# Dynamics of Structures

## SWAYAM Prabha Course Code - C7

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| **PROFESSOR'S NAME** | Prof. Manish Kumar |
| **DEPARTMENT** | Civil Department |
| **INSTITUTE** | Indian Institute of Technology, Bombay |
| **Course Outline** | Most of the structures are typically analyzed and designed for static loads (e.g., Dead load). However, there are many cases when structures need to be designed for dynamic loads (e.g., Earthquake, Wind, Impact). In fact the static loads are very slowly applied dynamic loads. The behavior of structures under dynamic loads are studied using principles of structural dynamics. The dynamic behavior of a structure is characterized by its period of vibration and rate of loading. The inertial effects due to mass of a structure and energy dissipation due to damping need to be considered to obtain the structure's response.<br>This course will focus on dynamics of structures with emphasis on earthquake and to some extent on impact loads. However, the principles can easily be extended to other types of loads (e.g., wind, blast).Three-dimensional structures would be idealized to simplified single-degree-of-freedom (SDOF) and multi-degree-of-freedom (MDOF) systems. Equation of motion for SDOF systems would be developed for period, non-periodic and random excitations. The numerical methods to obtain the dynamic response and their limitations would be discussed. The concept of earthquake response spectrum and design spectrum will be explained and their utility in the seismic analysis and design of structures would be discussed.<br>In the second part, more commonly found structures (e.g., buildings) would be idealized to multi-degree-of-freedom (MDOF) systems. The free and forced vibration response of the MDOF systems would be discussed. Techniques to construct the mass, stiffness and damping matrices of a MDOF system would be presented. The concept of mode shapes and modal analysis would be explained. The response of a MDOF system would be obtained using |

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| | modal decomposition methods. The seismic response of a building would be obtained using Response Spectrum method, which is an extension of the modal decomposition method. Finally, the concepts of structural dynamics would be applied to study the behavior of special structures (e.g., base-isolated buildings). |

**COURSE DETAILS**

| S. No | Module ID/ Lecture ID | Lecture Title/Topic |
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| **1** | **L1** | Introduction |
| **2** | **L2** | Idealization of System for Dynamic Analysis |
| **3** | **L3** | Simplify a System to Obtain a Response of Single Degree of Freedom System |
| **4** | **L4** | |
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**References if Any:**