Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–V • EXAMINATION – SUMMER • 2014

Subject Code: X50602 **Date: 29-05-2014**

Subject Name: Earthquake Engineering

Time: 02:30 pm - 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 Part I (2002) & IS 13920 (1993) are allowed in the Examination.***

Q.1 **(a)** Derive the expression for the dynamic load factor for the forced damped vibration with usual notations. **07**

(b) Explain four virtue of good earthquake resistant design. **07**

Q.2 **(a)** Explain concept of ductile detailing & explain factor affecting the ductility of structures in detail. Explain ductile detailing of column as per IS 13920 – 1993. **07**

(b) An elevated water tower tank with a capacity of 60000 litres of water has a natural period in lateral vibration of 1.5 sec when empty. When the tank is full of water, its period lengthens to 2.8 sec. Determine the lateral stiffness 'k' of the tower and the weight 'W' of the tank. Neglect the mass of the supporting column and damping. **07**

OR

(b) What is jacketing? Explain the jacketing of beams and column with illustrative sketches. **07**

Q.3 **(a)** A five storeyed building has size of 30m x 30m. It is located in Bhuj and resting on hard soil. The weights of floors and height of the floors are 2000kN, 2500kN, 2500kN, 2500kN and 2100kN AND 4.5m, 3.5m, 3.5m, 3.5m and 3.5m respectively from slab no.1 from bottom. Assuming the building as special moment resisting office building and 7% of critical damping, calculate the horizontal shear forces acting at the each slab level by equivalent lateral force method. **10**

(b) Discuss in detail the advantage of horizontal bands and vertical reinforcement in the masonry buildings. **04**

OR

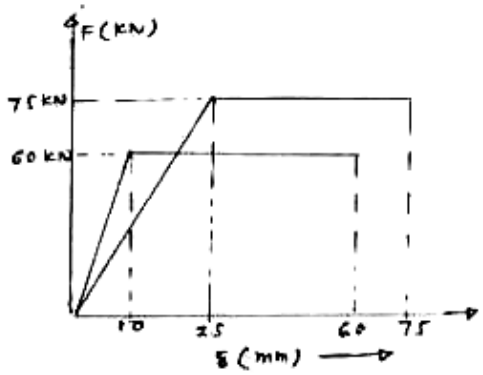
Q.3 **(a)** Define & explain liquefaction. Also give remedial measures for the liquefaction. **07**

(b) Explain Base Isolation technique. **07**

Q.4 **(a)** State whether following statements are true or false. Give logical reason for your answer : **07**

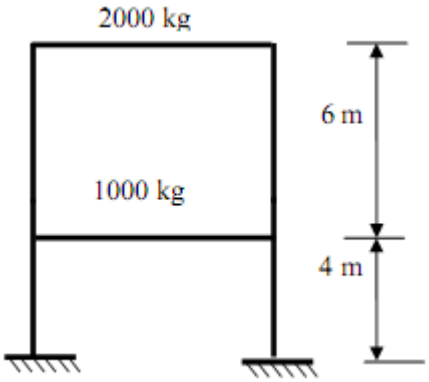
1. Masonry structures offers less damping as compared to steel structures.
2. Code specifies lower value of R for building having better performance.
3. Dahod is having maximum earthquake risk.
4. Peak ground acceleration (PGA) & Zero period acceleration (ZPA) are same.
5. Two identical building to be constructed in zone IV & V. Building in zone IV should be designed for higher lateral load than building in zone V.
6. Any structure is designed as earthquake proof structure.
7. Liquefaction is only possible in clayey soil.

Q.4 (b) Force deformation curve of two building is shown in Fig., 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 **07**

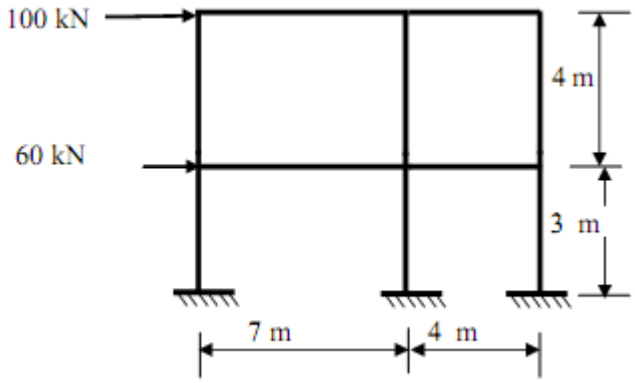


OR

Q.4 (a) What is mode shape? Plot the mode shapes for the frame shown in the fig. and indicate the fundamental mode. Take $EI_{column} = 1.5 \times 10^{12}$ Nmm^2, $EI_{beam} = \infty$. **14**



Q.5 (a) Enlist different approximate methods used for lateral load analysis. Analyze the frame shown in the fig. 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 . **14**



OR

Q.5 (a) Explain failures of masonry structures observed in past earthquakes & how will you improve performance of masonry building. **07**

(b) A SDOF vibrating system is having following parameters. m = 250 kg, k = 180 N/m, c = 50 N – sec / m. Determine (i) the damping factor (ii) the natural frequency of damped vibration (iii) logarithmic decrement (iv) the ratio of two successive amplitudes & (v) the number of cycles after which the original amplitude is reduced to 50%. **07**

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