# BOĞAZİÇİ UNIVERSITY
# Department of Civil Engineering

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**Syllabus of CE 502**

## Introduction to Finite Elements

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| **COURSE** | *Credits* | (2+0+2) 3 |
| | *Lecture Hours* | MMM 567 |
| | *Lecture Hall* | M2152 |
| **INSTRUCTOR** | *Name* | Serdar SELAMET |
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| | *Office Hour* | W 10:00-11:00 |
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| **TEACHING ASSISTANT** | Name | Aykut ONURSAL |
| | *Email* | aykut.onursal@hotmail.com |

### COURSE TEXTBOOKS

- Hibbeler, R.C., "Structural Analysis", 8th SI edition, Pearson Education
- Fish, Belytschko, "A First Course in Finite Elements", Wiley

### REFERENCE BOOKS

- Strang, G., Fix, G. "An Analysis of the Finite Element Method", Wellesley-Cambridge, 2nd Edition.
- Huebner, Dewhirst, Smith, Byrom. "The Finite Element Method for Engineers", Wiley-Interscience, 4th Edition.
- Hughes, T. "The Finite Element Method", Linear Static and Dynamic Finite Element Analysis, Dover Civil and Mechanical Engineering.
- Kassimali, A. "Matrix Analysis of Structures", Cengage Learning, 2nd Edition
- Strang, G., Fix, G. "An Analysis of the Finite Element Method", Wellesley-Cambridge, 2nd Edition.
- Huebner, Dewhirst, Smith, Byrom. "The Finite Element Method for Engineers", Wiley-Interscience, 4th Edition.
- Hughes, T. "The Finite Element Method", Linear Static and Dynamic Finite Element Analysis, Dover Civil and Mechanical Engineering.

### COURSE DESCRIPTION (CATALOG)

Matrix methods of structural analysis in structures in 2D. Stiffness properties of trusses, beams and plane frames. Principle of minimum potential energy, theory of finite elements, finite element formulation of trusses and beams and 2D elasticity (plane stress

and plane strain). A project where the matrix methods and finite element formulation is implemented in MATLAB code environment.

## LABORATORY AND COMPUTER USAGE

Students will use MATLAB to code structural matrix analysis and finite element program.

## GRADING POLICIES

1 Midterm 25%, Final Exam 40%, Homework 20%, Project 15%

Requirements to take the Final Exam:

50% class attendance & minimum one midterm should be taken

- Attendance policy - Students are expected to attend all the lectures and laboratory sessions. They are also expected to perform all the work assigned by the instructor and the TA.
- Tardy policy - All the assigned work must be submitted by the due date and time. Submissions that are within the next two days will be penalized for 20% of the grade. After 2 days, submissions will neither be accepted nor graded. Exceptions can be made for students with emergencies or special circumstances.
- Make-up policy - Students are expected to take the exams on the assigned dates and times. Make-up exams may be arranged for students with emergencies or special circumstances. The instructor should be notified at least 24 hours before the exam date. If not, no make-up exam is made.

## COURSE OUTCOMES

(1) Formulate equations of equilibrium for structures including truss, beam and frame members. Establish element stiffness matrix, assemble global stiffness matrix and introduce boundary conditions. Write a structural analysis code in MATLAB using the matrix method.

(2) Introduction to Finite element method. Formulate equations for 1D elements (beams and trusses). Formulate equations for 2D elasticity problems (plane stress, plane strain). Write a structural analysis code in MATLAB using the finite element method.