

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 6 – EXAMINATION – SUMMER 2026

Subject Code: 3160621

Date: 01/06/2026

Subject Name: Earthquake Engineering

Time: 10:30 AM TO 01:00 PM

Total Marks: 70

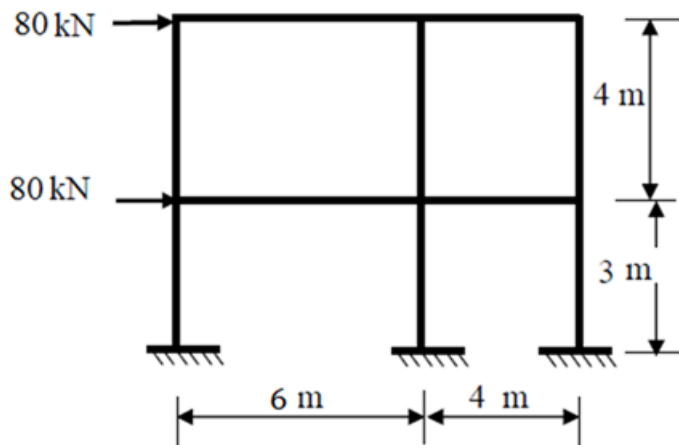
Instructions:

- 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.**

- Q.1** (a) Define following **03**
1. Focus 2. Epicenter 3. Isoseismal Line
- (b) Differentiate between Magnitude and Intensity of Earthquake **04**
- (c) Explain seismic waves **07**
- Q.2** (a) Define following **03**
1. Free Vibration 2. Forced Vibration 3. Resonance
- (b) Derive the equation for single degree of undamped free vibration system **04**
- (c) A spring mass model having 8 kg mass with spring stiffness of 4 N/mm was tested for viscous damped vibration. The test recorded two consecutive amplitudes as 1.4 cm and 1.15 cm respectively. Determine (i) The natural frequency of undamped system (ii) The logarithmic decrement (iii) Damping ratio (iv) The damping coefficient (v) Damped natural frequency of the system. **07**
- OR
- Q.2** (c) Explain Soil Liquefaction and Structural Controls in brief **07**
- Q.3** (a) What do you understand by Seismic strengthening of Structures **03**
- (b) Explain crack repair by grouting. **04**
- (c) Explain Earthquake Resistant Features of un-reinforced & reinforced masonry Structure **07**
- OR
- Q.3** (a) Describe the importance of Ductility in RC Buildings with respect to Earthquake Resistance **03**
- (b) Explain techniques of Column Jacketing with neat sketches. **04**
- (c) Showing appropriate codal provisions discuss the concepts of ductile detailing in Beams as per IS: 13920. **07**
- Q.4** (a) Enlist different approximate methods used for lateral load analysis. Also write assumptions made in any one method. **03**
- (b) Explain Rigid Diaphragm Effect **04**

- (c) Analyze the frame shown in the Fig.1 using an appropriate approximate method and draw Shear Force, Bending Moment and Axial Force diagrams. All columns are having equal cross section of 400 mm x 400 mm .

07



OR

- Q.4** (a) Describe the difference between Earthquake Resistant Design and Earthquake Proof Design 03
- (b) Explain four virtues of Earthquake Resistant Structures 04
- (c) Explain effects of irregularities on performance of RC Buildings 07

- Q.5** (a) A Nine story R.C. frame building for hospital located in Bhuj city has following properties, 03
1. No. of bays in X – direction - 6
 2. No. of bays in Y – direction - 5
 3. Bay width in both direction – 4 m
 4. Clear Storey height below beam bottom – 3.2 m
 5. Thickness of Slab - 120 mm
 6. Size of web of Beam - 300 mm x 460 mm
 7. Size of Column - 460 mm x 460 mm
 8. Internal wall thickness with plaster - 120 mm
 9. External wall thickness with plaster - 260 mm
 10. Live Load - 3 kN/m^2
- Assuming suitable data (if required) calculate lumped masses at various floor level.
- (b) For above data provided in Q-5 (a) calculate Design Seismic Base Shear using Seismic Coefficient Method. 04
- (c) For above data provided in Q-5 (a) carryout vertical distribution of Base Shear and draw distribution diagram 07

OR

- Q.5** (a) Explain PGA. 03
- (b) Explain soft storey & discuss performance of soft storey building in past earthquake. How will you avoid soft storey? 04
- (c) A two storey building frame having lumped masses 20 tonne at each floor levels has first storey stiffness 90 kN/m & second storey stiffness 80 kN/m. Perform free vibration analysis & draw all mode shapes. 07
