Earthquake Engineering
(3160621 Professional Elective-III)

B.E. Semester 6th (Civil Engineering)

Shantilal Shah
Engineering College

Directorate of Technical Education, Gandhinagar, Gujarat

Shantilal Shah Engineering College
Bhavnagar

Certificate

This is to certify that Mr. / Ms. _____

Enrollment No. _____ of B.E. Semester 6th Civil Engineering of this Institute (GTU Code: 043) has satisfactorily completed the Practical/Assignment work for the subject **Earthquake Engineering (3160621)** for the academic year 2024

Place: _____

Date: _____

Name and Sign of Faculty member

Head of the Department

Subject Code: 3160621

SUBJECT NAME: EARTHQUAKE ENGINEERING

SEMESTER-VI

Type of course: Professional Elective Course

Tutorials

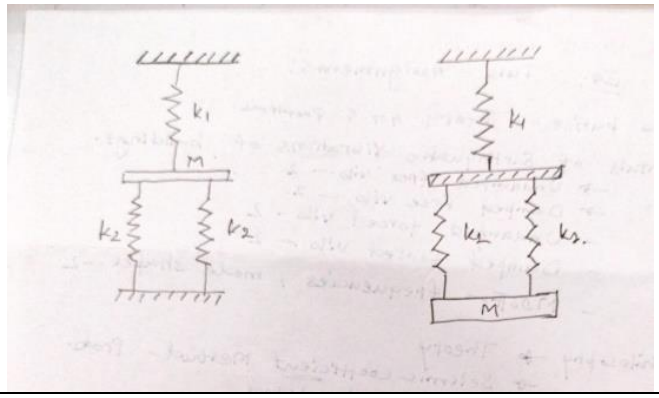
Sr. No	Course outcome	Learning level
1	Identify the causes of damages in structures during earthquake events	Apply
2	Determine the response of SDOF & MDOF structural system subjected to vibration including earthquake	Apply
3	Apply the concept of Earthquake Resistant Design & concept of lateral load distribution on buildings in design of RC structures	Apply
4	Determine the lateral forces generated in the structure due to earthquake.	Apply
5	Apply the concept of ductile detailing in RC structures & the concepts ERD to Masonry structures with knowledge of advanced technology	Apply

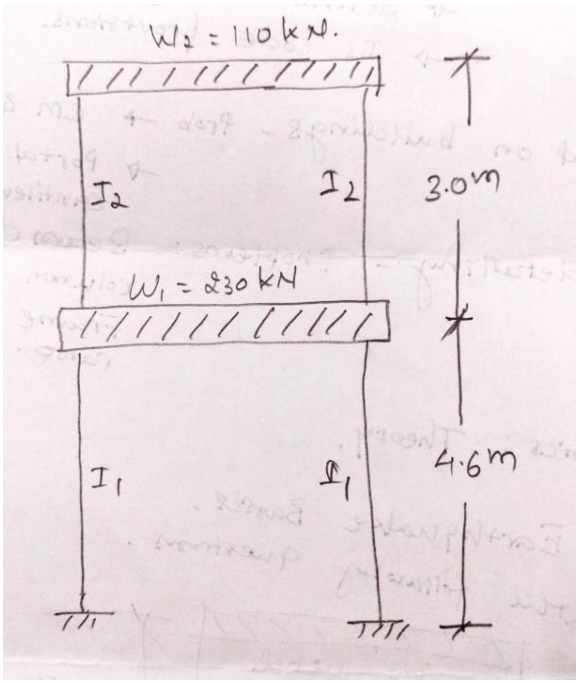
List of Tutorials:

Sr. No.	Topic
1.	Earthquake Basics
2.	Fundamentals of Earthquake vibration of buildings
3.	Design Philosophy
4.	Lateral loads on buildings
5.	Ductile detailing
6	Special Topics

Tutorial 1 Earthquake Basics			
Q. No.	Problem/ Question	CO	Learning level
1.	Define following terms:	1	Remembering
	(a) Epicentre		
	(b) Focus		
	(c) Magnitude		
	(d) Intensity		
	(e) P and S waves		
2.	Describe in brief the occurrence of earthquake.	1	R
3.	Describe the types of earthquake waves in brief.	1	R
4.	Differentiate between magnitude and intensity of earthquake in brief.	1	Remembering
5.	Give comparison of seismic zoning map of India according to IS-1893 Part 1 :2016. What r differences between zoning map in IS 1893 Part 1 2016 and 2002?	1	Analysing
6.	Prepare a report on any recent earthquake of magnitude higher than 5.5 occurred in last one year.	1	Analysing

Date of Submission: 26/02/2025

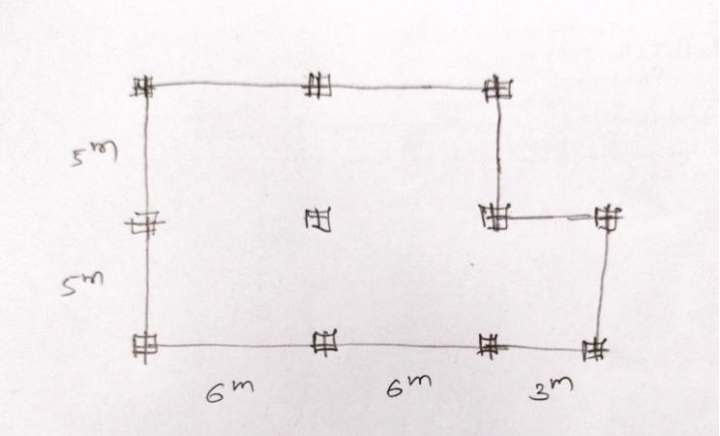
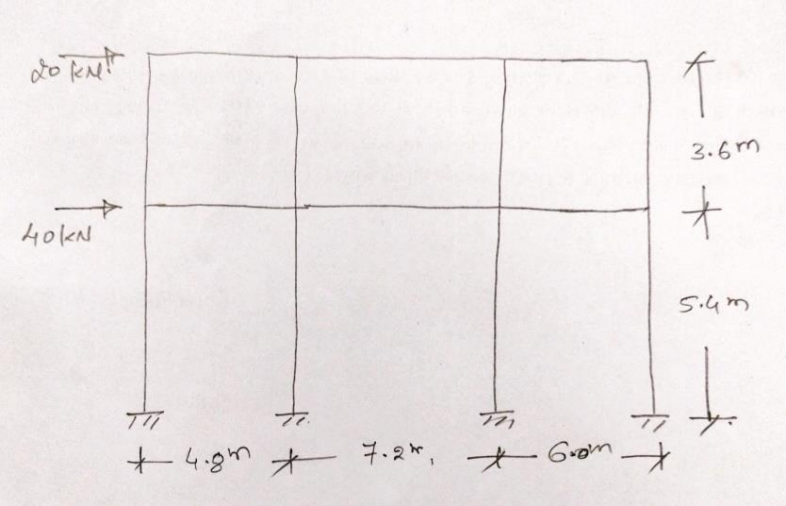
Tutorial 2 Fundamentals of earthquake vibrations of buildings			
Q. No.	Problem/ Question	CO	Learning level
1.	Calculate the natural frequency of spring mass system shown in Fig. 	2	Applying
2.	A linear spring supports a body weighing 300 N. In free vibration, the body oscillates at frequency of 375 cycles / min. Determine the spring constant k for the system.	2	
3.	A mass of 10 kg is attached to a linear spring. The oscillations started with zero initial displacement and some initial velocity. The motion is having time period of 0.18 sec and amplitude of 65 mm. Determine the spring constant and the initial velocity.	2	
4.	A vibrating system consist of a weight w = 50 N and a spring with stiffness 4 N / mm. The system is viscously damped such that the consecutive amplitudes are 1.0 and 0.86. Determine the natural frequency of the undamped system, the logarithmic decrement, the damping ratio, the damping coefficient and the damped natural frequency.	2	
5.	A viscously damped SDOF system shows a static deflection of 22 mm due to the own weight of 250 N. Determine the value of critical damping coefficient for the system.	2	
6.	A simply supported beam supports a machine at its mid span. The weight of the machine is 70 kN. The span of simply supported beam is 3.5 m and moment of inertia is 54 x 10^6 mm^4. The machine runs at 300 rpm and having unbalanced weight of 150 N rotating at radius of 200 mm. What will be the amplitude of steady state response if equivalent viscous damping for the system is 10 % of critical. E = 2 x 10^5 N/mm^2	2	
7.	A machine of weight 20 kN is mounted at the center of a 3 m span simply supported beam. The harmonic force produced by the machine is 30 kN and frequency of force is 60 rad / sec.Assuming 10 % of critical damping, determine the force transmitted to the beam support and amplitude of the motion. I= 0 x 10^6 mm^4 and E= 2 x 10^5 N/mm^2 .	2	

8.	Calculate the frequencies and mode shapes for the frame shown in Fig. I_1= 103x10^6mm^4, I_2=45 x 10^6mm^4 , E= 2 x 10^5 N/mm^2  	2	

Date of Submission: 19/03/2025

Tutorial 3 Design Philosophy			
Q. No.	Problem/ Question	CO	Learning level
1.	Describe the importance of configuration of the building for earthquake resistant design.	3	Applying
2.	Differentiate between strength and stiffness of the building considering the earthquake resistant design. Also list out importance of each factor for earthquake resistant design.		
3.	What is role of ductility in earthquake resistant design of the building?	3	R
4.	Using static coefficient method, calculate lateral forces at each floor level for an SMRF hospital building frame having following data. (a) No. of storey: 10 (b) Thickness of slab: 160 nun (c) Size of Beam & column: 600mm x 600mm (d) Bays @ x and y direction : 4 (e) Bays width: 4 m (f) Storey height: 3 m (g) Finished wall thickness is 250mm for exterior wall (h) Live load : 4 kN/m2 Take floor finish as 1 kN/m2. Water proofing of load 1.5 kN/m2 has been provided at terrace. Assume any additional data if required for the building frame and neglect the weight of interior infill wall panels. Building is situated in Ahmedabad.	4	Applying
5.	What is regular and irregular building according to IS 1893. Give list of all irregularities in buildings.	3	R
6.	What is ‘weak’,’soft ‘and ‘stilt’ storey? Describe the method of earthquake resistant design according to IS 1893 for each case.	3	R

Date of Submission:26/03/2025

Tutorial 4 Lateral load on buildings			
Q. No.	Problem/ Question	CO	Learning level
1.	The plan of a floor shown in Fig.Seismic load at that floor is 90 kN in both the directions. Size of columns is 400 mm x 400 mm. Thickness of slab is 125 mm. Floor height is 3.5 m. Find out the design eccentricity for earthquake load in both the directions. E for concrete = 22360 N/mm^2 	3	Applying
2.	Analyse the frame shown in Fig. for lateral loads by portal method and cantilever method. 	3	Applying

Date of Submission: 16/04/2025

Tutorial 5 Ductile Detailing			
Q. No.	Problem/ Question	CO	Learning level
1.	Describe the ductile detailing clauses for beams according to IS-13920.	5	R
2.	Describe the ductile detailing clauses for columns according to IS-13920.	5	R
3.	Describe the ductile detailing practice at the beam-column joint about relative capacity of beams and columns at a joint.	5	R

Date of Submission: 30/04/2025

Tutorial 6 Special topics			
Q. No.	Problem/ Question	CO	Learning level
1.	Describe earthquake resistant features in unreinforced masonry structures.	5	R
2.	Explain lateral load resisting mechanism in confined masonry.	5	R
3.	List and describe types of structural control in earthquake resistant structures.	5	R
4.	Explain seismic strengthening of RC columns with neat sketches.	5	R

Date of Submission: 30/04/2025