

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SECOND SEMESTER M.TECH DEGREE EXAMINATION, MAY 2016

Civil Engineering
Structural Engineering

01CE6106 ANALYSIS AND DESIGN OF EARTHQUAKE RESISTANT
STRUCTURES

Max. Marks : 60

Duration: 3 Hours

Use of IS 1893: 2002, IS 456:2000, SP16, IS 13920:1993 are permitted

Answer any **TWO** questions from each Part.

PART A (2×9=18 marks)

1. a) Differentiate between intensity and magnitude of earthquake. (3 marks)
b) Explain the characteristics of a typical earthquake response spectrum. (6 marks)
2. a) Explain the effects of vertical irregularities on the performance of structures subjected to seismic loads. (4 marks)
b) Discuss the main characteristics of different types of seismic waves. (5 marks)
3. a) Explain the construction of design elastic response spectrum. (5 marks)
b) Define i) ZPA ii) Bracketed duration. (4 marks)

PART B (2×9=18 marks)

4. Plan and elevation of a four-storey OMRF reinforced concrete office building located in Zone III is shown in Fig.1. The details of the building are as follows.

Live Load = 3 kN/m^2 Importance factor = 1.0

Columns = $450 \times 450 \text{ mm}$

Beams = $250 \times 400 \text{ mm}$

Thickness of Slab = 150 mm

Thickness of Wall = 120 mm

Determine design seismic lateral load and storey shear force distribution. (9 marks)

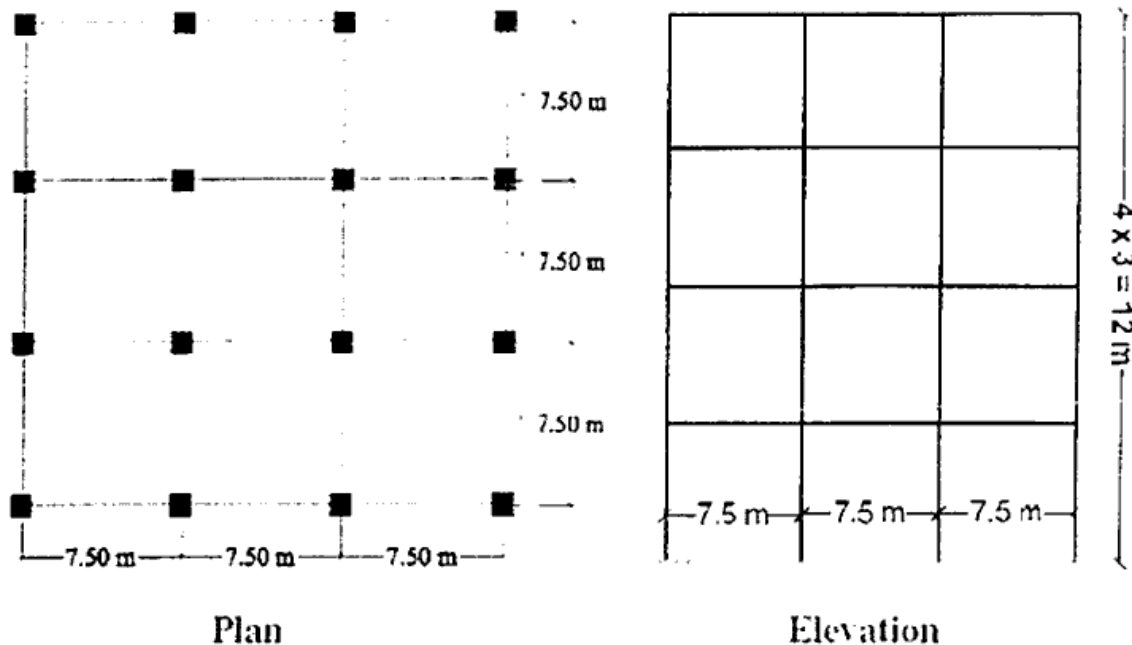
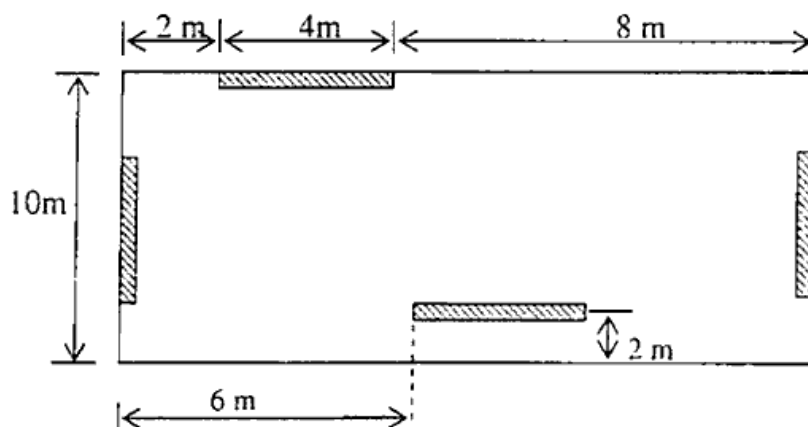


Fig. 1

5. Determine the lateral forces at different storey levels by dynamic analysis for the 3 storey OMRF school building located in Zone 5 whose mode shapes and frequencies are given below. Consider the effect of at least the first 2 modes.

	Weight (kN)	Mode 1	Mode 2	Mode 3
Period (sec)		0.36	0.16	0.1
Roof	640	1.000	1.000	1.000
2 nd floor	688	0.716	-0.444	-2.366
1 st floor	688	0.407	-0.579	2.7

6. a) Explain the philosophy of capacity design. (3 marks)
- b) Plan of a building having 4 identical shear walls, each 4m long and 200 mm thick is shown in Fig. 2. Determine the design lateral forces in the shear walls if the storey height is 4 m and the seismic force is 450 kN in either direction. (6 marks)



PART C (2×12=24 marks)

7. a) What is the difference between retrofitting and repair? Explain one method each for retrofitting and repair of structural members. (7 marks)
- b) Explain in detail, the procedure for design of shear walls as per IS 13920. (5 marks)
8. a) Discuss the significance of earthquake disaster mitigation. (3 marks)
- b) A circular column 300 mm diameter is reinforced with 8 bars of 20 mm diameter as main reinforcement and 10 mm diameter stirrups at 100 mm spacing. Assuming M 25 concrete, 40 mm clear cover and Fe 415 grade steel, design the special confining reinforcement and show the detailing for a floor height of 3.5 m. (9 marks)
9. An R.C. beam 25 cm × 50 cm spanning 3 m between supporting columns is reinforced with 3 bars of 16 mm diameter at the top and bottom throughout with a clear cover of 40 mm. Thickness of the floor slab is 10 cm. Suggest suitable shear reinforcement as per IS 13920 and show the detailing if it is to carry a live load of 1.5 kN/m. Assume M20 concrete and Fe 415 grade steel. (12 marks)
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