Course Syllabus

Summer 2023 Math 446-B03: Numerical Analysis I

<u>Instructor:</u> Patrick Bishop   **<u>Office:</u>** Exploratory Hall 4106

<u>Email:</u> pbishop3@gmu.edu

<u>Office Hours (Zoom):</u> M,W,F (or by appointment): 2:00pm - 3:30pm

<u>Required Textbook:</u> Numerical Analysis 3rd edition, Timothy Sauer.

<u>Prerequisite:</u> Math 203 and CS 112

<u>Course Description:</u>

     This will be an asynchronous course done entirely though blackboard. The goal of this course will be to design and implement algorithms for the solution of scientific and engineering problems. Emphasis will be placed on the written and graphical presentation of solutions. Topics covered in this course are the following:

- Floating point representation and arithmetic.

- Root finding methods for single variable functions.

- Solving Systems of Equations with iterative methods.

- Use and analyze different interpolation techniques.

- Using least squares to find different models for data.

Lecture:

Videos will be posted every week for you to watch. Each video will cover a different section of the book. A schedule of what will be covered can be found at the end of the syllabus. You will be expected to watch each video and complete the corresponding check ups on the dates given in the Course Calendar. You will have 5 attempts to complete each check up.

Homework:

Problems will be assigned from every section we cover for you to practice but will not be graded. Problem sections and numbers are listed on the course calendar in blackboard and can be found in the textbook.

Quizzes:

Quizzes will be posted to blackboard every Friday at midnight and will cover the material posted for that week (see the course calendar for details). You will have until 11:59 pm each Friday to take this quiz. Once started, you will not be able to back out without the quiz submitting and you only have one attempt. You will have 45 minutes to complete the quiz once started. Send me an email with a cool dinosaur fact to get one point on your lowest quiz grade. You will need to enable the Respondus Lockdown Browser before taking each quiz. See The Respondus Lockdown Browser section for details.

Labs:

There will be 6 graded labs during this course. Each lab will require you to implement a different method that we cover in lecture. Labs will be posted to blackboard every Monday at midnight and due every Sunday at 11:59pm. You will have 7 days to complete each project. Labs must be submitted to blackboard as a single pdf file and must include your analysis, your code, AND your diary.

Exams:

Exams must be taken on the given dates listed below in the Course Calendar. There will be two sections to each exam: a portion through

blackboard which will require the use of Respondus Lockdown Browser and a "Take Home" portion. Each portion will be open book and open notebook and each portion will make be worth 50 points. Adding to a total of 100 points possible.

Blackboard Portion: The blackboard portion of the exam will be similar to the quizzes taken over the course of the semester. You will be required to answer questions regarding theory in the subjects we discuss. You will have 90 minutes to answer each of these questions

Take Home: This portion of the final will require you to download a pdf with a set of questions posted to the Exams tab in Blackboard. You will be required to use Matlab and the methods discussed over the semester to help answer these questions. Final answers should be submitted as a SINGLE PDF. You may take pictures of your work and submit those as well but they must be converted to a SINGLE PDF FILE.

Matlab:

The software package Matlab will be used for analysis and presentation of data. Matlab is a matrix based language with an interactive development environment and is a commonly used high-performance language for technical computing. You will be required to write and implement code in Matlab. GMU offers a way for students to get a license. You can obtain a copy in one of three ways:

1.) Obtaining a license as a GMU student. Go to https://its.gmu.edu/service/software-listing-matlab/ for details.

2.)Any one of the GMU computer labs. Go to https://its.gmu.edu/service/computer-labs/ for locations.

3.) Using Citrix Virtual lab. This will require you to use Masons VPN. Go to https://its.gmu.edu/service/citrix-virtual-lab/ for more details.

To learn more about how to code in Matlab go to the Matlab section on blackboard and

Respondus Lockdown Browser:

LockDown Browser Requirement
This course requires the use of LockDown Browser for online exams. Watch this video to get a basic understanding of LockDown Browser:

https://www.respondus.com/products/lockdown-browser/student-movie.shtml

Download Instructions
Download and install LockDown Browser from this link:

https://download.respondus.com/lockdown/download.php?id=133435885

Once Installed

- Start LockDown Browser
- Log into Blackboard Learn
- Navigate to the exam

Note: You won't be able to access tests with a standard web browser. If this is tried, an error message will indicate that the test requires the use of LockDown Browser. Simply start LockDown Browser and navigate back to the exam to continue.

Guidelines
When taking an online exam follow these guidelines:

- Select a location where you won't be interrupted
- Before starting the test, know how much time is available for it, and also that you've allotted sufficient time to complete it
- Turn off all mobile devices, phones, etc. and don't have them within reach
- Clear your area of all external materials - books, papers, other computers, or devices
- Remain at your desk or workstation for the duration of the test
- LockDown Browser will prevent you from accessing other websites or applications; you will be unable to exit the test until all questions are completed and submitted

Getting Help

Several resources are available if you encounter problems with LockDown Browser:

- The Windows and Mac versions of LockDown Browser have a "Help Center" button located on the toolbar. Use the "System & Network Check" to troubleshoot issues. If an exam requires you to use a webcam, also run the "Webcam Check" from this area
- Respondus has a Knowledge Base available from support.respondus.com. Select "LockDown Browser & Respondus Monitor" as the product to view helpful articles.
- If you're still unable to resolve a technical issue with LockDown Browser, go to support.respondus.com and select "Submit a Ticket". Provide detailed information about your problem and what steps you took to resolve it

University Honor Code:

Mason has an Honor Code with clear guidelines regarding academic integrity. You are expected to follow the Honor Code. You can find the details here: https://oai.gmu.edu/mason-honor-code/. The principle of academic integrity is taken very seriously and violations are treated gravely.What does academic integrity mean in this course? Essentially this: when you are responsible for a task, you will perform that task. If you are reading this, email me a good math joke for one extra point towards your lowest quiz grade. When you rely on someone else's work in an aspect of the performance of that task, you will give full credit in the proper, accepted form. When in doubt (of any kind) please ask for guidance and clarification.

Disability Statement:

Disability Services at George Mason University is committed to providing equitable access to learning opportunities for all students by upholding the laws that ensure equal treatment of people with disabilities. If you are seeking accommodations for this class, please first visit http://ds.gmu.edu/ for detailed information about the Disability Services registration process. Then please discuss your approved accommodations

with me. Disability Services is located in Student Union Building I (SUB I), Suite 2500. Email: ods@gmu.edu | Phone: (703) 993-2474

<u>Tutoring Center:</u> The Math Tutoring Center is located in the Johnson Center Room 344. Help is available on a walk-in basis. For hours of operation see: <u>https://science.gmu.edu/academics/departments-units/</u> <u>mathematical-sciences/math-tutoring/tutoring-center-hours-and</u>

<u>Counseling and Psychological Servic</u>es: Counseling and Psychological Services pro- vides a wide range of free services to students. Individual and group therapy, work- shops, online self- help, and community education programs are designed to enhance students personal experience and academic performance.

<u>Privacy</u>:

Students must use their masonlive email account to receive important University information, including messages related to this class. See http:// masonlive.gmu.edu for more information.

<u>Grading:</u>

There will be a total of 23 check-ups, 7 quizzes, 6 labs, 1 midterm, and 1 final exam that will all contribute to your total grade. Final grades will be determined with the following scale:

Grade	Percentage Range
A	90% - 100%
B	80% - 89.9%
C	70% - 79.9%
D	60% - 69.9%
F	Below 60%

The total amount of points for each assignment can be found on the chart below:

Assignments	Points per Assignment	Total Amount
Section Check-Up	5	115
Weekly Quiz	20	140
Labs	50	300
Midterm	100	100
Final Exam	100	100
Total Points		755

Calendar:

Weeks	Section, lesson etc.	Assignments	Due Dates
Week 1 **(May 30 - June 2)**	Overview 1.1 Bisection Method 1.2 Fixed-Point Iteration 1.3 Accuracy	• **Read section 1.1** • **Take section 1.1 checkup** • **Read section 1.2** • **Take section 1.2 checkup** • **Read section 1.3** • **Take section 1.3 checkup** • **Take Quiz 1**	**Section 1.1 Checkup Due Date: 05/30** **Section 1.2 Checkup Due Date: 05/31** **Section 1.3 Checkup Due Date: 06/01** **Quiz 1 Due Date: 06/02**
Week 2 **(June 5 - June 11)**	1.4 Newton's Method 1.5 Secant Method 0.1 Polynomials 0.2 Binary Numbers	• **Read section 1.4** • **Take section 1.4 checkup** • **Read section 1.5** • **Take section 1.5 checkup** • **Read section 0.1** • **Take section 0.1 checkup** • **Read section 0.2** • **Take section 0.2 checkup** • **Take Quiz 2** • **Turn in Lab A**	**Section 1.4 Checkup Due Date: 06/05** **Section 1.5 Checkup Due Date: 06/06** **Section 0.1 Checkup Due Date: 06/07** **Section 0.2 Checkup Due Date: 06/08** **Quiz 2 Due Date: 06/09** **Lab A Due Date: 06/11**

Week 3 **(June 12 - June 18)**	0.3 Floating Point Numbers 0.4 Significance 2.1 Gaussian Elimination 2.2 LU Factorization	• **Read section 0.3** • **Take section 0.3 checkup** • **Read section 0.4** • **Take section 0.4 checkup** • **Read section 2.1** • **Take section 2.1 checkup** • **Read section 2.2** • **Take section 2.2 checkup** • **Take Quiz 3** • **Turn in Lab B**	**Section 0.3 Checkup Due Date:** **06/12** **Section 0.4 Checkup Due Date:** **06/13** **Section 2.1 Checkup Due Date:** **06/14** **Section 2.2 Checkup Due Date:** **06/15** **Quiz 3 Due Date:** **06/16** **Lab B Due Date:** **06/18**
Week 4 **(June 19 - June 25)**	**Midterm** 2.3 Error and Condition Number	• **Read section 2.3** • **Take section 2.3 checkup** • **Turn in Lab C**	**Midterm Date:** **06/20** **Section 2.3 Checkup Due Date:** **06/22** **Lab C Due Date:** **06/25**
Week 5 **(June 26 - July 2)**	2.4 PA = LU Factorization 2.5 Iterative Methods 2.7 Multivariate Newton's Method 3.1 Interpolation	• **Read section 2.4** • **Take section 2.4 checkup** • **Read section 2.5** • **Take section 2.5 checkup** • **Read section 2.7** • **Take section 2.7 checkup** • **Read section 3.1** • **Take section 3.1 checkup** • **Take Quiz 4** • **Turn in Lab D**	**Section 2.4 Checkup Due Date: 06/26** **Section 2.5 Checkup Due Date:** **06/27** **Section 2.7 Checkup Due Date:** **06/28** **Section 3.1 Checkup Due Date:** **06/29** **Quiz 4 Due Date:** **06/30** **Lab D Due Date:** **07/02**
Week 6 **(July 3 - July 9)**	3.2 Interpolation Error 3.3 Chebyshev Interpolation	• **Read section 3.2** • **Take section 3.2 checkup** • **Read section 3.3** • **Take section 3.3 checkup** • **Take Quiz 5** • **Turn in Lab E**	**Section 3.2 Checkup Due Date:** **07/05** **Section 3.3 Checkup Due Date:** **07/06** **Quiz 5 Due Date:** **07/07** **Lab E Due Date:** **07/09**

Week 7 (July 10 - July 16)	3.4 Splines 3.5 Bezier Curves 4.1 Normal Equations and Least Squares	• **Read section 3.4** • **Take section 3.4 checkup** • **Read section 3.5** • **Take section 3.5 checkup** • **Read section 4.1** • **Take section 4.1 checkup** • **Take Quiz 6** • **Turn in Lab F**	**Section 3.4 Checkup Due Date: 07/10** **Section 3.5 Checkup Due Date: 07/11** **Section 4.1 Checkup Due Date: 07/12** **Section 4.2 Checkup Due Date: 07/13** **Quiz 6 Due Date: 07/14** **Lab F Due Date: 07/16**
Week 8 (July 17 - July 23)	4.2 Models 4.3 QR Factorization	• **Read section 4.2** • **Take section 4.2 checkup** • **Read section 4.3** • **Take section 4.3 checkup** • **Take Quiz 7**	**Section 4.2 Checkup Due Date: 07/17** **Section 4.3 Checkup Due Date: 07/19** **Quiz 7 Due Date: 07/21**
Week 9 (July 24 - July 27)	Review and Final Exam	• **Take Final Exam**	**Review Date: Tuesday, 07/25** **Final Date: Thursday, 07/27**