Syllabus

Numerical and Computer Methods and Tools in Civil and Environmental Engineering I
EGN 4427 (crn 21223)
Spring 2012

Course Description:	An introduction to algorithmic and numerical solution of civil and environmental engineering problems.
Objectives:	Upon completion of this course the student should be able to:

1) Approach technical problems using a consistent problem solving approach involving problem definition, algorithm design, algorithm implementation, solution, and testing/evaluation.
2) Design an algorithmic solution to engineering problems using flowcharts and pseudo code.
3) Apply programming logic structures for numerical algorithm development and solution.
4) Apply common numerical methods for interpolation, regression, and root finding to the solution of engineering problems.
5) Solve elementary matrix arithmetic problems analytically and numerically.
6) Solve simultaneous linear equations using matrix mathematics.
7) Use Matlab for computational implementation, solution, and testing of algorithms.

Pre-Requisites:	MAC 2283 Engineering Calculus III or MAC 2313 Calculus III
Credit Hours:	3 units
Dates / Times / Location/ Format:	January 9 to April 27

	MW 3:05 – 4:20 pm in CIS 1045	Instructor lectures and laboratory
	F 9:40 – 11:30 am in ENC 1002	**In-class exams (3/9, 4/20)**, and TA-led session for laboratory completion and help (optional)

Note that if you have been granted dual enrollment during the Friday time slot, you need to ensure that you will be able to attend this class to take the exams on the dates listed above. I have coordinated with the ENV 4001 instructor to ensure that our exams do not coincide. However, you may need to carefully plan your ENV 4001 field trip attendance to ensure no overlap.

Attendance / Participation:	Students are expected to regularly attend and participate in class.

Instructor and TA Information:

	Instructor	Teaching Assistant
Name:	Prof. Stuart	Reja Rabbi, Graduate student
Office	CPH 1117	ENB 118
Student Help Office Hours	MW 4:30 - 5:30 pm USF Library	F 9:40 – 11:30 am (during TA help session) ENG 031
Phone	974-6632	974-8774
Email	astuart@hsc.usf.edu	reja@mail.usf.edu
Preferred method of contact:	Face-to-face during office hours. I will also respond to email and phone messages on a limited basis. Reply times may vary up to several days.	Face-to-face during Friday help sessions and labs or by email.

Course Outline:

(Tentative)

The timing and order are approximate, except for the scheduled exams. Chapter numbers refer to the course textbook.

Algorithmic problem solving introduced – Weeks 1 and 2
- Computing concepts
- Analytical versus algorithm solutions to engineering problems
- Approximation: numerical error, accuracy and precision
- A generalized process for solving engineering problems
- Introduction to algorithm design (stepwise refinement, flowcharting, types of semantics)

MATLAB fundamentals (Chapter 1 with selections from 7) – Week 3
- Command window, basic mathematical operations and built-in functions
- Variable definition and the workspace window
- Data representation and types
- Basic data storage

Introduction to MATLAB programming (Chapter 2 with selections from 9) – Weeks 4 and 5
- Programs and programming languages
- Syntax and semantics
- Script files (sequence)
- Data input and output (information)
- Good programming practice

Decision making / selection (Chapter 3) – Week 6
- Boolean logic, relational operators and expressions
- Decisions statements (If, If-else)
- Selection between alternatives (nested If-else, Switch)

Repetition (Chapters 4 and 5) – Week 7
- Explicit loops (For, While)
- Vectorized code

Advanced structured programming with MATLAB (Chapter 6 with selections from 10) – Week 8
- User-defined functions, input / output to functions and variable scope
- Modular programming
- Errors, debugging, and the Matlab debugger
- The programming process (designing, coding, debugging, testing, simulation, analysis)

***Midterm Exam 1* Friday, March 9**

Spring Break (March 12 – 16)

Advanced graphics and curve fitting (Chapter 11 and 15.1.2) – Week 9 and 10
- Plot types and functions
- Notes on better graphics
- Introduction to curve fitting (interpolation and regression)

Solution of algebraic equations (*root finding*) (Chapter 15.1.1) – Week 11
- Classification of equations
- Common methods (bisectional, Newton-Raphson) and their application

Introduction to linear algebra (Chapter 12.1) – Weeks 12 and 13
- Matrix and vector arithmetic
- Special matrices (identity, inverse, transpose)
- Determinants

Solution of simultaneous equations (Chapter 12.2) – Weeks 14 and 15
- Matrix representation of a system of algebraic equations
- Introduction to solution methods (Gaussian elimination, Cramer's rule)
- Numerical solutions using MATLAB

***Midterm Exam 2* Friday, April 20**

***Take-home Final exam* due Wednesday, May 2 at 5 pm**

Required Course Materials:	S. Attaway. *MATLAB. A practical introduction to programming and problem solving*. 2nd edition. Elsevier. 2011. The text is available for purchase through the USF Bookstore. Students are encouraged to access the required materials through whatever legal mechanisms work for their personal situation. For example, mechanisms include physical or electronic book purchase or rental, physical and electronic libraries, book sharing, and book borrowing.
	Use of Matlab® software is required. Matlab is available on computers in the engineering student computer labs. Virtual access via the web is available for all students through the Virtual Applications Portal (apps.usf.edu). Finally, the student version is available for purchase through the USF Computer Store.
	Each student must bring his/her laptop to each class in order to perform the in-class laboratories. (See the College of Engineering website for a discussion of the student laptop requirements at http://www2.eng.usf.edu/Ecomp/laptopconfiguration.asp)
	Additional readings may also be used.

Grading:

Scale:	Labs:	15%
	Homework:	15%
	In-class Midterm exams:	40% (20% each)
	Take-home final exam:	25%
	Class Participation	5%

	The course will be graded on a curve, with natural divisions in the scores leading to divisions in the letter grades. However, a certain level of performance is expected. Overall scores below 40% of the total points will lead to a failing grade. + and – grades will be used in this course.
Types of Assessments:	<u>Labs:</u> Labs will be completed during the laboratory sessions on an approximately weekly basis. <u>Homework:</u> Assignments will be due on an approximately weekly to every two weeks basis. Assignments will be completed and submitted as group work. Groups will be formed during the first week of class. <u>Exams:</u> There will be two in-class closed-book pencil and paper midterm exams. <u>Take-home final exam:</u> There will be a final comprehensive numerical exam project that will be distributed during the last week of class in lieu of a in-class final exam. <u>Class participation:</u> All students are expected to regularly participate in the class and laboratories.
Late and Make-up Policies:	Students are expected to turn in assignments on time and to be present to take the exams.
	If you cannot be present for the scheduled exam dates, inform the instructor of the conflict by the second class meeting, so that alternate arrangements can be made. Such arrangements will only be made if your reasons are very compelling. Some university-regulated excuses include disability-related conditions, observance of major religious holidays, and official participation in university-sponsored athletic events. Students who anticipate missing an exam for these reasons should provide the official paperwork or written notice for religious observance to the instructor by the second class meeting. ***Exams and labs will not be individually rescheduled for student personal reasons (vacation plans, work schedules, flight plans, etc.)***
	<u>Assignments are due at the beginning of class</u> on the due date. Any submissions after that time will be considered late. Each student may, at his/her discretion, turn in one late assignment during the semester for credit. To be accepted, the late assignment must be turned in to the instructor before the beginning of class following the due date. ***No other late assignments will be accepted***. It is advisable to save the late assignment allowance for a circumstance beyond your control.
	If you miss a class or anticipate missing a class, contact a fellow student to get any needed information, notes, or announcements of assignments.

Other Classroom Policies:

Electronic Equipment Usage:	Electronic equipment, including student computers, cell phones, personal digital assistants, etc. must be turned off prior to entering the classroom until specifically designated for use by the instructor. This equipment is disruptive to the class and distracting to students and the instructor.
Permission to Use Lectures:	Materials generated for this class may be copyrighted. You may make single copies for your personal scholastic use, in accordance with U.S. copyright law. Any other reproduction or dissemination is forbidden without prior express permission from the copyright holder. Lectures may not be recorded without prior permission of the instructor. All unauthorized recordings of class are prohibited. Recordings that accommodate individual student needs must be approved in advance and may be used for personal use during the semester only; redistribution is prohibited.

University Policies:

Academic Dishonesty and Disruption of the Academic Process:	Academic dishonesty or disruption of the academic process in any form will not be tolerated. Refer to policies and regulations regarding types and consequences at the office of the USF General Council. Specifically refer to regulation 3.027 on Academic Integrity of Students at http://generalcounsel.usf.edu/regulations/pdfs/regulation-usf3.027.pdf and 3.025 on Academic Disruption at http://generalcounsel.usf.edu/regulations/pdfs/regulation-usf3.025.pdf.
Plagiarism:	Plagiarism will not be tolerated and is grounds for failure. A detailed discussion of plagiarism and a tutorial for students can be found at http://www.cte.usf.edu/plagiarism/index.html. Safe-Assignment and other plagiarism checking methods may be used to help ensure academic honesty.
Special Accommodations:	Students in need of academic accommodations for a disability may consult with the office of Services for Students with Disabilities to arrange appropriate accommodations. Students are required to give reasonable notice (typically 5 working days) prior to requesting an accommodation. Students with Disabilities Services: http://www.sds.usf.edu/
Holidays and Religious Observances:	http://generalcounsel.usf.edu/policies-and-procedures/pdfs/policy-10-045.pdf
Student Handbook:	http://www.sa.usf.edu/dean/docs/USF_handbook.pdf
Undergraduate Catalog:	http://www.ugs.usf.edu/pdf/cat1112/20112012.pdf