STRUCTURAL DYNAMICS

II Semester: ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BSTB12	Core	3	0	0	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

Structural Dynamics is of utmost importance for understanding the analysis and design consideration of structures subjected to dynamic loading. This course introduces the basic concepts of dynamic loading and the response of structures to such loads, and then uses these concepts to illustrate applications in practical structures. It begins with the derivation of the basic equations of motion for an ideal single degree-of-freedom structure using various approaches, and the solution of these equations for different types of loading. Further, the development of equations for multi-degree-of-freedom structures is considered, with multi-storied buildings as the example structures, and free and forced vibration response analysis of these multi-storied buildings shall be discussed.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The dynamics response of single and multi-degree freedom systems using fundamental theory and equations of motion.
II. The numerical solution of structural responses of different loading conditions for the design of structures.
III. The responses of structures subjected to earthquakes and blasts for the efficient and economic design of structures.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:		
CO 1	Explain the concepts of equation of motion of a dynamic system and different loads acting on the structures for understanding the behavior of structures.	Understand
CO 2	Outline the concept of damped vibrations of single degree freedom systems for the analysis of structures subjected to dynamic loads.	Understand
CO 3	Develop the expressions for response of single degree freedom systems based on loading function for the response of structure used in design.	Apply
CO 4	Develop the equations of structural response to dynamic loads using Duhamel's integral and fourier analysis.	Apply
CO 5	Analyse the two-degree freedom systems subjected to free and forced vibrations for the design purpose.	Analyse
CO 6	Analyse the multiple degree of freedom systems to know the natural frequencies, modes and mode shapes using orthogonality and normality principles and superposition method.	Analyse

IV. SYLLABUS

UNIT -I	INTRODUCTION	Classes: 09

Objectives, Importance of Vibration Analysis, Nature of Exciting Forces, Mathematical Modeling of Dynamic Systems.

UNIT -II	SINGLE DEGREE OF FREEDOM SYSTEM	Classes: 09
Free and Forced Vibration with and without Damping, Response to Harmonic Loading, Response to General Dynamic Loading using Duhamel's Integral, Fourier Analysis for Periodic Loading, State Space Solution for Response.		
UNIT -III	**NUMERICAL SOLUTION**	**Classes: 09**
Introduction, accuracy and stability, Solution to Response using New mark Method and Wilson Method, State Space solution for response Numerical Solution for State Space Response using Direct Integration.		
UNIT -IV	**MULTIPLE DEGREE OF FREEDOM SYSTEM (LUMPED PARAMETER)**	**Classes: 09**
Two Degree of Freedom System, Multiple Degree of Freedom System, Inverse Iteration Method for Determination of Natural Frequencies and Mode Shapes, Dynamic Response by Modal Superposition Method, Direct Integration of Equation of Motion.		
UNIT -V	**MULTIPLE DEGREE OF FREEDOM SYSTEM & SPECIAL TOPICS IN STRUCTURAL DYNAMICS**	**Classes: 09**
Multiple Degree of Freedom System (Distributed Mass and Load): Single Span Beams, Free and Forced Vibration, Generalized Single Degree of Freedom System. Special Topics in Structural Dynamics(Concepts only): Dynamic Effects of Wind Loading, Moving Loads, Vibrations caused by Traffic, Blasting and Pile Driving, Foundations for Industrial Machinery, Base Isolation.		

Text Books:

1. Clough R. W. and Penzien J, "Dynamics of Structures", McGraw Hill.
2. Chopra A. K, "Structural Dynamics and Introduction to Earthquake Engineering", illustrated, Prentice Hall, 4th Edition, 2012.
3. Smith J. W, "Vibration of Structures - Application in Civil Engineering Design", Chapman and Hall.

Reference Books:

1. Humar J. L., "Dynamics of Structures", Prentice Hall.
2. Paz Mario, "Structural Dynamics Theory and Computation", CBS Publication.
3. Hart and Wong, "Dynamics of Structures"

Web References:

1.http://nptel.ac.in/courses/105101006/

E-Text Books:

1. http://scmero.ulb.ac.be/Teaching/Courses/MECA-H-303/MECA-H-303-Lectures.pdf