

University of Tennessee

MATH/COSC 471 Numerical Analysis

Meets: TR 1:10 PM - 2:25 PM through Zoom
<https://tennessee.zoom.us/j/8217664472>

Syllabus Fall 2020

Welcome to Our Numerical Analysis Class

Course Description

Prerequisites: Calculus II, ODEs and Matrix Algebra (Math 200, 251 or 257).

Instructor: Dr. Wenbo Li

Office Hours and Location: Office hours are hosted on zoom on Monday 3:30-5pm, Thursday 10-11:30am, and other times by appointments. Face-to-face discussions are also possible by appointments, and usually I will be at my office Walters F225 during my office hours on Thursday.

Ways to contact: wli50@utk.edu, or messages through canvas.

Course Communications: I will post course materials (homework, quizzes, exams, video records of class meetings), grades, and class announcements on Canvas. You are always welcome to contact me through email or canvas.

Student Learning Outcomes: Upon completion of Math 471, students will be able to

- Approximate functions by polynomials based on a variety of methods
- Compute errors for different methods of numerical differentiation and integration
- Develop and investigate algorithms to solve initial value problems for ODEs
- Apply mathematical theorems to analyze numerical algorithms

Materials: I will upload my own notes for this class on canvas. The textbook (recommended) for this class is: *An Introduction to Numerical Analysis, 1st Edition*, Endre Suli and David Mayers, Cambridge University Press. We will be covering chapters 6, 7, 9, 10, 11, and 12. Another reference (definitely no need to buy) is the book *Numerical Analysis: Mathematics of*

Scientific Computing by David R. Kincaid and E. Ward Cheney. Chapters 2, 6, 7, 8 from this book are related to our class.

Assessment and Evaluations Methods: (no extra points)

Computational homework (15%) + Quizzes (25%) + Midterm exam (24%) + Final (36%)

Computational Homework: this requires **coding, and I highly recommend you to use MATLAB although C/C++ or Python or Fortran is also allowed.** You need to write a short report including numbers or pictures asked by the assignments, together with your explanations. You are allowed to use the existing code from books or the internet, but you are definitely not allowed to ask other people to do the homework for you. You may discuss the assignments with other students, but copying and pasting other people's answers are not permitted.

Theoretical Homework: I will upload theoretical homework on canvas, but will not collect your solutions. Most of the problems come from two textbooks mentioned before. The homework would be helpful for your preparation of the quizzes and exams.

Quizzes: there will be 6 quizzes. In fact, the quiz is more like homework. I will upload the quiz problems on canvas, and you need to write down your solution and send it back to me before the deadline.

Midterm: there will be one in class midterm exam on Oct 13. I plan to make the exam in-class in the following way: I will upload the exam problems at the time our class begins. Then you need to finish the exam by writing down your solutions on paper, and you have to send the scanned version of your solutions back to me at the end of the class. The number of problems would be a little bit less compared to a normal test due to the inconvenience. We will also meet on zoom so you could ask me if you are not sure what the questions ask you to do.

Final: the final covers all the materials in this semester, while mainly focusing on the materials not covered by the midterm exam. The final exam will be on Dec 7 (Monday) 3:30 pm to 6 pm. The time here includes the setup time before the exam and the time needed to submit your answers after the exam. Guidance from school will come later.

Letter grades will be based on the following scale:

Grade	A	B+	B	C+	C	D+	D	F
%-Score	90+	87-89	80-86	77-79	70-76	67-69	60-66	0-59

I reserve the right to change this scale, provided the change benefits all students. All grades will be made available online.

Calculators: The use of a calculator as an auxiliary tool is allowed in this class. Devices with Internet capability such as cellphone calculators are prohibited during the quizzes and exams. To obtain credit, all the steps leading to the solution of a problem must be clearly written.

Learning Environment and Classroom Expectations/Etiquette:

Everyone is expected to maintain an atmosphere that fosters a positive learning environment.

- Attendance to every class is mandatory.
- Questions are welcomed

Make Up Policies: Late homework or quiz submission is not acceptable unless for a valid reason. Make ups for the in-class exams and final will be given only if a student can present evidence that an absence was caused by serious illness, a death in the immediate family, religious observance, or participation in University activities at the request of University authorities. For an illness, you should present a signed statement from a doctor that your illness was sufficiently serious to make you miss class. A note saying only that you visited the doctor or the Health Center may not Suffice. Furthermore, please let me know before the exam or the deadline if you cannot make it.

Campus Syllabus:

STUDENTS WITH DISABILITIES -- <http://sds.utk.edu>

“Any student who feels he or she may need an accommodation based on the impact of a disability should contact the Student Disability Services (SDS) at 865-974-6087 in 100 Dunford Hall to document their eligibility for services. Student Disability Services will work with students and faculty to coordinate reasonable accommodations for students with documented disabilities.”

ACADEMIC INTEGRITY

Each student is responsible for his/her personal integrity in academic life and for adhering to UT’s Honor Statement. The Honor Statement reads: “An essential feature of the University of Tennessee, Knoxville is a commitment to maintaining an atmosphere of intellectual integrity and academic honesty. As a student of the university, I pledge that I will neither knowingly give nor receive any inappropriate assistance in academic work, thus affirming my own personal commitment to honor and integrity.”

SOCIAL DISTANCING & COVID-19 PROCEDURES

Students are required to wear face masks at all times and maintain social distancing (6 feet between individuals in traditional classrooms, or, in instructional laboratories and similar settings, only a few minutes in closer proximity when absolutely necessary to achieve learning objectives). Students who are feeling ill or experiencing symptoms such as sneezing, coughing, or a higher than normal temperature will be excused from class and should stay at home.

Instructors have the right to ask those who are not complying with these requirements to leave class in the interest of everyone's health and safety. In the event that a student refuses to comply with these requirements, the instructor has the right to cancel class.

Additionally, following other simple practices will promote good health in and out of the classroom, such as frequent and thorough hand washing, wiping down desks and seats with disinfectant wipes whenever possible, not sharing personal items such as pens and cell phones, and avoiding crowded hallways and other enclosed spaces.

The Volunteer Creed reminds us that we bear the torch in order to give light to others. As Volunteers, we commit to caring for one another and for the members of the communities in which we live, work, and learn. This semester, the University asks that we all demonstrate the Volunteer spirit by following these and other health guidelines and requirements.

How to be Successful in this Course:

- Take notes and ask questions.
- Think, work smarter and discuss with classmates.
- Review and rework problems that you got wrong.
- Start preparing for exams early.

If the instructor finds it necessary to make informational changes (e.g. office hours, schedule adjustments) due to students' needs or unforeseen circumstances, students will be notified in writing/email of any such changes.

Key Dates - Fall 2020: [UT Calendar](#)

Math 471 Projected Schedule Fall 2020

(quiz would be due before the dates listed below, due dates for computational homework are not decided yet)

	Section numbers, topics	Homework and Quiz Information
8/20	Introduction of the course materials, computer arithmetic	
8/25	Computer arithmetic, mathematical preliminaries	
8/27	6.2 Lagrange interpolation	Homework 1 covers the materials up to this class
9/1	6.2 Lagrange interpolation, 6.3 convergence	
9/3	6.4 Hermite interpolation	Homework 2
9/8	6.4 Hermite interpolation, 6.5 numerical differentiation	Quiz 1 covering Hmwk 1 and 2.
9/10	6.5 Numerical differentiation	Homework 3, computational Hmwk 1 will be uploaded
9/15	7.2 Newton–Cotes formulae, 7.3 error estimates	
9/17	7.3 error estimates, 7.4 Runge phenomenon	Homework 4
9/22	7.5 Composite formulae	Quiz 2 covering Hmwk 3 and 4.
9/24	9.2 Inner product spaces, L_p norm,	Homework 5, computational Hmwk 2
9/29	Best approximation in the 2-norm, normal equations	
10/1	Existence and uniqueness of best approximation in the 2-norm	Homework 6
10/6	Orthonormal Systems, the Gram-Schmidt Process	Quiz 3 covering Hmwk 5 and 6.
10/8	Quick introduction of Romberg integration and adaptive quadrature (if time permits)	Homework 7
10/13	Midterm exam	Covering Hmwk 1-7, Quiz 1-3.
10/15	10.2 Gauss quadrature rules	
10/20	10.3 Construction of Gauss quadratures	
10/22	10.4 Error estimates and convergence	Homework 8, computational Hmwk 3

10/27	11.2 Linear splines	Quiz 4 covering Hmwk 8.
10/29	11.3 Linear splines, 11.4 Cubic splines	Homework 9
11/3	11.4 Cubic splines, 11.5 Hermite cubic splines (if time permits)	
11/5	12.1 ODE theories	Homework 10
11/10	12.2 One step method	Quiz 5 covering Hmwk 9 and 10.
11/12	12.3 Truncation error, global error and convergence, 12.4 implicit methods	Homework 11, computational Hmwk 4
11/17	12.5 Runge–Kutta methods	
11/19	12.5 Runge–Kutta methods	Homework 12
11/24	Review	Quiz 6 covering Hmwk 11 and 12
12/7 Monday	Final Exam	3:30 pm - 6:00 pm GOOD LUCK!!!