Manhattan College
Department of Mathematics
MATH 158 Section 01, Spring 2018

Introduction to Mathematical Computation

Class Time: MR 12:00 pm – 1:15 pm   *Class Room*: RLC 107

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Office Hours: Monday 1:30-2:20 P.M., Wednesday 3:30-4:20 P.M., Thursday 11-11:50 A.M. and or by appointment.

Textbook: MATLAB: An Introduction With Applications, Amos Gilat, Fourth Edition, John Wiley & Sons 2011

Recommended Textbook: More Math Into LaTeX, George Grätzer, Fourth Edition, Springer 2007
This text is available in PDF from O'Malley Library.

Software:
MATLAB: We will be using MATLAB and the toolboxes included in the student edition. MATLAB is a powerful software used in education, research and industry. Every student and faculty at Manhattan College has access to MATLAB through a university license: https://www.mathworks.com/academia/tah-portal/manhattan-college-40634592.html
The license gives you access to MATLAB and many additional toolboxes which you may need (and can download) in the future. For this class, you will need: MATLAB and the following toolboxes: Curve Fitting, Optimization, Image Processing, Signal Processing, Statistics and Machine Learning and Symbolic Math.
You can install it and run it in your personal computer. MATLAB can also be used in the computer labs on campus.

LaTeX: This is the typesetting program most commonly used for professional publishing of papers, presentations and books with heavy mathematical content. In this course we will use a web-based distribution: https://www.overleaf.com/.

Course Description:
This course is intended to help you become comfortable using personal computers to solve quantitative problems, as well as to experiment with mathematical concepts and techniques. A variety of problems from mathematics, science and engineering will be considered to illustrate the problem-solving process. It will reinforce the programming concepts in the context of applications. The mathematics covered in this class will focus on concepts from calculus and topics covered in high school (such as algebra and trigonometry) but will also explore ideas in more advanced topics like optimization, probability, differential equations and linear algebra which can be explored using computation. You will gain experience in the use of MATLAB, a software package for interactive numerical and symbolic computation, as well as in writing programs of your own. What you learn will prove to be useful in future courses in mathematics, particularly those involving numerical computation, mathematical modeling, and simulation. The skills you will develop are also valuable for any career in mathematics, science or engineering.

Along with using MATLAB to present programming techniques, we will introduce LaTeX as a mathematical typesetting language. LaTeX will be very useful when writing papers and presentations with heavy mathematical content. In this course, LaTeX will be used for selected HW assignments and for class presentations and papers. LaTeX is also used in upper level mathematics courses.

Catalog Description:
Introduction to mathematical problem-solving employing modern software used for mathematical modeling in industry and research. Numerical and symbolic computation including problems from calculus. A variety of problems arising in mathematics, science and engineering.

Pre-requisite: CMPT 101 (Computer Science I), Co-requisite: MATH 186 (Calculus II), MATH 188 (Honors Calculus II) or consent by instructor.

Course Objectives:
After completing this course, the students should be able to:
- Set up and solve application problems using MATLAB
- Typeset documents using LaTeX
- Write programs using functions and loops to solve mathematical problems
- Load data and visualize it
- Interpolate data and fit curves through data
- Solve integrals numerically and analytically
- Solve simple optimization problems
- Solve simple problems in discrete dynamical systems, linear algebra and differential equations

Course Homepage (Moodle):
Here you will find four features that will be used in this course:
- *Email:* make sure that your email on Moodle is one that you check regularly. Homework assignments, announcements and other class related information will be sent via email.
- *Course Information and Documents:* material covered each week, assignments and solution keys.
- *Student Discussion Board:* this online forum allows for students and faculty to communicate about the course.
- *Grades:* students will be able to keep track of their grades online.

Grading:
Homework and quizzes (30 %)

Exam 1 (20 %): February 22

Exam 2 (20 %): April 5

Final Project (30 %)
Initial Project Presentation (in class): April 16
Initial Paper: April 23
Final Project Presentations: Wednesday May 9, 11 am – 1 pm
Final Paper: Wednesday May 9, 11 am – 1 pm

The class project will explore a topic of your choice involving mathematical computation. You will work in pairs to develop skills for working in teams. The main idea is for you to find some mathematical problem that you are excited about which uses material from this course. Possible topics could be extensions of material in our text, may come from your own research projects, other classes or from outside sources, for example the Laboratories for Mathematical Exploration by The Mount Holyoke Mathematics Department (and J. William Bruce):
https://www.mtholyoke.edu/sites/default/files/acad/math/docs/MathLab2015.pdf
Or for more advanced students this online text of applications from the creator of MATLAB (Cleve Moler):
http://www.mathworks.com/moler/chapters.html
Details for the writing project will be given after Exam 1.

Tentative Grading Scale

Percent	93-100	90-92	87-89	83-86	80-82	77-79	70-76	67-69	60-66	0-59
Grade	A	A-	B+	B	B-	C+	C	D+	D	F

The exact grading scale will be determined after the final exam. The numerical scores in the tentative grading scale guarantee the associated letter grade but the instructor may change the scale to the student's benefit.

Dates to Remember
      January 24: Late Registration & Add/Drop Ends
      February 22: Exam 1
      March 6: Midterm Grades Due
      March 12-16: Spring Break (No Classes)
      March 29 – April 2: Easter Holiday (No Classes)
      April 4 – Monday Schedule

April 5 – Exam 2
April 13: Last Day to Withdraw from Courses
April 16: Initial Project Presentation
April 23: Initial Paper Due
April 28 Spuyten Duyvil Mathematics Conference
May 4: Last Day of Classes
May 9: Final Presentation and Paper Due

Class Policies
- Attendance is required. Students are expected to arrive on time.
- Failure to attend a class with an unexcused absence will result in a zero for quizzes given on that day. After four unexcused absences, the appropriate dean will be notified. To receive an excused absence, proper documentation and instructor approval is needed.
- Late homework sets will not be accepted after the solutions are distributed. In case the homework is handed in before the solutions are posted it will be marked 20% off for every day (or part thereof) it is late.
- The lowest HW or Quiz grade will be dropped.
- No make-up exams will be given, unless you have a medical or family emergency. These emergencies require valid documentation. The grade for a missed exam is zero.
- Cell phones (or other technology not related to the class) in the classroom is only allowed with express permission of the instructor for special circumstances. In general cell phone or other potentially disruptive technology use is not allowed in class.

Calculator Policy
A calculator is not required for this course.

Suggestions
- The course requires a time commitment of about 6-9 hours outside of class time per week (2-3 per class hour). The material builds on itself, so it is very important not to fall behind.
- Find a study partner or group.
- Treat your homework and quizzes as a study guide for future exams. Write solutions to problems in a neat and organized fashion.
- I encourage you to come to office hours regularly. I will do my best to help you.

Sources of Support
- The Center for Academic Success provides tutoring to support students with their courses. It also provides writing assistance. See their website for a list of their services and hours: https://manhattan.edu/academics/academic-support/center-academic-success.php

Academic Integrity:
As students of Manhattan College, you have each signed The Manhattan College Honor Pledge:

As a Manhattan College student, I will not lie, cheat, or steal in my academic endeavors, nor will I accept the actions of those who do. I will conduct myself responsibly and honorably in all my activities as a Manhattan College student. I am accountable to the Manhattan College community and dedicate myself to a life of honor.

Whenever you put your name on work to be handed in for grading in this class, you are reaffirming the above pledge. Violations of the Honor Code include, but are not limited to, cheating, plagiarism, fabrication, and other forms of academic misconduct. Students should familiarize themselves with the Manhattan College Student Code of Conduct and Academic Policies found at:
https://inside.manhattan.edu/student-life/dean-of-students/code-conduct.php

Special Accommodations:
- Students with special needs should bring appropriate documentation to the Specialized Resource Center, https://inside.manhattan.edu/academic-resources/specialized-resource-center/index.php, to obtain an Academic Adjustment/Auxiliary Aid form. Bring the completed form to me as soon as possible, and together we will decide on how best to fulfill the adjustments and/or aids listed on the form.

- Student athletes should bring their event schedules to me as soon as possible.

Course Outline:

Typesetting in LaTeX will be introduced during the second week and incorporated throughout the course in writing and presentation assignments.

Chapter 1 Starting with MATLAB
1.1 STARTING MATLAB, MATLAB WINDOWS
1.2 WORKING IN THE COMMAND WINDOW
1.3 ARITHMETIC OPERATIONS WITH SCALARS
1.4 DISPLAY FORMATS
1.5 ELEMENTARY MATH BUILT-IN FUNCTIONS
1.6 DEFINING SCALAR VARIABLES
1.7 USEFUL COMMANDS FOR MANAGING VARIABLES
1.8 SCRIPT FILES
1.9 EXAMPLES OF MATLAB APPLICATIONS

Chapter 2 Creating Arrays
2.1 CREATING A ONE-DIMENSIONAL ARRAY (VECTOR)
2.2 CREATING A TWO-DIMENSIONAL ARRAY (MATRIX)
2.3 NOTES ABOUT VARIABLES IN MATLAB
2.4 THE TRANSPOSE OPERATOR
2.5 ARRAY ADDRESSING
2.6 USING A COLON : IN ADDRESSING ARRAYS
2.7 ADDING ELEMENTS TO EXISTING VARIABLES
2.8 DELETING ELEMENTS
2.9 BUILT-IN FUNCTIONS FOR HANDLING ARRAYS
2.10 STRINGS AND STRINGS AS VARIABLES

Chapter 3 Mathematical Operations with Arrays
3.1 ADDITION AND SUBTRACTION
3.2 ARRAY MULTIPLICATION
3.3 ARRAY DIVISION
3.4 ELEMENT-BY-ELEMENT OPERATIONS
3.5 USING ARRAYS IN MATLAB BUILT-IN MATH FUNCTIONS
3.6 BUILT-IN FUNCTIONS FOR ANALYZING ARRAYS
3.7 GENERATION OF RANDOM NUMBERS
3.8 EXAMPLES OF MATLAB APPLICATIONS

Chapter 4 Using Script Files and Managing Data
4.1 THE MATLAB WORKSPACE AND THE WORKSPACE WINDOW
4.2 INPUT TO A SCRIPT FILE
4.3 OUTPUT COMMANDS
4.4 THE save AND load COMMANDS
4.5 IMPORTING AND EXPORTING DATA
4.6 EXAMPLES OF MATLAB APPLICATIONS

Chapter 5 Two-Dimensional Plots
5.1 THE plot COMMAND
5.2 THE fplot COMMAND
5.3 PLOTTING MULTIPLE GRAPHS IN THE SAME PLOT
5.4 FORMATTING A PLOT
5.5 PLOTS WITH LOGARITHMIC AXES
5.6 PLOTS WITH ERROR BARS
5.7 PLOTS WITH SPECIAL GRAPHICS

This syllabus may be changed at the instructor's discretion. Any changes will be communicated to the students.