UPES
End Semester Examination, May 2023

Course: Seismic Design of Structures   Semester: II
Program: M.Tech. Structural Engineering   Time   : 03 hrs.
Course Code: CIVL 7013   Max. Marks: 100

Instructions: IS 1893:2016, IS 13920:2016 and IS 456:2000 should be allowed/Provided. Assume necessary data if required.

SECTION A

S. No.		Marks	CO
Q 1	What are the basic concepts for ductile performance structures?	4	CO1
Q 2	Draw ductile detailing of the column as per IS 13920.	4	CO1
Q 3	What are the principles of earthquake resistant design of RCC buildings?	4	CO1
Q 4	What do you understand by response spectrum, and how this method is useful for design.	4	CO1
Q 5	Explain the steps of seismic hazard analysis.	4	CO1

SECTION B

Q 6	Please explain retrofitting solution for the damage shown in figure below.	10	CO4
Q 7	Briefly explain repairing techniques for different grades of damage to masonry buildings.	10	CO4
Q 8	Explain ductility considerations for earthquake resistant beam design as per IS 13920.	10	CO2
Q 9	Explain design procedure of a column design after push over analysis with a suitable example.	10	CO3

SECTION-C

| Q 10	Calculate seismic Loads on the below structure by capacity Method without infills.		
		20	CO2
	OR		
	Calculate seismic Loads on the below structure by capacity Method with infills.		
Q 11	Design a ductile RC shear wall for a five-story (G+4) apartment building shown in the figure below. The materials are M25 concrete and Fe 415 steel. The wall is to be detailed as a "Special RC shear wall" according to IS 13920 standards. The example shows the design for load combination 1.2(DL + LL +EL) only. In practice, all other combinations should also be considered. Gravity load is calculated with 200 mm RC Slab + 1KPa floor/roof finish and live load justified as 3 KPa. Here, 25% of LL has been considered for seismic weight calculations. The unfactored forces at various floor levels are given in the Table for the shear wall as shown in Figure. Overall height is 5 x 3100 = 15500 mm and length of shear wall = 4000 mm. Plan area of the building is 24m x 18m.	20	CO3
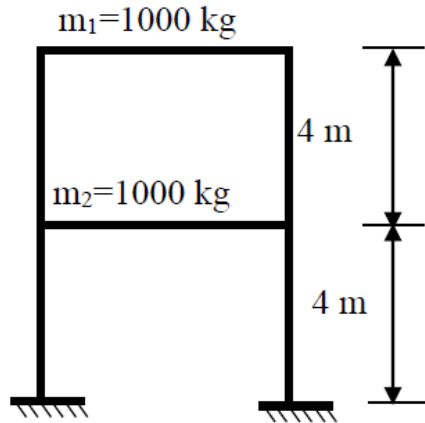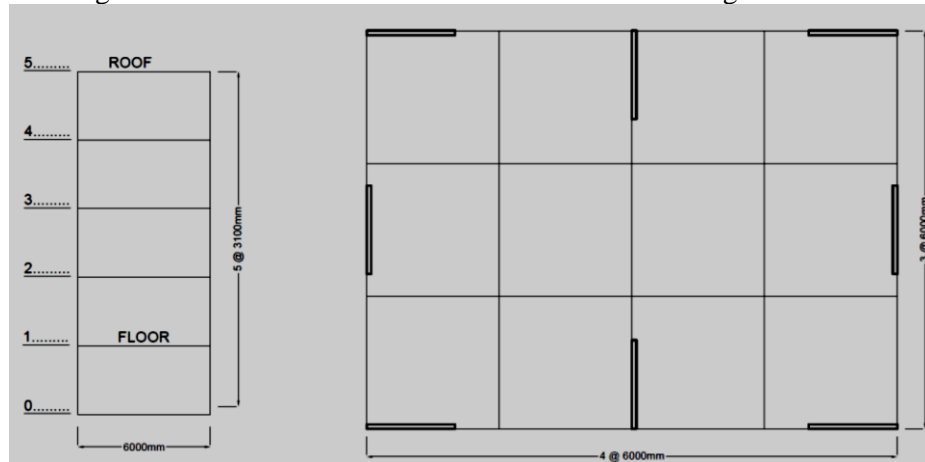
Level	P_{DL} (kN)	P_{LL} (kN)	V_{EL} (kN)	M_{EL} (kNm)
5 (roof)	396	0	177	0

4	396	162	309	548	
3	396	162	381	1502	
2	396	162	414	2684	
1	396	162	423	3967	
Base (total)	**1980**	**648**	**423**	**5276**	