STRUCTURAL DYNAMICS

II Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTC14	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	30	70	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total 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:

MODULE-I: THEORY OF VIBRATIONS (09)

Introduction, basic concepts of vibration, dynamic loading, comparison of static loading and dynamic loading, causes od dynamic effects, basic definitions types of vibration, response of the system, degrees of freedom, SHM, Consequences of vibration. Introduction to undamped vibrations, vibration analysis, free

vibration of undamped SDOF system, derivation of equation of motion, solution of the equation of motion, equivalent stiffness of spring combinations, natural frequency, time period, influence of gravitational force.

MODULE-II: DAMPED VIBRATIONS OF SDOF SYSTEM (09)

Introduction types of damping, measurement of damping.

Introduction to harmonic excitation, undamped harmonic excitation, damped harmonic excitation, characteristics curves, measurement of damping, vibration measuring instruments, vibration isolation

MODULE-III: RESPONSE TO PERODIC AND IMPULSIVE LOADING (09)

Introduction to periodic loading, Fourier series and analysis and response, derive an expression for the response of an SDOF system for the given loading function.

Introduction to impulsive loading, differential equation method, Duhamel's integral.

MODULE-IV: TWO DEGREE OF FREEDOM SYSTEM (09)

Introduction, concept of shear building, free vibrations of undamped system, damped free vibration, forced vibrations of undamped system, forced vibrations of damped system**.**

MODULE-V: MULTIPLE DEGREE OF FREEDOM SYSTEM (09)

Introduction, Free vibration analysis, undamped system, natural frequencies and normal modes, orthogonality and normality principles, damped systems, decoupling of equations, superposition method, forced vibration.

V.TEXT BOOKS:

1. S. Kavita and S. R. Damodaraswamy, "Basics of structural Dynamics and Aseismic Design", PHI Learning Pvt. Ltd., 1st Edition, 2012.
2. Clough R. W. and Penzien J, "Dynamics of Structures", 1st Edition, McGraw Hill, 1993.
3. Chopra A. K, "Structural Dynamics and Introduction to Earthquake Engineering", illustrated, Prentice Hall, 4th Edition, 2012.
4. Smith J. W, "Vibration of Structures - Application in Civil Engineering Design", Chapman and Hall, 1st Edition, 1988.

VI.REFERENCE BOOKS:

1. Humar J. L., "Dynamics of Structures", Prentice Hall, 2nd Edition, 2002.
2. Paz Mario, "Structural Dynamics Theory and Computation", CBS Publication, 5th Edition, 2002.
3. Hart and Wong, "Dynamics of Structures", John Wiley, 1st Edition, 1999.

VII. WEB REFERENCES:

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

VIII. E-TEXT BOOKS:

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