

B. Tech. Civil Engineering				
Course code: Course Title		Course Structure		Pre-Requisite
CE 324: Earthquake Technology		L	T	Nil
		3	0	
Course Objective: The course provides the basic principles of earthquake-resistant design of structures. Students are introduced to the engineering aspects of earthquakes, their characterisation, and effects. The course covers seismic design force computation, design, and detailing as per Indian Standards. An introduction to seismic evaluation and retrofitting is also included.				
S. No	Course Outcomes (CO)			
CO1	Able to understand the basic principles involved in earthquake engineering			
CO2	Analyse the effects of harmonic motion, vibrations and natural frequencies etc.			
CO3	Able to apply the concept of various degrees of systems involved in earthquake analysis.			
CO4	Understand the liquefaction process and its effects on foundations.			
CO5	Able to design and analyse the structure using IS 1893 and IS 13920 code provisions.			
S. No.	Contents			Contact Hours
UNIT 1	Introduction of structural dynamics, types of prescribed loads, Coordinates and coordinate transformation, Principles of Dynamics: D-Alembert’s principle, Principle of Virtual Work, Hamilton’s principle, mathematical and analytical models., Free body diagram and equation of motion. Single degree freedom systems, Simple problems on undamped and damped free vibration, frequency, period, and amplitude, Logarithmic decrement, Types of damping systems.			
UNIT 2	Response of SDOF System to Harmonic excitation, Dynamic excitation, Vibration of undamped two degrees of freedom system, Simple problems, Free vibration of MDOF System, Natural Frequencies & Mode shapes, Rayleigh’s method, Stodola method.			
UNIT 3	Modal response of MDOF systems, Mathematical model of MDOF Systems, Seismic coefficient and response spectrum method of analysis as per IS 1893 Code Provision. Simple problems on the response of MDOF systems to earthquake excitation.			
UNIT 4	Strong ground motion measurements, Seismic hazard analysis, Measurement of dynamic soil properties, One dimensional ground response analysis, Liquefaction: Susceptibility and effects, Simple problems.			
UNIT 5	Concept of Earthquake Resistant Design, IS 1893: Part I 2002; Provisions for Seismic Design: Ductile reinforcement detailing as per IS 13920 Code., Provisions of IS 4326: 1993,IS 13827 1993,IS 13828 1993 Appropriate experiments would be taken up.			
	Total			42

REFERENCES		
S. No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Dynamics of Structures A K Chopra. Published by Prentice Hall. ISBN 10: 013156174X, ISBN 13: 9780131561748.	2003
2	Dynamics of structures, Ray W. Clough and Joseph Penzien, McGraw-Hill, New York, 1993. ISBN 0-07-011394-7.	1993
3	Elements of Earthquake Engineering Jai Krishna, Brijesh Chandra South Asian Publishers, ISBN-10: 8170031834 ISBN-13: 978-8170031833.	2000
4	Structural Dynamics: Theory and Computation Mario Paz CBS Publishers & Distributors Pvt. Ltd New Delhi (2004) ISBN 10: 8123909780 ISBN 13 : 9788123909783.	2004
5	Geotechnical Earthquake Engineering, Steven L. Kramer, Pearson Education Inc. Dorling Kindersley (India) Pvt. Ltd. Delhi ISBN 81-317-0718-0.	2007
6	Theory of Vibration with Application, William T. Thomson, Marie Dillon Dahleh, Pearson Education Inc. Dorling Kindersley (India) Pvt. Ltd. Delhi ISBN 81-317-0932-9.	2007
7	IS 1893 Part I : 2002 BIS New Delhi.	2002
8	IS 13920: 1993 BIS, New Delhi.	1993
9	IS 4326: 1993 BIS, New Delhi.	1993
10	IS 13827, IS13828: 1993 BIS, New Delhi.	1993