

**MATH 6701 MATHEMATICAL METHODS OF APPLIED SCIENCES**

GEORGIA TECH LORRAINE

**COURSE SYLLABUS**

**Updated on February 12, 2024**

*(The syllabus may be updated during the semester, depending on the flow of the course.)*

*Welcome to Mathematical methods of applied sciences!*

*All of our students play an important role in our educational mission. Mathematics provides efficient and powerful tools for Sciences and Engineering. Enjoy learning these at GT!*



## 1. Course Description

**Course Title:** Mathematical Methods of Applied Sciences

**Course Meeting Times:** Mondays & Wednesdays, TBC

## 2. Instructor Information

**Instructor:** Dr. Salah MEHDI

**Office:** TBC

**Office Hours:** Mondays & Wednesday TBC

**E-mail:** [salah.mehdi@univ-lorraine.fr](mailto:salah.mehdi@univ-lorraine.fr) (preferred address)

## 3. Textbook

Mathematical Methods in the Physical Sciences, 3rd edition, by Mary L. Boas. Wiley. ISBN-139780471198260. Chapters 1, 2, 3, 8, 9, 12 & 14 only. The GT Bookstore has online, hard cover, and soft cover editions available.

## 4. Assessments & Information

**Assessments:** Tests (quizzes and midterms) will be returned in class. Three assessments to take home.

**Information:** Announcements and course-related documents will be posted on Canvas.

## 5. Prerequisites

A great deal of tools from calculus, including trigonometry, complex numbers, functions, differentiation, integration and partial fraction decomposition, will be used extensively. Topics from linear algebra are also supposed to be well understood, these include: row reduction, linear combinations, and linear independence. The codes for prerequisites are (from GT course official website): MATH 2406, MATH 4305 and MATH 2403.

## 6. Grades

Final grades will be calculated using whichever of the following weights yields the highest grade.

Assessment	Weight 1	Weight 2	Weight 3
Home assessments (x3)	15%	15%	20%
Quizzes (x3)	15%	15%	20%
Midterm	40%	30%	30%
Final Exam	30%	40%	30%

Letter grades will be determined based on the usual intervals. **A:** 90% and higher, **B:** [80%, 90%), **C:** [70%, 80%), **D:** [60%, 70%), **F:** [0%, 60%). For example, a final grade of 89.99% is converted into a B, a final grade of 79.99% is converted into a C, and so on. Any changes to these intervals would only be made after the final exam.

There will be three assessments to take home, four quizzes in class, one midterm exam in class and a final exam. The best three quizzes will be kept out of the five. Homework will be assigned as suggest problems, but will not be collected nor graded. Some of these problems will be discussed in class. A **midterm grade** will be assigned. A satisfactory grade will be assigned by to all students with a midterm average of 70% or higher.

## 7. Learning Outcomes and Topics

**Learning outcomes** (or learning **objectives**) are statements that articulate what students are expected to do in a course. The learning outcomes for this course include the following.

- **Acquire** fundamental techniques involved in linear algebra, complex analysis and differential equations.
- **Decide** on the convergence of a (power) series, find expansion of a function as a power series.
- **Compute** integrals using residues theorem, diagonalize a matrix and use it to solve systems of linear ODE's.
- **Solve** systems of differential equations using tools from linear algebra and (complex) analysis.
- **Analyze** a problem and find the adequate technique to solve it.
- **Understand** the meaning and the motivation of the classical theorems, and the classical ODE.
- **Write** logical progressions of precise mathematical statements to justify and communicate your reasoning.

**Topics** covered include infinite series, power series, complex numbers, linear algebra, ordinary differential equations, calculus of variations, series solutions of differential equations, special functions and functions of a complex variable. Applications are also discussed. Topic outline:

- Complex numbers and complex functions, Riemann surfaces, conformal mappings, complex differentiation and complex integration, contours and residues, series and power series.
- Vector spaces, subspaces, linear functions, linear operators, bases, change of basis, dimension, coordinates systems, matrices, determinants, inverse and projectors, systems of linear equations, eigenvalues, eigenvectors, diagonalization, Jordan shear transformation.
- Ordinary differential equations, the fundamental theorem of calculus, functions spaces, systems of linear ODE and diagonalization, constant coefficients, autonomous single equation, autonomous systems, linearization, rotational dynamics, special functions, Laplace transform and resolution of ODE, Dirac-Delta functions, method of Frobenius, approximations of solutions.

## 8. Expectations

### 8.1 Students

Students are expected to attend lectures and recitations and behave at all times in a respectful manner to their instructor, teaching assistants, and fellow students. Students are expected to study the subject matter outside of class time, review this syllabus, review their graded work in a timely manner for potential marking errors and to review where mistakes were made (if any), and ask for help when needed. Students are responsible for obtaining any announcements or materials sent by email, communicated orally in class or posted on Canvas.

## 8.2 Teaching Assistants (TAs), if applicable

TAs are responsible for facilitating learning activities during recitations, holding office hours, marking, and responding to questions from students via email and during office hours and recitations.

## 8.3 Instructor

As your instructor, my role is to facilitate interactive lectures, coordinate with teaching assistants to grade student work and facilitate learning activities, provide students with assessments that both develop and measure their understanding and knowledge of the subject matter, provide feedback on their performance, provide solutions to midterm, and be available for assistance when requested.

# 9. Preparing for Tests

Practice materials and additional office hours will be offered prior to each test. Depending on your goals, you may need to complete additional work beyond homework, worksheets, and practice materials to adequately prepare for them.

# 10. Homework, Participation, Assessments to take home, Tests Policies

## 10.1 Homework

Homework are assigned exercises (not necessarily from the textbook) and will not be collected. You are expected to understand all homework problems for all quizzes, midterms and the exam. In order to increase the effectiveness of lectures, you should attempt problems before lectures.

## 10.2 Assessments to take home

There will be three assessments to take home, at the end of each “block” of the syllabus (block 1 is complex analysis, block 2 is linear algebra and block 3 is ODE’s). Students will be allowed to return common work, provided they contribute equally to solutions.

## 10.3 Participation

The purpose of participation activities is to encourage participation and active learning, foster community among students, offer feedback to the instructor on student understanding and course activities, and help students become more aware of their level of understanding of course material. Participation activities will be held during lecture and recitation sessions. Participation activities will not be held in the first and last weeks of the course, and will only be graded for completion (not for accuracy). Participation activities could include activities such as individual problem solving, practice quizzes, group work activities, and surveys.

## 10.4 Midterm Schedule and Topics

We will have a 50 or 55-minutes midterm. Tentative date is on the last page of the syllabus. Topics to be covered in the midterm will be announced in class and posted on Canvas.

## 10.5 Midterm and Final Exam Procedures

### 10.5.1 Tests Procedures

- Books, notes, cell phones, and calculators are not allowed during tests.
- Students may have something to write with and an eraser when taking tests.
- Unless students are asked to use a particular method or theorem, they are allowed to use any approach to solve any problem they are given on any test.

- Unless indicated otherwise, students must adequately justify their reasoning for full marks.
- Marks can be taken off in a test for not using the correct notation.
- The tests are comprehensive.
- Students who are unable to take any test for any reason are responsible for notifying their instructor prior to the exam and as soon as possible.
- Tests will be returned to students in class.

### 10.5.2 Additional Final Exam Procedures

Students take their final exam in the room where they have lectures (as per institute policy). The duration, date, and time of the final exam for local students is listed on the registrar website: <http://www.registrar.gatech.edu/registration/exams.php> Note that the schedule of the final exam is non negotiable.

### 10.5.3 Re-grade Requests for Tests

- 1) If any of your work has been graded in error, you should contact your **instructor** as soon as possible.
- 2) Teaching assistants are not permitted to handle re-grade requests.
- 3) Should you wish to have your work re-graded, do not change or add to the work on your paper.
- 4) A re-grade request can only be submitted if you did something correct that was marked as incorrect.
- 5) Re-grade requests **must be requested within two weeks** after the work has been returned to you.
- 6) You must check your answers with the solutions before submitting such a request.
- 7) To submit a re-grade request, you must send your instructor an email from your GT email account that contains your first and last name, the midterm you are referring to, the question(s) you are referring to, and a description of what was graded incorrectly.

## 11. Illnesses, Emergencies, Absences

Students who will miss a midterm or final exam due to a university-sponsored event or athletics should provide their instructor with the official documentation in advance. Any student who misses a test, with reasonable explanation, can write a make-up. Students must notify their instructor as soon as they can to make necessary arrangements.

## 12. Re-Scheduled/Missed Exams

**NO MAKE-UP EXAMS!** In general, no make-up exams will be given and any missed exam results in a "0" score.

- If you have a valid reason to request a make-up exam, please contact Dr. Mehdi or the TA as early as possible. Only extraordinary cases will be considered.
- In the case of illness and emergency, please contact the Office of Dean of Students immediately. The Dean's office will verify the case, determine the severity of the problem, and then interact with the instructor if necessary.
- Requests for student organization excused absences must be made no later than two weeks prior to the date of the event. No late requests will be honored. Please have your advisor send me a written notice or an e-mail.
- Students who are absent because of participation in a particular religious observance will be permitted to make up the work missed during their absence with no late penalty, provided the student informs Dr. Mehdi of the

upcoming absence, in writing, within the first two weeks of class, and provided the student makes up the missed material within the timeframe established by the course instructor.

- If you have off campus interviews for jobs or graduate/professional schools on the test dates, please contact me as early as possible with a supporting document.

## 13. Class Policies

### 13.1 Attendance

In the event of an absence, you are responsible for all missed materials, assignments, and any additional announcements or schedule changes given in class. Class disruptions of ANY kind will NOT be tolerated and may result in your removal from the classroom. Please show courtesy to your fellow classmates and instructor by adhering to the following class rules.

- Come to class on time and stay for the entire class period.
- Refrain from conversing with your fellow students while the instructor is lecturing.
- Put away any reading materials unrelated to the course.
- Please, refrain from using laptops and do not bring food to eat during lectures, they are a distraction to others.

### 13.2 Academic Dishonesty

All students are expected to comply with the Georgia Tech Honor Code (see <http://www.policylibrary.gatech.edu/student-affairs/code-conduct>). Any evidence of cheating or other violations of the Georgia Tech Honor Code will be submitted directly to the Dean of Students. Cheating includes, but is not limited to the following.

Using a calculator, cell phone, books, or any form of notes on exams.

Copying directly from **any** source during an exam, including friends, classmates, or a solutions manual.

Allowing another person to copy your work. Taking a test using someone else's name, or having someone else take a test in your name.

Asking for a re-grade of a paper that has been altered from its original form.

Using someone else's name to gain participation points for them, or to take tests for them, or asking someone else to use your identity for any graded or participation submission.

### 13.3 Students with Disabilities and/or in need of Special Accommodations

Georgia Tech complies with the regulations of the Americans with Disabilities Act of 1990 and offers accommodations to students with disabilities. If you are in need of classroom or testing accommodations, please make an appointment with the ADAPTS office to discuss the appropriate procedures. More information is available on their website, <http://www.adapts.gatech.edu>

## 14. Campus-Wide Dates

Please check with Registrar for possible updates

08 - 21 - 2024 First day of class

08 - 23 - 2024 Course registration deadline

10 - 28, 11 - 03 - 2024 Fall Break

12 - 03 - 2024 Final Instructional Class day

12 - 04, 05 & 10 - 2024 Reading periods

12 - 05 - 12 - 2024 Final Exams period

For further information on campus-wide dates see <http://www.registrar.gatech.edu/calendar>

The date and time of the final exam is scheduled by the registrar.

For **final exam schedules**, see <http://www.registrar.gatech.edu/students/exams.php>.

## 15. TENTATIVE SCHEDULE

Please use this as an approximate class schedule. Section coverage may change depending on the flow of the course.

Week and Dates	Section Coverage in Lecture	Tests in class	Assessments to take home
Week 1	Complex numbers and complex functions		
Week 2	Riemann surfaces and conformal mappings		
Week 3	Complex differentiation	Quiz 1	
Week 4	Complex integration		
Week 5	Vector spaces, Linear functions and operators		
Week 6	Subspaces, bases, dimension, coordinates, base change	Quiz 2	Assessment 1 due
Week 7	Determinants, inverses and projections, systems		
Week 8	Eigenvalues, eigenvectors, diagonalization		
Week 9	Jordan shear transformation, Introduction to ODE's	Quiz 3	
Week 10	Fundamental theorem of calculus, functions spaces and linear ODE's	Midterm	Assessment 2 due
Oct 28 - Nov 3	NO CLASS	NO CLASS	FALL BREAK
Week 11	Linear ODE's and autonomous single equation		
Week 12	Autonomous systems, linear constant coefficients	Quiz 4	
Week 13	Linearization, rotational dynamics		
Week 14	Laplace transform, Dirac-Delta functions	Quiz 5	Assessment 3 due
Week 15	Review for Final Test		<i>Last day of class, Dec 3</i>