b)	For the rigid floor shown in the **Figure – I**, find design lateral forces	**08**

for the columns as per IS 1893 provisions if design lateral force acting on floor is 200 kN along X direction. All columns are of same height and size 300x900mm. Mass is uniformly distributed on the floor.

Q.4 **(a)** Explain the effect of building configuration on seismic response in brief. **07**

(b) Define liquefaction and explain the causes and remedial measures of liquefaction. **07**

OR

Q.4 **(a)** Describe concept of ductile detailing & explain factors affecting the ductility of structures in detail. Also explain ductile detailing of beam – column joint as per IS 13920 – 1993. **07**

Q.4 **(b)** Briefly explain base isolation. **07**

Q.5 **(a)** A three story building frame with uniform floor height of 4m is having lumped masses of 4.5 tonns, 3.5 tonns and 2.5 tonns at first, second and third floor respectively with uniform storey stiffness of 650 kN/m at each floor. Calculate natural frequency and corresponding mode shapes for the fundamental mode only. Also draw mode shapes. **14**

OR

Q.5 **(a)** Analyze the building frame shown in **Figure - II** by cantilever method and draw shear force, bending moment and axial force diagrams. **10**

(b) Define terms: i) Diaphragm action ii) Rigid diaphragm iii) Flexible diaphragm iv) Centre of mass v) Centre of rigidity **04**

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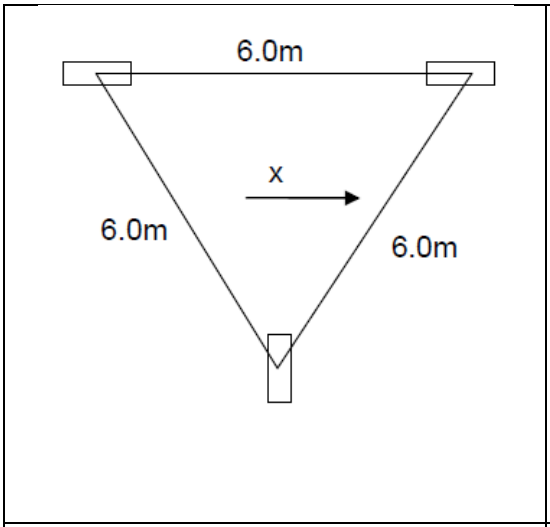

Figure - I

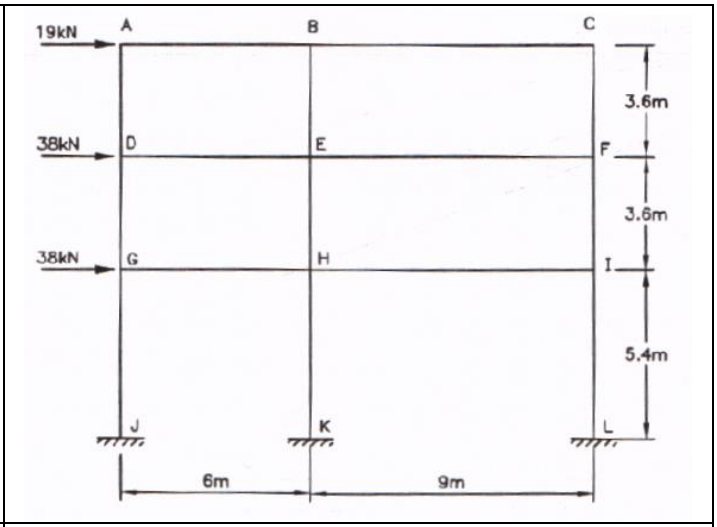

Figure - II