Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–V. EXAMINATION – SUMMER 2016

Subject Code:X50602 **Date:13/05/2016**

Subject Name:Earthquake Engineering

Time:02:30 PM to 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 (Part-I) and IS 13920:1993 is allowed.***

Q.1(a) Derive equation of response of SDOF free damped vibration using usual notations. **07**

Q.1(b) Explain design philosophy for earthquake resistant structures. **07**

Q.2(a) Explain effect of irregularities in seismic behavior of RCC structures. **07**

Q.2(b) Explain factors affecting liquification in detail. Also give remedial measures to for liquification. **07**

OR

Q.2(b) Explain criterias for ductile detailing of RC columns as per IS 13920:1993. **07**

Q.3 Calculate base shear and storey shear for G+9 storey school building located in Ahmedabad with following details. Use seismic coefficient method. **14**

No of Bays in X Direction: 6 bays at 5 m c/c distance
No of Bays in Y Direction: 10 bays at 4 m c/c distance
Storey Height: 3 m
Size of beams: 300 mm x 450 mm
Size of columns: 300 mm x 600 mm
Thickness of slab: 125 mm
Live load : 4 kN/m^2
Floor Finish and Terrace Water Proofing: 1 kN/m^2
Damping: 20%
Type of frame: Special moment resisting frame (SMRF)
Density of RCC: 25 kN/m^3
Do not consider contribution of infill walls in calculation. Assume suitable data if required.

OR

Q.3(a) Derive equation of displacement for SDOF force damped vibration using usual notations. **07**

Q.3(b) A cantilever beam of span 4 m is subjected to a mass of 1000 kN at free end. The size of beam is 230 mm x 300 mm and modulus of elasticity is 20000 N/mm^2. The beam is initially displaced 50 mm and released to vibrate. Consider damping is 5% of critical damping. **07**

Calculate (i) Natural frequency of un-damped system (ii) Natural frequency of Damped system (iii) Absolute Damping coefficient (iv) Logarithmic decrement (v) Amplitude after 5 cycles (vii) Number of cycles required for displacement to reach 10 mm.

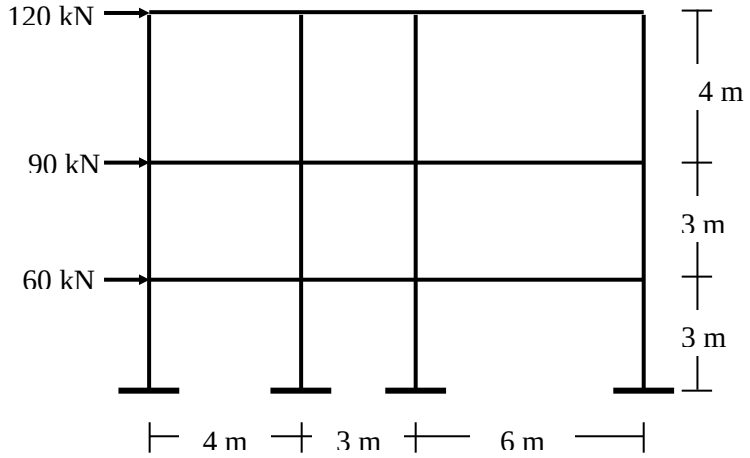
Q.4 A three storey single bay RC frame has lumped floor weights of 180 kN & having storey stiffness of 80 kN/m at every floor level. Perform free vibration analysis and determine all natural frequencies & sketch all mode shape. **14**

OR

Q.4(a) A rectangular building of plan size 6 m x 8m is subjected to Earthquake force perpendicular to 6 m side. Perform lateral load analysis if four columns are provided at each corner. The size of columns is 400 mm x 400 mm. Use IS 1893:2002 (Part-I). **07**

Q.4(b) Explain base isolation technique in detail. **07**

Q.5 Analyse the frame shown in figure by portal method and thereby draw axial force, shear force and bending moment diagrams. **14**



OR

Q.5(a) Explain capacity design concept and strong column weak beam theory. **07**

Q.5(b) How will you incorporate earthquake resistant design features in masonry structures? Explain in detail. **07**