

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VII (NEW) EXAMINATION – WINTER 2018

Subject Code: 2170612

Date: 15/11/2018

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. Permit use of IS-1893 and IS-13920

- Q.1 A** Define (i) Seismograph (ii) Epicenter (iii) Focus 3
- B** State whether following statements are true or false. If your answer is false, write correct answer in short 4
1. Over damped system comes to rest, faster than critically damped system.
 2. Code specifies lower value of R for building having better performance.
 3. Energy released in an earthquake of magnitude 6, is double compared that released in magnitude 3 earthquake.
 4. Masonry structures offers less damping as compared to steel structures
- C** Explain Earthquake Resistant Design Philosophy & Differentiate between Earthquake Proof Design and Earthquake Resistant Design. 7
- Q.2 A** Explain Mathematical Modeling with appropriate example 3
- B** Differentiate between 4
1. Magnitude & Intensity
 2. P wave and S wave
 3. Hypocenter and Epicenter
 4. Inter-plate Earthquake and Intra-plate Earthquake
- C** Write the equation of motion for damped free vibration and derive the expressions for the displacement. 7
- OR
- Q.2 C** A spring mass model consists of 9 kg mass and spring of stiffness 5 N/mm was tested for viscous damped vibration. The test recorded two consecutive amplitude is 1.5 cm and 1.2 cm respectively. Determine (i) natural frequency of undamped system (ii) logarithmic decrement (iii) damping ratio (iv) damping coefficient (v) damped natural frequency of system. 7
- Q.3 A** The dimension of a circular column is 600 mm diameter. If these dimensions become doubled, what should be the increase in the lateral load carrying capacity of the column with respect to column with earlier dimension 3
- B** Enlist and explain in details the factors that affect the natural time period / natural frequency of a structure. 4
- C** Write short note on damping. 7
- OR
- Q.3 A** Name the major plates of the earth. 3
- B** What are the various methods of restoring an earthquake damaged masonry structure? 4
- C** Force deformation curve of two building is shown in **Fig.1**, calculate (i) Stiffness of building A and B (ii) Ductility factor of building A and B (iii) Energy absorption capacity of building A and B (iv) Maximum load capacity of building A. 7
- Q.4 A** State the soil conditions under which liquefaction can occur 3

- B** Discuss in detail the concepts of the ductile detailing in Beams. 4
C Enlist different approximate methods used for lateral load analysis. Analyze the frame shown in the **Fig.2** using an appropriate approximate method and construct BM, SF and axial force diagrams. Give the assumptions made in the analysis. All columns are of same cross section 300 x 300 mm . 7

OR

- Q.4 A** Give various methods of improving the ductility of structures. 3
B What is meant by over damped, critically damped and under damped system? 4
C Calculate base shear in for five storey school building in Bhuj with following data by seismic coefficient method. 7

(a) No. of bay in x direction = 4	(b) No. of bay in y direction = 4
(c) Storey height = 3.0 m	(d) Width of each bay = 5 m
(e) Total DL on roof = 10 kN/m ²	(f) Total DL on floor = 12 kN/m ²
(g) LL = 5 kN/m ²	(h) Damping = 3%

Neglect weight of infill walls. Assume suitable data if required. Write all the clauses of IS 1893 (2002).

- Q.5 (a)** Discuss in detail the advantage of horizontal bands and vertical reinforcement in the masonry buildings. 3
(b) Explain four virtue of good earthquake resistant design. 4
(c) If a column of size 350 mm × 550 mm is having the longitudinal reinforcement of 1.75 % of the gross cross sectional area. Detail the longitudinal reinforcement of the column satisfying all criteria of IS 13920-2016 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. Take concrete grade = M25, steel grade = Fe 415 and clear cover to longitudinal reinforcement = 40 mm 7

OR

- Q.5 (a)** Differentiate between active and passive methods of structural control. 3
(b) Draw a neat sketch of beam-column connection. 4
(c) Explain in brief base isolation technique. 7

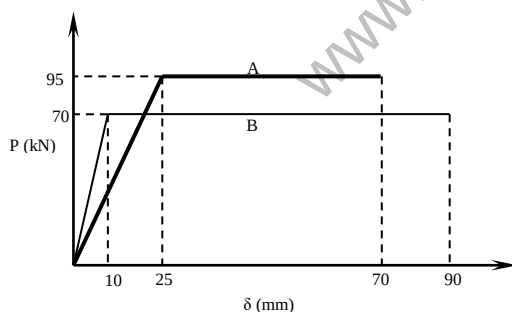


Fig.1

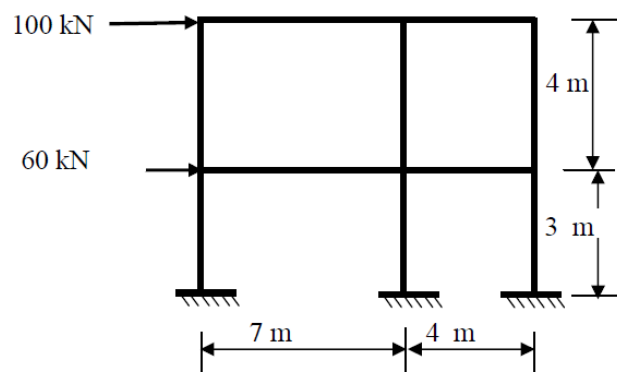


Fig.2