NEW YORK CITY COLLEGE OF TECHNOLOGY
The City University of New York

DEPARTMENT:	Mathematics
COURSE:	MAT 2630
TITLE:	Applied Mathematics Technology - Numerical Methods
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.
TEXT:	Numerical Analysis Timothy Sauer 2nd edition, Pearson, 2011
CREDITS:	3
PREREQUISITES:	MAT 2580, MAT 1575 and one of: CST 1101 or higher, MAT 1476L, MAT 1475H, MAT1630
	Prepared by Professors Holly Carley, Boyan Kostadinov, Jonathan Natov (Spring 2012) Modified by Professors Nan Li, Lin Zhou (Fall 2019)

A. Testing/Assessment Guidelines:
The following should be scheduled:

1. A class exam at the end of the First Quarter.
2. A class exam at the end of the Second Quarter.
3. A final project and a final exam.

B. Using a Computer Algebra System (CAS) is required.

Course Intended Learning Outcomes/Assessment Methods

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

General Education Learning Outcomes/Assessment Methods

Learning Outcomes	Assessment Methods
1. Gather, interpret, evaluate, and apply information discerningly from a variety of sources.	Classroom activities and discussion, homework, project, exams.
2. Understand and employ both quantitative and qualitative analysis to solve problems.	Classroom activities and discussion, homework, project, exams.
3. Employ scientific reasoning and logical thinking.	Classroom activities and discussion, homework, project, exams.
4. Communicate effectively using written and oral means.	Classroom activities and discussion, homework, project, exams.
5. Make meaningful and multiple connections between mathematics and other areas of study leading to a major or profession.	Classroom activities and discussion, homework, project, exams.
6. Work with teams. Build consensus and use creativity.	Classroom activities and discussion, project.

New York City College of Technology Policy on Academic Integrity

Students and all others who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty is prohibited in The City University of New York and at New York City College of Technology and is punishable by penalties, including failing grades, suspension, and expulsion. The complete text of the College policy on Academic Integrity may be found in the catalog.

MAT 2630 Applied Mathematics Technology – Numerical Methods
Text: *Numerical Analysis* by Timothy Sauer, 2nd edition, Pearson, 2011

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