

Higher Institute of Earthquake studies and Research

Course: Structural Dynamics (Part 2)

Hours: (2 Hours Theoretical+2hours Practical)weekly

Teaching Staff:

Description:

Structures are often subjected to dynamic forces of one form or the other during their lifetime. This course introduces the theory of dynamic response of structures with emphasis on physical insight into the analytical procedures and with particular application to earthquake engineering. The structural dynamics component of the course includes free and forced vibration response of MDF 'multi-degree of freedom' systems. The earthquake engineering component considers seismic analysis methods, earthquake resistant design philosophy and includes elements of engineering seismology.

Aims & Objectives:

By the end of the course, the student should be able to:

- Derive differential equations for single degree of freedom (SDOF) systems and for multi-degree of freedom systems (MDOF) subjected to a range of dynamic forces.
- Calculate the free vibration characteristics of SDOF and MDOF systems.
- Derive the response of SDOF systems subjected to forced vibrations.
- Evaluate and describe the response of MDOF systems using the principal of mode superposition.
- Identify the possible causes of failure in a poorly designed structures subjected to earthquake loading.
- Demonstrate basic knowledge of engineering seismology.
- Demonstrate an understanding of design seismic loading;
- Demonstrate an understanding of response/design spectra;
- Perform calculations to evaluate seismic response of simple structures using time history and spectral methods;

Syllabus:

Chapter 1: MDF systems: Analysis of vibration frequencies with examples; analysis of vibration modes with examples; orthogonality of vibration modes, derivation and examples.

Chapter 2: MDF systems: Practical evaluation of vibration modes; description of the free vibration response of complex MDF systems; examples; introduction to dynamic response of MDF systems under forced vibration.

Chapter 3: Response spectrum: Response of MDF systems to earthquake excitation; response quantities of interest; Concept of mode superposition; generalized mass stiffness and force; uncoupled equations of motion.

Chapter 4: Earthquake response analysis: Mode superposition; modal expansion of earthquake excitation.

Chapter 5: Earthquake response analysis: Response spectrum analysis; combination of peak modal responses;.

Chapter 6: Earthquake response analysis: Direct integration methods of analysis; example.

Chapter 7: Earthquake codes: Earthquake design philosophy; simplified design procedures.

Course Outline:

Week 7+8+9: MDF systems

Week 10: Response spectrum

Week 11+12+13+14: Earthquake response analysis

Week 15: Earthquake codes

Instructional Methodology & Teaching Resources:

Lectures, examples, applications

Head of Department:

Date:

Vice Dean:

Date:

Dean:

Date: