Faculty of Mechanical Engineering, Technion-Israel Institute of Technology

036015 Finite Elements for Engineering Analysis

Course Syllabus

Class Time and Location: *Wednesdays* 8:30-10:30 [Lectures], 441, Lady Davis Bldg.
Wednesdays 10:30-12:30 [Tutorials], 441, Lady Davis Bldg.

Frontal lectures and tutorials will *not* be recorded.

Instructor: Prof. Pinhas Bar-Yoseph
Office Hours: Sundays 13:00-14:00 (208, DK Bldg. or via zoom)
E-mail Address: baryoseph@me.technion.ac.il

Teaching Assistant: Amit Ashkenazi
Office Hours: Tuesdays 17:00-18:00 (103, Lady Davis Bldg.)
E-mail Address: amit.ash@campus.technion.ac.il

Course materials: Lectures and Tutorial notes will be posted on the course website.
General Course Description: This first graduate course on Finite Element procedures introduces students to the basic methodology, and techniques for FE solutions of engineering problems. Topics covered include: Mathematical background and weak formulation, FE formulations for 1D and 2D second-order Elliptic BVP's, Finite Element Error Analysis, Concepts and Implementation of FEA, Validation & Verification [V&V] in FEA, FE approximations of IVP's [Eigenvalue and time marching FE procedures].

Tentative Course Outline & Schedule

Week 1	A brief introduction to FEM and Galerkin Method (L) A Short Rehearsal on Numerical Analysis (T)	10.1.24	HW1
Week 2	Weak Formulation and FE Methodology, Galerkin Method (L/T)	17.1.24	
Week 3	1D Second order BVP's- Lagrange Finite Element $\left(C^0\right)$ (L/T)	24.1.24	HW2
Week 4	FE Analysis of 2D Elliptic PDE's; Linear Triangular Element (L) Non-homogeneous B.C. and Quadratic Element (T)	31.1.24	
Week 5	FE Analysis of 2D Elliptic PDE's; Linear Triangular Element (L/T)	7.2.24	HW3
Week 6	Quadrilateral Lagrangian and Quadratic Triangular Isoparametric Elements	14.2.24	
Week 7	Concept of Isoparametric Mapping; 1D and 2D Isoparametric Mapping	21.2.24	HW4
Weak 8	Finite Element Error Analysis	28.2.24	
Week 9	Validation & Verification [V&V] in FEA (L,T)	6.3.24	
Week 10	FE Approximations of Eigenvalue Problems (L,T)	13.3.24	HW5
Week 11	Semi-discrete FE Approximations for Parabolic and Hyperbolic IVP's (L,T)	20.3.24	
	Project due date Project defense date	21.4.24 1.5.24	

Grading Plan

Coursework will be weighted as follows:

Student Engagement and Classroom Attendance [extra credit points]:	5
Individual Final Project:	64%
Homework assignments:	36%

* The student must pass the final project with a passing grade or higher; otherwise, the student fails the course - (Total grade=Final project grade).

Late Homework assignments will not be accepted.

Statement on Academic Dishonesty

Academic dishonesty is an extremely serious offense and will not be tolerated in any form.

Academic dishonesty in general is the presentation of intellectual work that is not originally yours. Examples include, but are not limited to, copying or plagiarizing class assignments including homework, reports, designs, and other submitted materials; copying or otherwise communicating answers on exams with other students; bringing unapproved aids, either in physical (written) or electronic form to an exam; obtaining copies of an exam prior to its administration, etc. Academic dishonesty violates both the ethical and moral standards of the Engineering profession and all infractions related to academic dishonesty will be prosecuted to the fullest via the Technion's Academic Court for Students.

For you, the honest student, academic dishonesty results in lower class curves, hence a depression in your GPA and class standing, while cheapening the degree you earn.

Statement on Use of Chatbots

Chatbots, such as ChatGPT, can only be used during this course only if given approval from the course staff. Any use of a chatbot must be given proper citation and be acknowledged in the assignment.

AI tools that use language models can be used to quickly create texts, and codes. They are highly effective yet can also give poor results if used without thought. Consequently, we will not allow their use, unless the need and the way they will be used be discussed with the course staff. Any unauthorized and uncredited use of these chatbots will be considered to be a violation of the Technion's Academic Integrity.