MATH 5382 Applied Mathematics II

The University of Texas at Tyler, Spring 2026

Instructor: Dr. Ivan Ramirez-Zuniga
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Office: RBN 4005
Website: All materials will be posted on Canvas

Time and Place:

- MoWeFr 2:30 pm - 3:25 pm at RBN 3041.

Office Hours: MWF 9-10 am , or request an appointment by email (at least one day in advance).

Preferred method of communication: My preferred method of communication is by email.

Textbook: Partial Differentia Equations with Fourier Series and Boundary Value Problems by Nakhle' H.Asmar, Second Edition. An online edition is available at https://www.iitg.ac.in/jiten/Extra/Asmar.pdf.

Additional references include:

- Partial Differential Equations: An Introduction, 2nd Edition, by Walter Strauss. An online edition is available at https://math24.wordpress.com/wp-content/uploads/2016/03/partial-differential-equations-by-w-a-s.pdf.
- Fourier Series and Boundary Value Problems (Brown and Churchill Series), 8th Edition.

Course description: This course develops core analytical methods for classical partial differential equations. Topics include Fourier series and orthogonal expansions; Sturm–Liouville eigenvalue problems; separation of variables for initial- and boundary-value problems; and solution methods for the heat, wave, and Laplace/Poisson equations in one and two spatial dimensions. Additional techniques may include transform methods (Fourier and Laplace transforms), Green's-function ideas, and representative applications from physics and engineering. Emphasis is placed on well-posed formulation, rigorous solution procedures, and interpretation of solutions.

Course prerequisites: A grade of B or better in MATH 5381 is required to take this course.

Student Learning Outcomes: Upon completion of this course, students should be able to do the following:

- Classify second-order PDEs (elliptic/parabolic/hyperbolic) and interpret the roles of initial and boundary conditions.
- Derive PDE models from basic physical principles (e.g., conservation laws and constitutive relations) in representative settings such as heat conduction, vibrating strings/membranes, and potential problems.
- Compute Fourier series representations of functions on finite intervals, including half-range sine/cosine expansions, and use these expansions to solve boundary value problems.
- Apply the method of separation of variables to obtain series solutions of the one-dimensional heat and wave equations, and explain how boundary conditions determine admissible eigenvalues and eigenfunctions.
- Use Sturm–Liouville theory to:
  - establish orthogonality of eigenfunctions,
  - construct eigenfunction expansions to represent solutions of PDEs.
- Solve Laplace and Poisson problems in rectangular domains using eigenfunction expansions.
- Formulate and solve PDEs in polar/cylindrical/spherical coordinates for symmetric geometries.
- Apply the Fourier transform method to solve PDEs on infinite or semi-infinite domains.
- Apply Laplace transform techniques to solve linear PDE/ODE initial value problems.
- Construct and use Green's functions for boundary value problems, and connect Green's identities and Green's theorem to solution representations for Laplace/Poisson equations.
- Communicate solutions clearly and rigorously, including correct use of notation, justification of method choice and interpretation of the resulting formulas in terms of the modeled phenomenon.

Grading procedure:

- Midterm Exams (3): 80% of final grade (equally weighted)
- Homework 20%

Grading scale: The grading scale will not be more harsh than:

$$A : 85 - 100, B : 70 - 85, C : 55 - 70, D : 40 - 55, F < 40$$

Homework: Collaboration on homework assignments is allowed and encouraged. However, **each student is responsible for preparing and submitting their own written solutions. The work you turn in must be your own, and you should be able to explain it**. **Copying another student's work or online solutions is not acceptable. If two or more submissions are essentially identical, none of them will receive credit**. Some of the homework problems are fairly standard, and you may find solutions online. However, such solutions often do not use the notation, definitions, or methods used in class and are therefore **not acceptable**. **All solutions must include complete details and clear justification for every claim.**

Make-up policy: Make-ups for documented absences that are required as part of a UT Tyler obligation (e.g. athletes participating in an event, students participating in a debate contest, etc.) or for religious observation will be granted. **For all make-ups of this type, prior notification of at least one week and documentation are required. Other make-ups are granted only in extreme cases and at the sole discretion of the instructor. Valid documentation, such as a medical note from a health professional (dated within 72 hours of the missed evaluation) must be provided to be eligible for the make-up evaluation**. Consider visiting the Health Clinic on Campus for such a request. To make an appointment call (903) 939-7870. It is the responsibility of the student to communicate with me promptly and regularly until arrangements for the missed work have been established. If this criterion is not met, make-up evaluation won't be granted. Leaving early for a break is NOT grounds for a make-up, so please make your travel plans accordingly.

Attendance: Attendance is **mandatory**. You are expected to attend to class on time and prepared. Students are responsible for all announcements made during lecture.

Cellphones and electronic devices: Cellphones are not permitted during class. At all times cellphones must be silenced and must be put away.

Artificial Intelligence Statement: UT Tyler is committed to exploring and using artificial intelligence (AI) tools as appropriate for the discipline and task undertaken. We encourage discussing AI tools' ethical, societal, philosophical, and disciplinary implications. All uses of AI should be acknowledged as this aligns with our commitment to honor and integrity, as noted in UT Tyler's Honor Code. Faculty and students must not use protected information, data, or copyrighted materials when using any AI tool. Additionally, users should be aware that AI tools rely on predictive models to generate content that may appear correct but is sometimes shown to be incomplete, inaccurate, taken without attribution from other sources, and/or biased. Consequently, an AI tool should not be considered a substitute for traditional approaches to research. You are ultimately responsible for the quality and content of the information you submit. Misusing AI tools that violate the guidelines specified for this course (see below) is considered a breach of academic integrity. The student will be subject to disciplinary actions as outlined in UT Tyler's Academic Integrity Policy.

For this course, **the use of AI tools is permitted outside of class, but it is important to understand that you do so at your own risk**. **It is your responsibility to understand and be able to explain/defend any homework assignment submitted with your name on it**. While AI may provide correct answers, relying solely on these tools can **defeat the purpose of homework as a learning tool**. Homework is designed to help you understand and apply the material, which is essential for your success in this course. If you merely copy answers from AI without fully engaging with the problems, **you may find yourself unprepared for in-class evaluations, where NO electronic devices, including AI tools, will be allowed**. Ultimately, this approach could negatively impact your performance on exams and your overall understanding of the subject.

UT Tyler a Tobacco-Free University: All forms of tobacco will not be permitted on the UT Tyler main campus, branch campuses, and any property owned by UT Tyler. This applies to all members of the University community, including students, faculty, staff, University affiliates, contractors, and visitors. Forms of tobacco not permitted include cigarettes, cigars, pipes, water pipes (hookah), electronic cigarettes (vaping), smokeless tobacco, snuff, chewing tobacco, and all other tobacco products. There are several cessation programs available to students looking to quit smoking, including counseling, quitlines, and group support. For more information on cessation programs please visit https://www.uttyler.edu/offices/human-resources/wellness/tobacco-cessation/students/.

Academic Integrity: Your work must be your own. Violations will be processed according to the estab-

lished guidelines of the department, college, and university. Violations of academic integrity include, but are not limited to, cheating, fabrication, or plagiarizing. A range of academic sanctions may be taken against a student who engages in academic dishonesty.

Accessibility: The Department of Mathematics at UT Tyler offers accommodations to students with learning, physical, and/or psychological disabilities. If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and the Student Accessibility and Resources (SAR) as early as possible in the term. SAR will verify your disability and determine reasonable accommodations for this course. You can find more information in their website https://www.uttyler.edu/academics/success-services/disability-services/.
Take into account that once an application and supporting documentation is received, the SAR registration process may take 5-7 business days to complete. It is the student's responsibility to apply for and obtain accommodations in a reasonable time frame within the semester. No accommodation reviews will be completed during the final three weeks of the current semester unless the condition is temporary or newly diagnosed.

Policies: See https://www.uttyler.edu/offices/academic-affairs/files/syllabus-information.pdf for these and other important University policies including: UT Tyler Honor code, student rights and responsibilities, campus carry, UT Tyler a tobacco-free university, grade replacement and forgiveness, state-mandated course drop policy, student accessibility and resources, student absence for university-sponsored events, social security and FERPA, emergency exits and evacuation, and student standards of academic conduct.

Important Dates: To find these and other important dates visit the University academic calendar at: https://www.uttyler.edu/academics/academic-calendar-25-26/.

- January 26. Census date: Date to withdraw without penalty, grade replacement deadline.
- March 30. Last day to withdraw from one or more courses with a W.
- Midterm 1: Friday February 20th.
- Midterm 2: Friday March 27th.
- Midterm 3: Friday April 24th.