SEISMIC BASE ISOLATION
CE5803 (3-0) 3

Instructor: Dr. Uğurhan Akyüz

References:
- **R. I. Skinner, W. H. Robinson and G. H. McVerry,** An Introduction to Seismic Isolation, Wiley, 1993.
- **F. Naeim and J. M. Kelly,** Design of Seismic Isolated Structures, Wiley, 1999.
- **P. I. Komodromos,** Seismic Isolation for Earthquake Resistant Structures, WIT Press, 2000.
- **FEMA-273,** NEHRP Guidelines for the Seismic Rehabilitation of Buildings, Report Number FEMA-273, Federal Emergency Management Agency, 1997.
- **FEMA-274,** Commentary on the Guidelines for the Seismic Rehabilitation of Buildings, Report Number FEMA-274, Federal Emergency Management Agency, 1997.
- **IBC-2000,** International Building Code, International Code Council, 2000.

Catalog Description

General features; isolator devices and systems; mechanical characteristics and modeling of isolators; structures with seismic isolation; code provisions for seismic isolation; stability of elastomeric isolators; ground motion characteristics.

Course in relation to the programs

i) M.S. and Ph.D. programs in Civil Engineering
ii) This course is an advance course in structural engineering, especially in earthquake engineering

The basic purpose is to give an idea about seismic isolation devices and to discuss earthquake response of seismically isolated structures to students of structural engineering.

Course Objectives

To provide a detailed treatment of mechanical characteristics of seismic isolation systems, and to present the response of seismically isolated structures subjected to major earthquakes.

Course Outline:

I. Introduction (1 week)
- I-1. Seismic Isolation
- I-2. Conventional and Seismic Isolation Approaches
- I-3. Components in an Isolated System

II. General Features (1 week)
- II-1. Natural Periods and Mode Shapes of Unisolated and Isolated Linear Structures
- II-2. Modal and Total Seismic Response
- II-3. Linear and Bilinear Isolation Systems

III. Isolator Devices and Systems (2 weeks)
- III-1. Steel Hysteretic Devices
- III-2. Elastomeric Bearings
- III-3. Lead Plug Bearings
- III-4. Friction Pendulum Systems

IV. Mechanical Characteristics and Modeling of Isolators (2 week)
- IV-1. Mechanical Characteristics of Elastomeric Bearings
- IV-2. Mechanical Characteristics of Lead-Plug Bearings

IV-3. Mechanical Characteristics of Friction Pendulum Systems
IV-4. Bilinear Modeling

V. Structures with Seismic Isolation (2 weeks)
V-1. Linear Structures with Linear Isolation
V-2. Linear Structures with Bilinear Isolation
V-3. Torsionally Unbalanced Structures

VI. Code Provisions for Seismic Isolation (2 weeks)
VI-1. Seismic Hazard Level
VI-2. Design methods
VI-3. Static Analysis
VI-4. Dynamic Analysis
VI-5. Requirements for Nonstructural Components
VI-6. Design and Testing Requirements for Isolators
VI-7. Aseismic Design of Bridges with Superstructure Isolation

VII. Stability of Elastomeric Isolators (1 week)
VII-1. Stability under Large Lateral Displacement
VII-2. Rollout Stability

VIII. Ground Motion Characteristics (1 week)
VIII-1. Characteristics of Earthquake Ground Motions
VIII-2. From Response Spectra to Design Spectra
VIII-3. Earthquake Energy Content and Energy Spectra
VIII-4. Code Interpretations of Design Ground Motions
VIII-5. Application of Earthquake Time Histories

IX. Design Examples (2 weeks)
IX-1. Design Example for a High-Damping Rubber Bearing
IX-2. Design Example for a Lead-Plug Bearing

Course Evaluation:

Two take home exams/projects	45 %
One final exam	35 %
Homework's	20 %