

560.220: Civil Engineering Analysis
Fall 2015

Prereq: Calculus I, II
Credits: 3
Lectures: MW 1:30-2:45pm
Room: Krieger 309 (eStudio)

Instructor: Prof. Judith Mitrani-Reiser, jmitrani@jhu.edu
Office Hours: M W 3-4pm and by appointment; Latrobe 202 (Ext 6-7763)

TA: Xilei Zhao, xzhao29@jhu.edu
Office Hours: T Th 9-10am; Latrobe 313

Blackboard: <https://blackboard.jhu.edu> (Login using JHU Enterprise Authentication)

Description: This course introduces engineering students to the fundamentals of numerical methods and its applications to civil engineering problems. Students are expected to demonstrate comprehension of statistics, calculus, linear algebra, ordinary and partial differential equations, discrete analysis, and programming skills that enable them to solve challenging engineering problems numerically. Students will be able to apply these principles to a range of civil engineering applications, including material science, remote sensing, hazard analysis, structural analysis, and water resources. MATLAB programming is introduced to facilitate the solutions, and will be used in assignments throughout the course.

Objectives:

- (1) This course covers the fundamentals of numerical methods that are necessary and widely used in engineering research and practice.
- (2) This course provides students with basic principles of computational mathematics and computer programming for career advancement through graduate study and/or professional practice.
- (3) Students will learn to think critically through hands-on programming activities in the classroom as well as through student participation exercises on the chalkboard.
- (4) Students are expected to apply modern engineering tools to identify, formulate, and execute engineering solutions as well as communicate their results through their term project and formal in-class presentation of their results.
- (5) The in-classroom and homework problems are strategically selected to broadly educate the students in contemporary issues of civil engineering as practiced in today's world.

Textbook: Chapra, S.C., 2012 *Applied Numerical Methods with MATLAB for Engineers and Scientists*, 3rd edition, McGraw-Hill. (Available at bookstore or can be purchased online.)

Software: MATLAB by MathWorks (<http://www.mathworks.com/products/matlab/>)

Access: <http://www.it.johnshopkins.edu/services/software/matlab/>

Grading: A weighted average will be calculated as follows:

| | |
|---------------|-----|
| Homework (10) | 20% |
| Quizzes (9) | 10% |
| Midterms (2) | 50% |
| Final Project | 20% |

Note that I will automatically drop your lowest homework and quiz grades. The course grades will be determined as follows:

| | | | | | | | | | | | | | |
|--------------|-----|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-----|
| Score | >97 | 93-96.9 | 90-92.9 | 87-89.9 | 83-86.9 | 80-82.9 | 77-79.9 | 73-76.9 | 70-72.9 | 67-69.9 | 63-66.9 | 60-62.9 | <60 |
| Grade | A+ | A | A- | B+ | B | B- | C+ | C | C- | D+ | D | D- | F |

Homework: Homework contributes to 20% of your final grade. **HW assignments are due at 5pm** on the given date, and should be dropped off in the box outside my office. Any homework assignments turned in late will be penalized with a 50% deduction. No exceptions will be made for late assignments, and so the lowest homework grade will be dropped. If you believe an error was made in grading the homework, you should write a short justification of your claim and attach it to the original homework assignment in question and return it to the instructor in class or in the mailbox outside her office. The TA or instructor will review your concern and respond to you directly. The “statute of limitations” for submitting such claims is one week after the homework is returned.

Homework Guidelines: Homework assignments that are solved by hand must be submitted on engineering computation paper. Your name, class title (e.g., ‘Civil Analysis’), and solution page number (e.g., ‘1/10’, ..., ‘10/10’) must appear on every page of your solutions. Additionally, the first page of your solutions should include the number of hours taken to complete the assignment and the name of any classmates that worked with you on the homework assignment. Any time that MATLAB is used in a homework assignment, you should include a **printout** of the most relevant parts of your script file, clearly identifying any input/output used by your program. Additionally, any relevant m-files and dat-files shall also be **emailed** to the Professor and TA, with the name of the homework assignment (e.g., ‘Homework #7’) written on the subject line. Additionally, your last name, homework number, and problem number shall all be included as part of your MATLAB file names (e.g., ‘Mitrani_HW7PR2.m’, Mitrani_HW7PR2_input.dat’).

Quizzes: Quizzes contribute to 10% of your final grade. Short quizzes will be given throughout the semester. Quizzes will be administered at the **beginning of class** so be sure to be in class on time. Make-up quizzes will not be offered, and so the lowest quiz grade will be dropped.

Midterms: Exams (2 midterms) contribute to 50% of your final grade. These exams will be written in order to test your understanding of the topics covered in class, homework, and quizzes. I encourage you to ask lots of questions in class and through the Discussion section of Blackboard to help prepare you for examinations. Students who are unable to take a scheduled exam (with a documented excuse) will schedule an alternate time to take the exam.

Project: The final project contributes to 20% of your final grade. Your final project is to write a **mega** MATLAB computer program that focuses on an engineering/science/math problem of your choosing. Fifty points of the project will be devoted the computer program and fifty points will be devoted to the development of the project concept,

PowerPoint slides, and the delivery of your in-class presentation describing the project. You can work with a partner on this project, but this is optional.

Disabilities: Any student with a disability who may need accommodations in this class must obtain an accommodation letter from Student Disability Services, 385 Garland, (410) 516-4720, studentdisabilityservices@jhu.edu

Ethics: The strength of the university depends on academic and personal integrity. In this course, you must be honest and truthful. All violations of academic ethics will be prosecuted. Ethical violations include cheating on exams, plagiarism, reuse of assignments, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition. For further information, please see the guide on “Academic Ethics for Undergraduates” and the Ethics Board Website (<http://ethics.jhu.edu>).

Schedule:

| Date | Topic | Reading | Assignment |
|-----------|--|-----------|------------|
| 31 Aug | Lecture 1: Introduction | Ch. 1 | |
| 02 Sept | Lecture 2: Computing Basics | Ch. 1 | Quiz 1 |
| 07 Sept | NO CLASS: Labor Day | | |
| 09 Sept | Lecture 3: Error Sources in Numerical Methods | Ch. 1 | HW 1 due |
| 14 Sept | Lecture 4: Data Types; Mathematical Operations | Ch. 2 | Quiz 2 |
| 16 Sept | Lecture 5: If-Then Statements; For-Loops; Nested Loops | Ch. 2 | HW 2 due |
| 21 Sept | Lecture 6: Functions | Ch. 3 | Quiz 3 |
| 23 Sept | Lecture 7: Loading & Plotting Data | Ch. 3 | HW 3 due |
| 28 Sept | Lecture 8: Roots of Equations | Ch. 5-6 | Quiz 4 |
| 30 Sept | Lecture 9: Roots of Equations | Ch. 5-6 | HW 4 due |
| 05 Oct | Lecture 10: Linear Algebraic Equations | Ch. 8-9 | Quiz 5 |
| 07 Oct | Lecture 11: Gauss Elimination | Ch. 9 | HW 5 due |
| 12 Oct | Lecture 12: LU Factorization & Matrix Inverse | Ch. 10-11 | Quiz 6 |
| 14 Oct | Lecture 13: Statistics & Exam Review | Ch. 14 | |
| 15 Oct | Exam 1 | | |
| 19 Oct | Lecture 14: Linear Regression | Ch.15 | |
| 21 Oct | Lecture 15: Interpolation | Ch.17 | HW 6 due |
| 26 Oct | Lecture 16: Interpolation | Ch. 17-18 | Quiz 7 |
| 28 Oct | Lecture 17: Num. Differentiation | Ch. 21 | HW 7 due |
| 02 Nov | Lecture 18: Num. Differentiation & Integration | Ch. 19 | Quiz 8 |
| 04 Nov | Lecture 19: Numerical Integration | Ch. 19-20 | HW 8 due |
| 09 Nov | Lecture 20: Num. Integration | Ch. 20 | Quiz 9 |
| 11 Nov | Lecture 21: Civil Analysis Lab | | HW 9 due |
| 16 Nov | Lecture 22: Civil Analysis Lab; Exam Review | | |
| 18 Nov | Exam 2 | | |
| 23-27 Nov | NO CLASS: Thanksgiving | | |
| 30 Nov | Lecture 23: ODE's | Ch. 22 | |
| 02 Dec | Lecture 24: ODE's | Ch. 23-24 | HW 10 due |
| 18 Dec | Final Project Presentations (9am-12pm) | | |