MSE 3025
Statistical and Numerical Methods
CRN 81582

Instructors: Prof. Seung Soon Jang
seungsoon.jang@gatech.edu
Office: Love 351

Class: Tuesday & Thursday 14:00-15:15 pm, Clough UG Learning Commons 423
Office Hours: Tuesday & Thursday 16:00-17:00 pm (please email the instructor first)

Objectives: To provide knowledge of the basic numerical methods commonly employed in solving materials science and engineering problems, along with solution tools that are robust for use research and other courses.

Suggested Textbooks: Numerical Methods for Engineers, 8th Ed., Steven C. Chapra and Raymond P. Canale

Why This Course?
Computational methods in engineering, in general, are rapidly becoming a requirement for the workplace and advanced courses. In particular, computational materials science is a key in research, development and applications environments.
This course will also be very useful in giving you the ability to solve problems numerically in future courses, offering more flexibility and power to visualize solutions and better understand the physics.

Grade: Exams (50 %), Homework (30%) Coding Project (20%)

No Classes: 9/7 Labor Day; 10/5-10/6 Fall Break; 11/25 Student Recess; 11/26-11/27 Thanksgiving Break
Note: 12/7-12/8 Final Instructional Class Days; 12/9 Reading Day; 12/10-12/17 Final Exams

Exams
1. If you need to reschedule the test with reasons such as family issue and health issue, you must contact the instructor at least one week before the test with explanation and proof.
2. If you could not take the exam on the scheduled date due to unexpected issues such as accidents, sickness, and so on, you may ask another date for your test. Contact the instructor with explanation and proof.
3. Regarding late test without proof and explanation, you will be able to take the test, but your score will be reduced by 20 %.
4. Each of 4 exams has the same weight for average.
5. The discussion and correction about wrong grade should be made within two weeks.

Homework (30 %)
1. Your homework should be submitted as a hard copy in our classroom.
2. If you submit homework after the deadline, your homework score will be reduced by 20 %.
3. The discussion and correction about wrong grade should be made within two weeks.

Matlab Coding Projects (20 %)
1. The topics will be announced through classes.
2. Each student should make a team with other students (The team leader will get more credit).
3. Each team should submit a presentation file (pptx file) and Matlab code before the due date.
4. Each team should bring a notebook computer to present the pptx file.
5. Do not use built-in functions.

Overall Grade Criterion:
90-100: Grade A; 80-89: Grade B; 70-79: Grade C: 60-69: Grade D; <59: Grade F.

Attendance Policy:
1. Class attendance is mandatory.
2. Class attendance will be evaluated using Point Solutions (clicker).
3. For the Point Solutions, it is each student's responsibility to correctly sign in such that it syncs with their Georgia Tech account.
4. Each student may miss four lectures without penalty, no questions asked.
5. Students with OFFICIAL institute absences (athletics, conference, and absences approved by the Dean of Students), contact the instructor. Students with an otherwise unexcused extended absence (e.g., illness lasting 2+ weeks), contact the instructor.

Topic Outline

0. Introduction (1)

1. Problem Solving (3)
Approximations, Accuracy, Precision, Round-Off Errors, and Truncation Errors

2. Roots of Equations (2)
Bracketing Methods, Open Methods: Chapters 5-6

Exam #1: Topics 1 and 2

3. Numerical Integration (2)
Newton-Cotes Integration Formulas & Integration of Equations (Chapters 21 & 22)

4. Numerical Differentiation (2)
Numerical Differentiation, Chapter 23

5. Ordinary Differential Equations (3)
Ordinary Differential Equations (Chapters 24)

Exam #2: 3/11, Topics 3, 4, and 5

6. Linear Algebraic Equations (2)
Gauss Elimination, Chapter 9
LU Decomposition and Matrix Inversion, Chapter 10

7. Curve Fitting (3)
Least-Squares Linear Regression, Chapter 17
Interpolation, Chapter 18

Exam #3: Topics 6 and 7

8. Statistics (3)
Data Representation: Mean, Standard Deviation and Variance
Experiments, Outcomes, Events
Probability, Permutations and Combinations, Random Variables
Distributions: Binomial Distribution, Poisson Distribution, Normal Distribution
t-Student Test

Exam #4: Topic 8