



SILVER OAK UNIVERSITY

Engineering and Technology (M.Tech.)

Civil Engineering (Computer Aided Structural Analysis & Design)

Subject Name: Structural Dynamics

Subject Code:

Semester:1st

Prerequisite: Mechanics of Solids, Structural Analysis, Matrix Methods of Structural Analysis and Engineering Mathematics

Objective: Earthquakes are one of the most devastating natural hazards that cause great loss of life and livelihood because of collapse of structures. Earthquakes impose time-dependant lateral inertia forces on the structure. To make a structure earthquake resistant, it is to be designed for lateral loads in addition to gravity loads. The lateral loads acting on structure are calculated using theory of structural dynamics. Therefore, the understanding of structural dynamics, characteristic of earthquakes and its effect on structure is essential for safe design of civil engineering structures.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Evaluation Scheme				Total Marks
L	T	P	C	Internal		External		
				Th	Pr	Th	Pr	
3	0	2	4	40	20	60	30	150

Content:

Unit No.	Course Contents	Teaching Hours	Weightage %
1	Structural Dynamics: Response of SDOF to harmonic and general dynamic loading, Vibration of multiple degree of freedom systems, numerical techniques for finding natural frequencies & mode shapes, orthogonality relationship of principal modes, Rayleigh's & Dunkerley's principle, Evaluation of dynamic response by mode superposition method, Analysis by response spectrum theory and time history analysis	14	30
2	Earthquake Engineering: Causes of earthquake and their characteristic, earthquake parameters, seismic zoning of India, Lessons from past earthquake and remedial measures, Response spectra & Combined D-V-A plot	04	10

3	Behavior of floor diaphragms, effect of various structural irregularities, lateral force analysis of building - Torsionally uncoupled and coupled system	06	20
4	Capacity design of various structural elements, various lateral load resisting structural systems – MR frame with shear wall & bracing, Provisions of IS 1893 & IS 13920	06	10
5	Structural controls: Passive Controls – Base isolation, various dampers, Active controls	04	10
6	Response of nonstructural components & structural considerations	04	10
7	Modeling and response of structure to earthquake, dynamic analysis of high-rise buildings, structural system for low, medium and high rise building, water tank and bridges using professional software like STAAD, SAP, ETAB, MIDAS, ANSYS etc.	04	10

Course Outcome:

Sr. No.	CO statement	Unit No
CO-1	Understand characteristics of earthquake and its effect on structures.	1
CO-2	Estimate lateral forces acting on symmetric as well as asymmetric buildings.	2
CO-3	Find mode shapes and natural frequency.	3
CO-4	Carry out seismic response analysis of a structure.	4,5
CO-5	Design and detail to enhance ductility.	6,7

Teaching & Learning Methodology:-

1. Use of Learning Management system like canvas
2. Demonstration through ppt and videos and lectures
3. Brainstorming and group discussion sessions
4. Collaborative learning

List of Experiments/Tutorials:

Minimum 10 problems from above topics.

Major Equipment:

Shake Table

Books Recommended:-

1. Dynamics of Structures - A.K.Chopra
2. Structural Vibrations - Theory and Computation - Mario Paz
3. Earthquake Resistant Design - Manish Shrikhande & Pankaj Agrawal
4. Vibrations of Structures Application in civil Engg - J.W.Smith
5. Design Structural Dynamics - Clough & Penzien
6. Introduction to Structural Dynamics - John M.Biggs
7. Dynamics and Vibration of Structures - Demeter G.Fertis
8. Elements of earthquake engineering - Jaikrishna & Chandrasekaran
9. IS 1893-2002
10. IS 13920- 1993

List of Open Source Software/learning website:

1. www.nicee.org http:
2. www.earthquakeinfo.org/ opensees.berkeley.edu/
3. http://nptel.ac.in/ http://ocw.mit.edu/courses/civil-and-environmental-engineering/ www.eeri.org/
4. www.earthquakeengineering.com/ www.curee.org