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

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC SEM-V Examination-Nov-2011

Subject code: X50602 **Date: 22/11/2011**

Subject Name: Earthquake Engineering

Time: 2.30 pm -5.00 pm **Total marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 Calculate lateral forces **in the critical direction only** at each floor level for the office building in Junagadh with following data by seismic coefficient method. **14**

(a) No. of storey = 10 (b) No. of bay in x direction = 12
(c) No. of bay in y direction = 2 (d) storey height = 3.0 m
(e) Width of each bay = 7 m (f) No of occupants = 499
(g) Total DL on roof = 12 kN/m^2 (h) LL on floors = 5 kN/m^2
(i) Total DL on floors = 10 kN/m^2

Neglect weight of infill walls. Assume suitable data if required. **Write all your assumptions & clauses of IS 1893 (2002).** Also draw distribution of lateral force at each floor level.

Also discuss **(only)** following in short

- If the same building is located in Dahod, is there any change in design lateral force?
- The functional purpose of the building is changed & now it will used as residential house having 500 occupants, what will be the change in design lateral force?

Q.2 (a) Derive expression for the response of SDOF free damped structural system. **07**

(b) A SDOF vibrating system is having following parameters. **07**
m = 90 kg, k = 150 N/m, c = 20 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 40%.

OR

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

Q.3 (a) **State whether following statements are true or false & also justify your answer in short.** **07**

1. Liquefaction is only possible in cohesive soil.
2. Intensity will reduce & magnitude will increase near epicenter.
3. As per IS 1893 2002, Gujarat is divided in Zone III, IV & V only.
4. Ductile detailing is compulsory for RCC building located in Gujarat.
5. Buildings in Gujarat can resist 9 magnitude earthquakes.
6. Design philosophy for gravity loads & design philosophy for lateral loads due to earthquake are same.
7. A building is located in zone III but on the boundary of zone III & IV. It will be designed as if it is in zone IV.

(b) Attempt **any three** **07**

1. What is the natural period of vibration of the second system with respect to first if both systems are identical except support condition? First system has hinge support & second system has fixed support.
2. The dimension of the column is 300 mm x 300 mm. If the 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. Explain four virtue of good earthquake resistant design.
4. Give your comment
   - Importance factor depends on performance of the building.
   - Base isolation is preferred in high rise building.

OR

Q.3 **(a)** **State whether following statements are true or false & also justify your answer in short.** **07**

1. Performance of shear walls which are located near geometric centre of building is better than the identical shear wall located on periphery.
2. Non structural wall will fail before structural wall.
3. IS 13920-1993 has given special detailing for beam-column joint.
4. Concrete structures offer less damping as compared to steel structures.
5. Code specifies higher value of R for building having better performance.
6. Any structure is designed as earthquake proof structure.
7. Mizoram is having least seismic risk.

(b) Attempt following any three **07**

1. Enlist three latest great earthquake of the world after 2007. Name two inter plate & two intra plate earthquakes of India.
2. Explain the deficiencies of building exposed in recent Japan earthquake. Also write remedial measures of each deficiency.
3. Define & explain liquefaction.
4. Differentiate : Ductility Vs Flexibility

Q.4 **(a)** Calculate the forces in four columns located in corner due to lateral load of 1600 kN acting in X direction for the single storey building having slab dimension 12m x 8m. Intensity of loading is 10kN/m^2 which is uniform. All columns are identical square column. Use all provisions of IS 1893 – 2002 Part-I including torsion provision. **07**

(b) If the half of the floor is used for storage purpose having intensity of loading is 15 kN/m^2, recalculate the forces in the columns. Intensity of loading in other half slab panel is 10 kN/m^2. **07**

OR

Q.4 **(a)**

1. Differentiate (i) Magnitude & Intensity (ii) Iso-seismal & Meizo-seismal (ii) Seismograph Vs Seismogram (iv) S wave & P wave **07**
2. Explain mathematical modeling with two examples.

(b) Analyze the two bay two storey RC frame by any appropriate approximate method of analysis & draw axial force, shear force & bending moment diagram. Lateral force of 100kN & 60 kN is acting at first & second floor respectively. Storey height = 4 m & bay width of each bay =.6 m. **07**

Q.5 For the three storey building frame having lumped masses 10 tonne at floor level having first & second storey stiffness 90 kN/m & ground storey stiffness 25 kN/m. Draw all mode shapes, interpret the result of the mode shape & identify the deficiency. **14**

OR

Q.5	**(a)**	A simply supported beam of negligible mass spanning 8 m supports a machine of 40 kN at center with an unbalanced rotor applying a vertical force of 120 sin 40t kN. The damping force is 0.3 kN-s/m & Flexural rigidity of beam is 30000 kN-m^2. Determine (i) Maximum amplitude of vibration (ii) Amplitude of vibration at resonance.	**07**
	(b)	Explain failures of masonry structures observed in past earthquakes & how will you improve performance of masonry building.	**07**

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