NIRMA UNIVERSITY

Institute of Technology

School of Engineering

Master of Technology - Civil Engineering

(Computer Aided Structural Analysis and Design)

Semester- I

L	T	P	C
3	0	2	4

Course Code	6CL102
Course Name	Structural Dynamics

Course Outcomes:

At the end of the course, students will be able to -

1. illustrate methodologies to derive dynamic equilibrium equation for structural systems
2. analyze Single Degree of Freedom System subjected to free and forced vibrations
3. determine natural frequencies and mode shapes of Multi Degree of Freedom System and uniform beam.

Syllabus: **Teaching hours: 45**

Unit-1: Introduction **Hours: 06**

Objective, Difference between static and dynamic analysis, Mathematical modelling of linear systems, Derivation of dynamic equilibrium equation of motions, Concept of equivalent springs.

Unit-2: Singe Degree of Freedom Systems **Hours: 20**

Free & forced vibration with & without damping, Evaluation of damping, Response of single degree of freedom system subjected to periodic loadings, Transmissibility, Base isolation, Response of single degree of freedom system subjected to arbitrary dynamic loadings.

Unit-3: Numerical Solution of Linear Systems **Hours: 04**

Numerical solution to linear systems using Newmark-Beta and Runge-Kutta method.

Unit-4: Multi Degree of Freedom Systems **Hours: 10**

Response of two degree of freedom system to free vibration, Orthogonality of natural modes, Free vibration response of multi degree of freedom system using stiffness method and iterative methods.

Unit-5: Continuous Systems **Hours: 05**

Derivation of equation of motion, Free vibration of uniform beam, Natural frequencies and modes.

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:

Laboratory work based on above syllabus with minimum 06 exercise to be incorporated.

Suggested Readings:

1. Clough, R. W. &Penzien, J. *Dynamics of Structures*, McGraw-Hill.
2. Geham, Kelly, S. *Fundamentals of Mechanical Vibrations*, McGraw-Hill.
3. Humar, J. L. *Dynamics of Structures*, Prentice Hall.
4. Paz, M. *Structural Dynamics: Theory & Computations*, CBS Publishers.
5. Craig, R. R. *Structural Dynamics: An Introduction to Computer Methods*, John Wiley & Sons.
6. Chopra, A. K. *Dynamics of Structures: Application to Earthquake Engineering*, Pearson, Prentice Hall.

L= Lecture, T= Tutorial, P= Practical, C= Credit

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w.e.f. academic year 2019-20 and onwards