MAP5932-04: Computational Finite Elements (Spring 2006)

Course Hours: M W F 12:20 - 01:10 PM

Class Location: DSL 0152

PROFESSOR: Ionel Michael Navon

OFFICE HOURS: MW 1:30-2:30; TR 8:15-9:00; W 8:30-9:30
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Intended Audience: Graduate students in Applied Mathematics, Engineering and in particular Mechanical ,
Chemical, Electrical and Civil Engineering, Physics, Geophysics in particular Geology,
Meteorology and Oceanography as well as G.F.D.I. Qualified undergraduate students are welcome if they meet basic requirements

TEXT: An Introduction to Linear and Nonlinear Finite Element Analysis: A Computational Approach
by Prem K Kythe, Dongming Wei, Birkh er, 2004, 445pp,
ISBN
0817643087

COMMUNICATION: I will communicate with you via email as well as the blackboard course web location where content, codes and assignment material is provided

COURSE GOALS: The major goal is to combine theory with numerical application of finite element methods to application problems represented by commonly encountered partial differential equations models in 2-D plus time. Develop student capability to be able to write a 2-D and time finite element solvers for above partial differential equations.
Gear the problems towards commonly encountered in engineering and

geosciences applications.
Content and software examples as well as assignments will be provided on Blackboard Learning System.

https://campus.fsu.edu/webapps/portal/frameset.jsp?tab=courses&url=/bin/common/course.pl?course_id=_78049_1

PRE-REQUISITES:

Basic Numerical Analysis and an introduction to numerical solution of partial differential equations.

Programming. Exposure to a programming language is required, preferably Fortran 95.

HONOR and CONDUCT CODES. The Academic Honor System of FSU is based on the premise that each student
has the responsibility to (1) uphold the highest standards of academic integrity in the University community, (2) foster a high sense of integrity and social responsibility on the part of the University community. VIOLATIONS OF THIS ACADEMIC HONOR SYSTEM WILL NOT BE TOLERATED IN THIS CLASS. Specifically, incidents of plagiarism of any type or referring to any unauthorized material during examinations will be rigorously pursued by the instructor. Please read the Academic Honor System and Student Conduct Code in its entirety (FSU Student Handbook) and ask the instructor to clarify any of its expectations. Students must also obey local ordinances, plus State, Federal, and appropriate International laws.

AMERICAN DISABILITIES ACT. Students with disabilities needing academic accommodations should:

1) register with and provide documentation to the Student Disability Resource Center (SDRC);

2) bring a letter to the instructor from SDRC indicating you need academic accommodations.

This should be done within the first week of class.
GRADING (with approximate percentages)

1. One 75 MINUTE EXAM: 15%.
If you miss an examination, notify me via email as soon as possible. Your score on the missed exam will be based upon the final exam.
2. FINAL EXAM: 35%.
3. ASSIGNMENTS 50%.
a. Assignments are due at the beginning of class on the date due; reduced credit for late assignments.
b. All work must be neatly done and legible. Usually a discussion will be appropriate; proper English and mathematical notation are required. Graph/quadrille paper required for all graphs.
c. All assistance (except the text and instructor) given or received must be explained clearly.
d. Some problems will involve the use of computer software.

4. GRADING STANDARDS: A=88-100%, B=75-87.9%, C=60-74.9%, D=50-59.9%.
Plus/Minus grades will be assigned for the top/bottom 25% of each grade range (no A+,F+,F-)

1. <u>Highlights of the Course</u>.

Variational formulation of the finite-element method
Matrix formulation of the finite-element method
Finite element methods for elliptic boundary value problems.
Solution of time dependent problems
Frontal solution technique
Isoparametric elements
Adaptive mesh refinement: The PLTMG version 7.0 package
Hierarchic finite elements
Upwinding methods for convection -diffusion problems
Petrov-Galerkin formulations
Penalty-finite-element methods
Finite-element methods in fluid mechanics : Full Navier-Stokes equations in 2-D , shallow water flow and
transport equations

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Fluid Flow Topics

Advection - Diffusion

Environmental Flows

Free Surface Flow

Grid Generation and Adaptivity

Incompressible Flows

Mathematical Methods

Shallow Waters

Thermal Flows

A Fully Detailed Curriculum is available from the Instructor