

OUTCOMES:

The students will be able to get a basic knowledge to analyse structures subjected to dynamic loading and to design the structures for seismic loading as per code provisions.

TEXT BOOKS:

1. Chopra, A.K., "Dynamics of Structures – Theory and Applications to Earthquake Engineering", 4th Edition, Pearson Education, 2011.
2. Agarwal. P and Shrikhande. M., "Earthquake Resistant Design of Structures", Prentice Hall of India Pvt. Ltd. 2007

REFERENCES:

1. Anil K. Chopra, Dynamics of Structures, Pearson Education, 2007.
2. Leonard Meirovitch, Elements of Vibration Analysis, McGraw Hill, 1986, IOS Press, 2006.
3. Mario Paz, Structural Dynamics -Theory and Computation, Kluwer Academic Publishers, 2004.
4. Roy R. Craig, Jr, Andrew J. Kurdila, Fundamentals of Structural Dynamics, John Wiley & Sons, 2011.

Course Objectives (CO)	CO1: To analyse structures subjected to dynamic loading and to design the structures for seismic loading as per code provisions. CO2: Students will be in a position to assess the behavior of columns, beams and failure of materials.
Expected Course Outcomes (ECO)	At the end of the course, the students should be able to: ECO1: The student will have the knowledge to analyze structures subjected to dynamic loading and to design the structures for seismic loading as per code provisions. ECO2 : The student will be able to Understand the difference between static and dynamic analysis of structure ECO3: The student will be able to carry out the dynamic analysis of various types of structures. ECO4: The student will be able to Use of random vibration concept to understand the behavior of structures under earthquake loads ECO5: The student will be able to apply the concepts of dynamic systems. ECO6 The student will be able to identify, formulate and solve dynamic response of SDOF & MDOF.
Mapping of CO & PO (Specify the PO's) - (Fill the cols with the legend given below) Programme Outcomes of Civil Engineering <ol style="list-style-type: none"> a. Graduates of Civil Engineering program will be able to apply the fundamental knowledge of mathematics, science and engineering to solve problems pertaining to Civil Engineering. b. Graduates of Civil Engineering program will be able to identify, analyze, formulate, and solve civil Engineering problems in accordance with Indian Standard codes of practice. c. Graduates of Civil Engineering program will be able to design a system component, or process to meet desired needs within realistic constraint such as economic, environmental, social, political, ethical, health safety, manufacturability, and sustainability. d. Graduates of Civil Engineering program will be able to design and conduct experiments, as well as to analyze and interpret data. e. Graduates of Civil Engineering will be able to use the techniques, skills, and modern civil engineering tools, necessary for engineering practice. f. Graduates of Civil Engineering program will be able to incorporate specific contemporary issues 	



- into the identification, formulation, and solution of specific civil engineering problems.
- g. Graduates of Civil Engineering program will be able to work on the basis of broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
 - h. Graduates of Civil Engineering program will be able to understand the role of Civil Engineers and ethical responsibility.
 - i. Graduates of Civil Engineering program will be able to function on multidisciplinary teams.
 - j. Graduates of Civil Engineering program will be able to deliver effective verbal, written, and graphical communications.
 - k. Graduates of Civil Engineering program will be able to recognize the need for, and an ability to engage in life-long learning.
 - l. Graduates of Civil Engineering program will be able to perform economic analysis, quality checks, time/labour management and cost estimates related to design, construction, operations and maintenance of systems in the civil technical specialties.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	2	1	-	-	-	-	-	-	-	-
CO2	3	-	-	-	1	-	2	-	-	-	-	-
CO3	1	3	1	1	-	-	-	-	-	-	-	1
CO4	1	2	1	-	-	-	-	-	-	-	-	2
CO5	2	1	-	-	-	-	2	-	-	-	-	-
CO6	1	3	1	-	-	-	1	-	-	-	-	1
Additional Topics beyond syllabus/Seminars/Assignments		1. Tsunami 2. Earthquake Resistance Structures										
Related Website URLs		W1: https://hon.dv.tamu.edu/Inside/HR2504/PDFs/SYL_201411_11260.pdf W2: http://textofvideo.nptel.itm.ac.in/video.php?courseId=105101082										
Related Video Course Materials (min. 3 nos)		V1: https://www.youtube.com/watch?v=N2LW9tUFHA V2: https://www.youtube.com/watch?v=bC8v6hXnSk V3: https://www.youtube.com/watch?v=R7Fz8c0IGSo V4: https://www.youtube.com/watch?v=evSXyULwiuI V5: https://www.youtube.com/watch?v=wTnl_kfPBhQ										

S.No	Topic Name	Book Page no	Mode of delivery	No of hrs	Cumulative hrs
UNIT I THEORY OF VIBRATIONS					
1	Introduction to vibrations, Difference between static loading and dynamic loading	-	Brain storming	2	2
2	Degree of freedom – idealisation of structure as single degree of freedom system	Own notes	Class room teaching	2	4
3	Formulation of Equations of motion of SDOF system	Own notes	Class room teaching	1	5
4	D'Alemberts principles – effect of	Own	Class room	2	7

	damping – free and forced vibration of damped and undamped structures	notes	teaching		
5	Response to harmonic and periodic forces.	Own notes	Class room teaching	2	9
UNIT II MULTIPLE DEGREE OF FREEDOM SYSTEM					
1	Introduction to Multiple degree of freedom system	-	Brain storming	1	10
2	Two degree of freedom system – modes of vibrations	Own notes	Class room teaching	2	12
3	formulation of equations of motion of multi degree of freedom (MDOF) system	Own notes	Class room teaching	2	14
4	Eigen values and Eigen vectors – Response to free and forced vibrations	Own notes	Class room teaching	2	16
5	Damped and undamped MDOF system – Modal superposition methods.	Own notes	Class room teaching	2	18
UNIT III ELEMENTS OF SEISMOLOGY					
1	Introduction to Elements of seismology	-	Brain storming	1	19
2	Causes of Earthquake – Plate Tectonic theory	Own notes	Class room teaching	2	21
3	Elastic rebound Theory – Characteristic of earthquake	Own notes	Class room teaching,	2	23
4	Estimation of earthquake parameters	Own notes	Class room teaching	2	25
5	Magnitude and intensity of earthquakes – Spectral Acceleration.	Own notes	Class room teaching	2	27
UNIT IV RESPONSE OF STRUCTURES TO EARTHQUAKE					
1	Introduction to Response of structures to Earthquake	-	Brain storming	1	28
2	Effect of earthquake on different type of structures – Behaviour of Reinforced Cement Concrete, Steel and Prestressed Concrete Structure under earthquake loading	Own notes	Class room teaching	2	30
3	Pinching effect – Bouchinger Effects	Own notes	Class room teaching	2	32
4	Evaluation of earthquake forces as per IS:1893 – 2002 - Response Spectra	Own notes	Class room teaching	2	34
5	Lessons learnt from past earthquakes.	Own notes	Class room teaching	2	36
UNIT V DESIGN METHODOLOGY					
1	Introduction to Design methodology	-	Brain storming	1	37
2	Causes of damage – Planning considerations / Architectural concepts as per IS:4326 – 1993.	Own notes	Class room teaching	2	39
3	Guidelines for Earthquake resistant design -Earthquake resistant design for masonry and Reinforced Cement	Own notes	Class room teaching	2	41

	Concrete buildings -				
4	Later load analysis	Own notes	Class room teaching	2	43
5	Design and detailing as per IS:13920 - 1993.	Own notes	Class room teaching	2	45

	<i>Prepared by</i>	<i>Approved by</i>
Signature		
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Signed date	26.06.2018	26.06.18

LEGEND:**METHODOLOGY TO MAP OBJECTIVE WITH OUTCOME**

Course outcomes are achieved through

- Suitable Analogies.
- Class room teaching.
- Assignments.
- Tutorials
- Weekly, monthly and model exams.
- Brain storming.
- Group discussion and role play.
- Seminars/Workshops.
- Expert lectures.

*Endorsed /
26/6/18
(P.H.)*