STRUCTURAL STABILITY
CE528 (3-0) 3

Instructor: Dr. Uğurhan Akyüz

References:
Z.P. Bazant, L. Cedolin, Stability of Structures, Dover, 2003.
W.PF. Chen, E.M. Lui, Stability Design of Steel Frames, CRC Press, 1991.
A. Chajes, Principles of Structural Stability Theory, Prentice Hall, 1974.
M.S. E. Naschie, Stress, Stability and Chaos in Structural Engineering: An Energy Approach, McGraw Hill, 1990.
G.J. Simitses, Elastic Stability of Structures, Prentice Hall, 1976.

Catalog Description:

Concepts of stability; types of buckling; mechanical stability models; elastic and inelastic buckling of columns; elastic buckling of frames; plasticity on frame behavior; design of beam columns; P-Delta effects; energy criterion and energy-based methods; torsional and torsional-flexural buckling of columns; lateral buckling of beams; bracing.

Course in relation to the programs:

i) M.S. and Ph.D. programs in Civil Engineering and Mechanical Engineering
ii) This course is one of the basic course in structural mechanics.

The basic purpose is to give fundamental theories of structural stability of member and frames to students of structural engineering

Course Objectives:

To provide a detailed treatment of buckling characteristics of various structural elements, and to present different methods to solve stability problems.

Course Outline:

I. Introduction
- I-1. Background
- I-2. Concepts of stability
  - I-2.a. Static criterion of stability
  - I-2.b. Dynamic criterion of stability
  - I-2.c. Energy criterion of stability
- I-3. Types of Buckling

II. Mechanical Stability Models
- II-1. One degree of freedom models
- II-2. Two degree of freedom models
- II-3. Snap through models
- II-4. Imperfect models

III. Buckling of Columns
- III-1. Elastic buckling of columns
  - III-1.a. Critical loads of perfect columns
  - III-1.b. Imperfect columns
  - III-1.c. Large deformation theory for columns
  - III-1.d. Restrained columns

III-2. Inelastic buckling of columns

IV. Buckling of frames

IV-1. Elastic buckling of frames

IV-1.a. Beam-column theory

IV-1.b. Stability of a frame by matrix analysis

IV-1.c. Design of framed columns

IV-2. Plasticity on frame behavior

V. Design of Beam Columns

V-1. P-Delta effects

V-2. Use of C_m factor in beam-column design

V-3. Effect of end restraint on buckling strength of columns – the *K* factor

V-4. Modifications to the monographs for different beam end conditions

V-5. Modifications to the monographs for different column end conditions

V-6. Correction factor for monograph for unidentical columns

VI. The Energy Criterion and Energy-based methods

VI-1. Timoshenko's method

VI-2. The Rayleigh-Ritz method

VII. Torsional Buckling

VII-1. Torsional behavior

VII-2. Strain energy of torsion

VII-3. Torsional and torsional-flexural buckling of columns

VII-4. Effect of moment gradient on lateral torsional instability of beams – the *Cb* factor

VII-5. Lateral Buckling of Beams

VII-6. Design simplifications for lateral buckling

VIII. Bracing

VIII-1. Bracing for stability

Course Evaluation:

Two take home exams	45 % (22.5 % each test)
One final exam	35 %
Homeworks	20 %