

MATH 652 Numerical Analysis II

MWF 2:30 PM – 3:45 PM, LGRT 1114

Instructor:

- Professor: Yao Li
Office: LGRT 1340; Email: yaoli@math.umass.edu (preferred); Tel: 545-4254
Office Hours: WF 11:00AM - 12:00PM or by appointment

Prerequisite: MATH 651 or permission of the instructor.

Recommended Texts: 1, Numerical Partial Differential Equations Finite Difference Method by JW Thomas

2, Numerical solutions of partial differential equations by the finite element method by C. Johnson

3, Numerical solution of partial differential equations by Morton and Mayers

I will mainly use materials from the above three books. Materials from other books and papers may also be used. Please check lecture notes on Moodle after each class.

Course Description

This course covers a broad range of fundamental numerical methods for numerical partial differential equations. Students will gain practical programming experience in implementing numerical methods using MATLAB or Python programming languages.

We will cover the following topics:

- Finite difference methods for partial differential equations (consistency, stability, and convergence)
- Finite element methods
- Finite volume method and numerical conservation law differentiation. Introduction to numerical ODEs.
- Solving partial differential equations with artificial neural networks
- Numerical optimization methods for artificial neural networks

The grade will be based on homework assignments, class participation, and exams.

Access to MATLAB at UMass

Here is the instruction of MATLAB installation. <https://www.mathworks.com/academia/tah-portal/university-of-massachusetts-amherst-40702063.html>.

Required Work

The required work for the course will consist of 8 written homework assignments and one take-home final exam.

Class Participation

Your participation is necessary in order to make this course a success. Due to the class size, I expect that you will attend every class, will not enter the classroom late, and will complete the reading and the assignments on time. In case of any problems affecting your work, please see me when they happen. I will try to help you. If unable, I will direct you to someone who can help.

Homework

Homework is an important component of this course. You are expected to express your ideas rigorously, clearly, legibly and completely. Late homework will be graded with a 50% penalty unless you have my permission. Unreadable work, scratching out, etc. will not be graded. The lowest homework score will be dropped.

Each homework assignment consists 5 written or programming problems. Please turn in written homework in class and submit programming problems on Moodle. By all means you may work in groups on the homework assignments. Collaboration is a big part of learning and of scholarship in general. However, each student must turn in his or her own write-up of the solutions, with an **acknowledgment of collaborators**.

You can use MATLAB, C, C++, Fortran, or Python for the programming assignment. Python and MATLAB are recommended. It is your responsibility to make your programming assignment compile and run successfully on approved platforms. No credit will be given for code that does not run or compile. You are expected to write the code for your assignments from scratch. Doing a web search to find and use online code is a very serious ethics violation.

Exams

During the semester there will be one take-home final exam. You will have 48 hours to finish the take home final. You must work on it independently. The final exam must be written up on paper and turned in by yourself.

I may approve out-of-sequence exams in the following cases:

1. A documented medical excuse;
2. A University sponsored event such as an athletic tournament, a play, or a musical performance. Athletic practices and rehearsals do not fall into this category. Please have your coach, conductor, or other faculty advisor contact me.
3. A religious holiday
4. Extreme hardship such as a family emergency

Requests must be made at least one week before the actual exam.

I will not accommodate out-of-sequence exams, quizzes or finals for purposes of more convenient travel, including already purchased tickets.

Grading

Item	Weight
Homework	40%
Midterm Exam	20%
Final Exams	30%
Attendance and classroom participation	10%
Total	100%

The course score will be converted to a letter grade beginning with these values as cutoffs:

A	A-	B+	B	B-	C+	C	C-	D+	D	F
86	82	78	72	69	65	62	59	55	50	< 50

These cutoffs might be adjusted, but only in the downward direction (to make letter grades higher).

Drop, Withdrawal, and Incomplete

The last day to drop/add with no record is September 18th. The last day to drop with a DR is October 16th.

An incomplete is possible only if all of the following apply: (1) you have a compelling personal reason, e.g., serious illness; (2) your work so far would receive a passing grade; and (3) there is a good chance you will complete the course with a passing grade within the allotted time. Thus, *expecting to fail the class is no reason to ask for an incomplete.*

Class etiquette statement

- Except for emergency, do not send text messages/emails or make/receive phone calls during lectures.
- If you arrive late to class, sit in the first seat you can find so as not to disturb others, and do not come up to the front of the room to pick up or hand in papers.
- You can use laptops and tablets during class provided that you do not disturb your fellow classmates or my lectures (for example: mute the speaker). They are not allowed during exams.
- Please read *Guidelines for Classroom Civility and Respect*: http://www.umass.edu/dean_students/campus-policies/classroom

Academic integrity statement

Since the integrity of the academic enterprise of any institution of higher education requires honesty in scholarship and research, academic honesty is required of all students at the University of Massachusetts Amherst. Academic dishonesty is prohibited in all programs of the University. Academic dishonesty includes but is not limited to: cheating, fabrication, plagiarism, and facilitating dishonesty. Appropriate sanctions may be imposed on any student who has committed an act of

academic dishonesty. Instructors should take reasonable steps to address academic misconduct. Any person who has reason to believe that a student has committed academic dishonesty should bring such information to the attention of the appropriate course instructor as soon as possible. Instances of academic dishonesty not related to a specific course should be brought to the attention of the appropriate department Head or Chair. Since students are expected to be familiar with this policy and the commonly accepted standards of academic integrity, ignorance of such standards is not normally sufficient evidence of lack of intent.

Please read *Academic Honesty Policy and Procedures*: <http://www.umass.edu/ombuds/honesty.php/>

Accommodation Statement

The University of Massachusetts Amherst is committed to providing an equal educational opportunity for all students. A student with a documented physical, psychological, or learning disability on file with Disability Services (DS) may be eligible for reasonable academic accommodations to help succeed in this course. If you have a documented disability that requires an accommodation, please notify the instructor within the first two weeks of the semester so that we may make appropriate arrangements.