Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI • EXAMINATION – WINTER • 2014

Subject Code: 160605 Date: 03-12-2014

Subject Name: Earthquke 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 and IS 13920 is permitted**

Q.1 Using seismic coefficient method estimate the storey lateral forces at each floor level for a RCC framed office building and draws the distribution of storey lateral forces and shear. **14**

Use following data

(i) No. of storey and height: 5 storey with 3.5 m storey height
(ii) No. of bays : 4 bays along X and Y direction
(iii) Bay width: 5 m along, both X and Y direction
(iv) Slab Thickness : 125 mm
(v) Size of beam : 0.3 m (width) x 0.45 m (depth below soffit)
(vi) Size of column : 0.40 m x 0.40 m
(vii) Wall : 150 mm thick brick masonry All
(viii) Parapet: 1 m high 230 mm thick brick masonry
(ix) Live Load : 4 kN/m^2
(x) Location : Gandhidham (Kutchh)

Q.2 (a) Choose most appropriate answer from the given alternatives. **07**

(i) Zone factor generally represents..
  (A) Seismicity of a region
  (B) Importance of the structure
  (C) Size of Structure
  (D) None of these

(ii) Generally damping for steel structure is taken as..
  (A) 5% of critical damping
  (B) 2% of critical damping
  (C) 10% of critical damping
  (D) 20% of critical damping

(iii) Fastest seismic waves are…
  (A) Love waves
  (B) Raleigh waves
  (C) P waves
  (D) None of these

(iv) Generally Intensity of earthquake….
  (A) Increases away from the epicenter
  (B) Remains constant
  (C) Decreases away from the epicenter
  (D) None of these

(v) The Himalaya has immerged from which inter plate interaction?
  (A) Divergent Plate Boundary
  (B) Convergent Plate Boundary
  (C) Transformed Plate Boundary
  (D) None of these

(vi) Earthquake is classified as shallow focus if focal depth is ….

(A) Less than 70 km
(B) Less than 7 km
(C) Less than 14 km
(D) Less than 700 km

(vii) Maximum intensity scale based on MSK scale is….
(A) X
(B) V
(C) XI
(D) XII

(b) Derive the motion equation for the forced undamped vibration. **07**

OR

(b) Derive the motion equation for the free damped vibration **07**

Q.3 **(a)** List the four virtues of good earthquake resistance design and describe any one in detail. **07**

(b) List and sketch the earthquake resistance feature of ordinary brick masonry structure. **07**

OR

Q.3 **(a)** Explain soft storey? Explain how soft storey problems can be eliminated in the existing buildings. **07**

(b) Explain how ductile design is helpful for better earthquake resistance. **07**

Q.4 **(a)** For a floor slab shown in the fig.1, Locate centre of mass and stiffness. Find design eccentricity and torsional moment if 200 kN force acts long Y direction. All columns are of 300 X 600 mm c/s with same height. Mass is uniformly distributed. **07**

(b) Write short note on Liquefaction and remedial measures **07**

OR

Q.4 **(a)** Write short note on structural control **07**

Q.4 **(b)** Describe various strengthening methods for RCC columns and beams through illustrative sketches. **07**

Q.5 **(a)** Analyse the plane frame shown in the fig. 2 using an appropriate approximate method and sketch SF and BM diagram. **07**

(b) The building frame shown in the Fig.3 is given a 120 mm lateral displacement and released from the rest to vibrate freely. Find the logrithmatic decrement and displacement of the system after 10 cycles and comments on the result. Consider 5% damping. Take $EI_{column} = 1.2 \times 10^{12}$ Nmm, $EI_{beam} = \infty$. **07**

OR

Q.5 **(a)** What is mathematical modeling? Enlist the dynamic parameters of model. Prepare mathematical model of the system shown in the fig.4 and find natural frequency of the system. **07**

(b) A SDOF vibrating system is having following parameters. **07**

m= 10 kg , k=80 N/m ,C=10 N s /m.

Determine (i) Damping Factor (ii) Natural Frequency (iii) Damped frequency (iv) Logarithmic decrement (iv) No. of cycles after which the original amplitude reduces to 25 % .

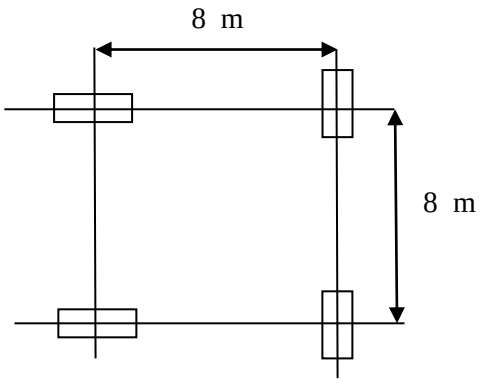

Fig.1-Q-4(a)

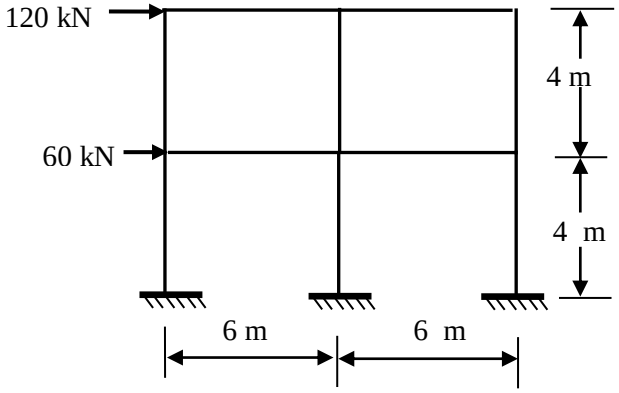

Fig.2-Q-5(a)

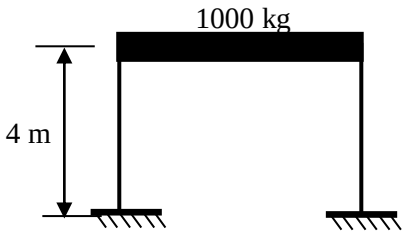

Fig.3 Q-5(b)

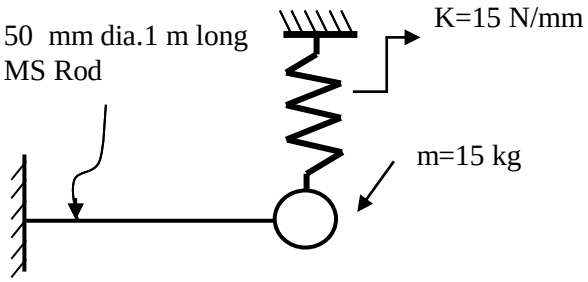

Fig.4 Q-5 (a) OR

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