

MA-4323/6323: Numerical Analysis II

(Spring 2025)

Instructor

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Class

Classroom: 19 Allen; MWF 8:00 – 8:50 AM

Office Hours

MWF 9:00 – 9:50AM, or by appointment

Course Description

(Prerequisites: CSE 1233 or equivalent. MA 3113 and MA 3253). Three hours lecture. Numerical solution of equations; error analysis; finite difference methods; numerical differentiation and integration; series expansions; difference equations; numerical solution of differential equations.

Course Materials

- **Text:** Seongjai Kim, *Numerical Analysis using Maple and Matlab*, Lecture Note: https://skim.math.msstate.edu/LectureNotes/Numerical_Analysis_Lecture.pdf
- **Supplemental References:**
 - Richard L. Burden and J. Douglas Faires (2011). *Numerical Analysis (9th Ed.)*, Brooks/Cole.

Class Plan

- The students will complete 6 sets of homework, one for each of Chapters 7-12.
- The students will take a mid-term and the final exam, with the final being comprehensive.
- There are *Graduate Student Requirements*; see page 3.
- For Campus 5, the students are expected to complete and turn in assignments via Canvas.
- **Class:** begins on **Wed 1/15** and ends on **Mon 5/5**.

Learning Objectives

- To provide advanced undergraduate students and early year graduate students with a solid mathematical background for numerical methods.
- To recognize mathematical issues that arise in scientific computing.
- To discuss recent approaches in scientific computing.

Content

The course covers Chapters 8-14 in Dr. Kim's lecture note.

Ch. 8. Eigenvalues and QR Factorization

Ch. 9. Principal Component Analysis

Ch. 10. Iterative Algebraic Solvers

Ch. 11. Mathematical Optimization

Ch. 12. Machine Learning

Ch. 13. Boundary-Value Problems of One Variable

Ch. 14. Numerical Solutions to Partial Differential Equations

Delivery Methods for Campus 5

- A webcam will be installed in the classroom and connected to Canvas for students in Campus 5. Thus for Campus 5, lectures are synchronous through Canvas (WebEx connection).

Exams

There will be a mid-term exam and a comprehensive final exam.

- The mid-term will cover Chapters 8–11, of 100 points worth.
- The final exam, 200 points worth, will cover all chapters covered.

Homework

Homework will be assigned after finishing each chapter, each 50 points worth. Problems are given in the lecture note, at the end of each chapter as Exercises. Some problems require mathematical derivation/proof and others need to implement computational algorithms.

Quizzes

There will be no quizzes.

Projects

The students will work on a project, developing and implementing computer algorithms.

Campus 5: Discussions and Questions

Students in distance learning are encouraged to post questions and other concerns on discussion board in Canvas and communicate with your class mates. Also you may send emails to the instructor to ask questions.

Evaluation

The students' understanding of the concepts covered in this course will be evaluated by a combination of homework assignments, a project, a mid-term exam, and the final exam. The overall final grade will be calculated in the following manner:

Homework	40%
Mid-term	15%
Project	15%
The final exam	30%

Final Grade

The standard MSU grading scale will be considered:

$\geq 90\%$	A
80~ 89.99%	B
70~ 79.99%	C
60~ 69.99%	D
Below 60%	F

When the average performance of students is lower than a certain level, a curve will be given at the end of the class.

Graduate Student Requirements

Certain assignments will include problems which are optional for undergraduate students, but required for graduate students.

Below are the standard MSU policies in education and learning.

Attendance Policy

This section is a face-to-face instructional class. Per Academic Operating Policy 12.09, students are expected to attend all class meetings in person. Should a student expect a university-excused absence from a class, the student should contact the course instructor of record to inform them of the absence and the reason for it. Special instructions regarding illness and contagious infection are included in the syllabus section entitled: Contagious Infection and Other Health Accommodations for face-to-face instruction.

General Class Information

By attending class, you agree to behave in a manner that allows for you and your classmates to learn effectively. If you disrupt class or behave in any other inappropriate fashion, you will be dismissed from class. Repeated instances of disruptive behavior will result in permanent dismissal. Also, all cell phones must be turned off before entering the classroom and left off until class is dismissed.

Student Honor Code

Mississippi State has an approved Honor Code that applies to all students. The code is as follows: "As a Mississippi State University student, I will conduct myself with

honor and integrity at all times. I will not lie, cheat, or steal, nor will I accept the actions of those who do." Upon accepting admission to Mississippi State University, a student immediately assumes a commitment to uphold the Honor Code, to accept responsibility for learning, and to follow the philosophy and rules of the Honor Code. For additional information, please visit: <https://www.honorcode.msstate.edu>.

Title IX

MSU is committed to complying with Title IX, a federal law that prohibits discrimination, including violence and harassment, based on sex. This means that MSU's educational programs and activities must be free from sexual discrimination, sexual harassment, and other forms of sexual misconduct. If you or someone you know has experienced sex discrimination, sexual violence and/or harassment by and member of the University community, you are encouraged to report the conduct to MSU's Director of Title IX/EEO Programs at 325-8124 or by e-mail to titleix@msstate.edu. Additional resources are available at <https://www.oci.msstate.edu/focus-areas/title-ix-sexual-misconduct>. If you need help, please contact the MSU Safeline at 325-3333.

Student Support Services

Students who need academic accommodations based on a disability should visit the Office of Student Support Services, 01 Montgomery Hall, call 325-3335, or visit the website at <http://www.sss.msstate.edu>.

University Safety Statement

Mississippi State University values the safety of all campus community members. Students are encouraged to register for Maroon Alert texts and to download the Everbridge App. Visit the Personal Information section in Banner on your mystate portal to register. To report suspicious activity or to request a courtesy escort via Safe Walk, call University Police at 662-325-2121, or in case of emergency, call 911. For more information regarding safety and to view available training resources, including helpful videos, visit ready.msstate.edu.

Attendance policy for Face-to-face Instruction

This section is a face-to-face instructional class. Per Academic Operating Policy 12.09, students are expected to attend all class meetings in person. Should a student expect a university-excused absence from a class, the student should contact the course instructor of record to inform them of the absence and the reason for it. Special instructions regarding illness and contagious infection are included in the syllabus section entitled: *Contagious Infection and Other Health Accommodations for face-to-face instruction*.

Contagious Infection and Other Health Accommodations for Face-to-face Instruction

Students required to isolate due to symptomatic or asymptomatic contagious infection or quarantine due to potential exposure to contagious infection will be accommodated on a case-by-case basis. Such students must provide an excuse from either the Dean of Students, the Longest Student Health Center, or qualified medical practitioner

directing quarantine procedures, and the recommended date of return. Information provided will be enforced at the instructor's discretion.

In cases meriting accommodation, quarantining students may be expected to log into the lecture during the scheduled class time or complete equivalent assignments approved by the instructor. If a student is too ill to participate in a class at the scheduled time, the student may be provided a link to a recording of the lecture or offered a similar accommodation as determined by the instructor.

It is the responsibility of the student to initiate and maintain contact with their instructor(s) regarding their quarantine status. All accommodations are subject to the instructions provided by the Dean of Students', Longest Student Health Center, or qualified medical practitioner.

Continuity of Instruction

In the event that face-to-face classes are suspended due to the pandemic or its effects, the instructor will continue instruction in a manner that best supports the course content and student engagement. In this event, all instructors will notify all students of the change via their university email address (the official vehicle for communication with students). At that time, they will provide details about how instruction and communication will continue, how academic integrity will be ensured, and what students may expect during the time that face-to-face classes are suspended. If a student becomes unable to continue class participation, the student should contact their instructor and advisor for guidance.

Facial Coverings

To safeguard the health of all members of the MSU campus during this global pandemic, the university has reconfigured classroom spaces and adjusted room capacities to assure adequate physical distance between all individuals in each room. In addition, the university has published requirements for the use of face coverings for everyone on campus, including specific requirements for their use in all classrooms, labs, and shared office spaces regardless of physical distancing. In order to mutually protect the students' freedom to learn and the instructor's ability to teach in a safe classroom environment, everyone in this classroom is required to wear a face covering in the classroom in accordance with MSU policy. If a student cannot wear a face covering due to a medical condition, they should request an accommodation via the Office of Disability Support Services. If a student simply doesn't want to wear a face covering, they will not be permitted to remain in the classroom or lab.