# **GUJARAT TECHNOLOGICAL UNIVERSITY** ME - SEMESTER-II • EXAMINATION – SUMMER - 2017

# Subject Code: 2722010Date: 26/05/2017Subject Name: Structural Dynamics and Earthquake EngineeringTotal Marks: 70Time: 02:30 PM To 05:00 PMTotal 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 and IS 13920 1993 is permitted.
- Q.1 (a) State whether following statements are true or false & also justify 06 your answer in short.

(1) Nagaland is having least seismic risk.

(2) Inter storey drift is maximum in Zero Period Structure.

(3) Design philosophy for gravity loads & design philosophy for lateral loads due to earthquake are same.

(4) Non structural wall will fail before structural wall.

(5) If mass of SDOF system will become four times, then frequency will increase & become doubled.

(6) P & S waves are responsible for maximum damage to structures.

- (b) Give details of expected damages by Earthquake in structures with 08
  - 1. Short columns,
  - 2. Building frames without shear panels,
  - 3. Floating columns,
  - 4. Unsymmetrical plan.
- Q.2 (a) Define Ductility. Explain concept of ductile detailing as per IS 13920 07 1993. Sketch ductile detailing for beam as per the code.
  - (b) Calculate maximum SF and BM at supports for the frame shown in 07 Fig.1 after five cycle of vibration if the floor is displaced horizontally by 80 mm and suddenly released. Take fck = 20 MPa and 500 mm diameter column size. Assume suitable damping. Also draw amplitude envelop for first five cycles of vibration.

#### OR

- (b) Derive expression for the free vibration response of damped SDOF **07** structural system and differentiate the response with that of free undamped response.
- Q.3 (a) Derive expression for the response of SDOF forced damped structural 07 system.
  - (b) A vertical cantilever of mild steel tube section is 3.0 m long and 07 supports 7 kN weight. The tube has external diameter 200 mm and wall thickness 5 mm. The system is subjected to a harmonic force of 12 kN amplitude and 2.5 Hz frequency find the maximum steady state displacement in the tube. Take damping as 2% of critical damping.

### OR

- Q.3 (a) Explain the effects of architectural features on performance of 07 buildings during earthquake.
  - (b) Explain the importance of provision of shear walls in seismic regions. 07

Q.4 For a two storied single bay steel residential building located in seismic 14 zone V and resting on medium soil, calculate design lateral forces, storey shear and storey drift using response spectrum method of analysis as per IS:1893-2002. The structural elements of the building will be detailed as per IS:13920-1993. The mass on each floor is 1.5 tonne and story stiffness is 200 kN/m for both storey. Height of each floor is 3.2 m and bay width 5m.

# OR

- Q.4 (a) Explain (1) modal mass participation, and (2) missing mass correction 07
  (b) Explain importance of bands in masonry buildings. 07
- Q.5 (a) A typical floor as shown in Figure 2 is subjected to design lateral force 07 of 200 kN in X direction. Size of column is 450 mm x 650 mm and mass is uniformly distributed. Using appropriate clauses of code carry out lateral forces on the column.
  - (b) Describe seismic waves briefly.

07

#### OR

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Q.5 (a) Explain the causes and remedial measures of liquefaction 07
 (b) Explain various methods of dynamic analysis. Explain Response 07
 Spectrum Analysis in detail.



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