New York City College of Technology
The City University of New York

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MAT 2630-D662 Numerical Methods (4 cr, 4 hr) Fall 2015

Course Meetings: M,W 4:00 - 5:40 PM (N723)
Instructor: Ezra Halleck **Phone:** (718) 260-5931
Office Hours (in N726): MW 2:00-3:00 and by apt **Email:** ehalleck@citytech.cuny.edu

Text: *Numerical Analysis* by Timothy Sauer, 2nd edition, Pearson, 2011

Computer software: MATLAB; please bring USB memory stick to class or save your work on cloud.

Course Description: An introduction to solving mathematical problems on the computer using a symbolic algebra program with applications drawn from science and engineering. Topics include roots of non-linear functions, interpolation, numerical differentiation and numerical integration.

Prerequisite: MAT 2580, MAT 1575 and one of: CST 1101 or higher, MAT 1476L, MAT 1475H

Student Learning Outcomes Specific to the Course: At the end of the semester, students will be able to

1. Determine the errors of computations resulting from computer limitations, and estimate their size.
2. Solve non-linear equations using numerical algorithms.
3. Solve systems of linear equations using numerical algorithms.
4. Analyze the sensitivity of a system of linear equations by using its conditioning number.
5. Interpolate data points using spline methods.
6. Fit models to data using the methods of linear least squares.
7. Numerically approximate derivatives and integrals.
8. Use computer technology to assist in the above objectives.

General Education Student Learning Outcomes: Students will develop skills needed to

1. Make meaningful connections between mathematics and other areas of study.
2. Employ scientific reasoning and logical thinking.
3. Communicate effectively using written and oral means.

Attendance: You may miss no more than 3 classes. Lateness between 0 and 40 minutes counts as 1/2 an absence. Once in class, stay for the full period; if you *leave early* without making prior arrangements, *you will be marked as absent or late (depending on how early you leave)*. Students who have been excessively absent and failed the course at the end of the semester will receive a WU grade if they have attended the course at least once. This includes students who stop attending without officially withdrawing from the course.

Cell phones: Please turn *off or on vibrate* and place out of sight. If the instructor sees or hears a phone, he may ask that you hand it to him for the duration of class.

Academic honesty: You are encouraged to work in groups on assignments, but be able to explain *anything* you turn in or post. It is your responsibility to cover your work. During an exam, showing someone else your work is considered cheating; you will be treated in the same way as the person who copies.

Set enough time aside each week: You are expected to spend 6-8 hours outside the classroom each week reading the text, working on projects, doing homework and preparing for exams.

Semester project: By session 20, ALL students should have a project they are working on, either individually or in a small (2-3 person) group. More details will be provided by session 5.

Grade components:

- Semester Projects 20%
- Best 2 out of 3 midterm exams: 45% (allows for one miss as there are no makeups)
- Final exam: 25% (no student can pass the course without taking the final exam)

***Time* problems?** Here is a **damage control priority list:**

1. *Read the section prior to the class in which it is covered.* This reading will facilitate your understanding and participation in class and enable you to make a journal entry.
2. *Attempt at least some of the homework problems immediately after class,* so that you know how much of the class you understood.
3. *Take advantage of office hours:* If you are unable to attend the scheduled hours, make an appointment.
4. *Make use of the Atrium & Voorhees Learning Centers (approximately 9AM-8PM, M-Th, shorter hours on F & Sat):* While some of the tutors are advanced undergraduate students, many are adjunct faculty. The math department also typically has tutoring sessions run by advanced mathematics major.

Day		date	Numerical Methods	Hmwk Exercises	Hmwk Comp Probs
1	M	8/31	0.1 Evaluating a polynomial (pages 1 – 4)	P.5: 1,3,7	P.5: 1
2	W	9/2	0.2 Binary Numbers (pages 5 – 7)	P.7: 1,3	
3	W	9/9	0.3 Floating Point Numbers (pages 8 – 14)	P.14: 1,3,5,10	
4	Th	9/10	1.1 Bisection (pages 25 – 29)	P.29: 1,2	P.31: 1,2,3,4,6,7
5	W	9/16	1.2 Fixed-Point Iteration (pages 30 – 40)	P.40: 1,3,5,7,11	P.43: 1,2,3
6	M	9/21	1.4 Newton's Method (pages 51 – 58)	P.58: 1,3,5,7,8,9	P.59: 1,3,7
7	M	9/28	2.1 Gaussian Elimination (pages 71 – 78)	P.78: 1,3,7	P.79: 1,2
8	W	9/30	2.2 The LU Factorization (pages 79 – 84)	P.84: 1,3,5	P.94: 1,2
9	**M**	**10/5**	**First Exam (sessions 1-7)**		
10	W	10/7	2.3 Sources of Errors (pages 85 – 93)	P.93: 1,3,5,7	
11	W	10/14	2.5 Iterative methods (pages 106 – 112)	P.115: 1,2	P.116: 1,2
12	M	10/19	2.6 Symmetric Positive-Definite Mats (pp 117-121)	P.128: 1,3,5,6,9	
13	W	10/21	4.1 Least Squares & Normal Eqtns (pp 188 – 197)	P.198: 1,2,3,7,9,11,12	P.199: 2,4,5
14	M	10/26	4.2 A Survey of Models (pages 201 – 208)	P.209: 1,2,3,4,5,6	P.210: 1,3,7,9
15	W	10/28	4.3 QR-factorization (pages 212 – 223)	P.224: 2,4,6,7	P.225: 5
16	M	11/2	Exam Review		
17	**W**	**11/4**	**Second Exam (sessions 8-15)**		
18	M	11/9	3.1 Interpolating Functions (pages 139 – 148)	P.149: 1,2,5,7	P.151: 1,2
19	W	11/11	3.2 Interpolation Error (pages 151 – 156)	P.156: 1,3	P.157: 3
20	M	11/16	3.5 Bezier curves (pages 179 – 181)	P.182: 1,2,5,6	P.183: 1,2
21	W	11/18	5.1 Numerical Differentiation (pages 244 – 251)	P.252: 1,2,3,5	P.254: 1
22	M	11/23	5.2 Newton-Cotes Formulas, Num Int (pp 254 – 263)	P.263: 1,3,5	P.264: 1,2,3,4
23	W	11/25	6.1 Initial Value Problems (pages 282 – 291)	P.291: 1,2,3,5	P.292: 1,2
24	M	11/30	6.4 Runge-Kutta Methods & Apps (pp 314 – 320)	P.320: 1,3	P.321: 1,2
25	W	12/2	Exam Review		
26	M	12/7	**Third Exam (sessions 18-24)**		
27	W	12/9	Project Presentations		
28	M	12/14	Project Presentations		
29	W	12/16	Comprehensive Final Review		
30	**M**	**12/21**	**Final Exam (Sessions 1-24)**		

Grade scale:

93 – 100	A	77 – 79.9	C+
90 – 92.9	A-	70 – 76.9	C
87 – 89.9	B+	60 – 69.9	D
83 – 86.9	B	0 – 59.9	F
80 – 82.9	B-		