Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – WINTER 2012

Subject code: 711502N Date: 09-01-2013

Subject Name: Structural Dynamics & 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. **Use of IS 1893-2002, IS 456-2000, IS 13920 – 1993, IS 4326, SP 16 is allowed**

Q.1 **(a)** Attempt **any four** **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. Explain Capacity design concept.
5. Give your comment
   - Importance factor depends on performance of the building.
   - Base isolation is preferred in high rise building.

(b) **State whether following statements are true or false & also justify your answer.** **07**

1. If mass of SDOF system will become four times, then frequency will increase & become doubled.
2. Nagaland is having least seismic risk.
3. Soft storey is always become weak storey.
4. Design philosophy for gravity loads & design philosophy for lateral loads due to earthquake are same.
5. Inter storey drift is maximum in Zero Period Structure.
6. Performance of shear walls which are located near geometric centre of building is better than the identical shear wall located on periphery.
7. Non structural wall will fail before structural wall.

Q.2 **(a)** A SDOF vibrating system is having following parameters. **07**
m = 20 kg, k = 120 N/m, c = 10 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%.

(b) Derive expression for the free vibration response of damped SDOF structural system & differentiate the response with that of free un-damped response. **07**

OR

(b) Derive expression for the response of SDOF forced un-damped structural system. **07**

Q.3 **(a)** Define Ductility. Explain concept of ductile detailing as per IS 13920 – 1993. Sketch ductile detailing for column as per the code. **07**

(b) Calculate maximum SF & BM at supports for the frame shown in fig.1 after five cycle of vibration if the floor is displaced horizontally by 100mm & suddenly released. Take f_{ck} = 25 MPa & size of column = 500 x 500 mm. Assume suitable damping. Also draw amplitude envelop for first five cycles of vibration. **07**

OR

Q.3 **(a)** 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

(b) 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.

Q.4 **(a)** The fig. 2 shows the plan of 7 m height residential building. Carry out lateral load distribution as per IS 1893 Part I 2002 if recorded acceleration at roof level is 0.6 g. **07**

(b) You can change structural layout as per your choice to overcome the deficiency identified above. Reanalyze the problem & compare the result. **07**

OR

Q.4 **(a)** Explain failures of masonry structures observed in past earthquakes & how will you improve performance of masonry building. **07**

(b) A simply supported beam of negligible mass spanning 10 m supports a machine of 50 kN at center with an unbalanced rotor applying a vertical force of 150 sin 20t kN. The damping force is 0.3 kN-s/m & Flexural rigidity of beam is 40000 kN-m^2. Determine (i) maximum amplitude of vibration (ii) amplitude of vibration at resonance **07**

Q.5 **(a)** For the two storey building frame having lumped masses 20 tonne at floor level having first storey stiffness 80 kN/m & ground storey stiffness 40 kN/m. Draw all mode shapes, interpret the result of the mode shape give your expert comment. **07**

(b) Carry out response spectrum analysis for the structure define in Q 5 (a) **07**

OR

Q.5 **(a)** Explain **07**

- Explain modal mass participation
- Missing mass correction

(b) Explain various methods of dynamic analysis. Explain Response Spectrum Analysis in detail. **07**

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