The University of Texas – Rio Grande Valley
Syllabus for Math 3341.07: Differential Equations Spring 2026
EMAGC 2.206 MW 09:30–10:45

Contact information

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Course information

Prerequisites: MATH 2414 (or MATH 2488) with a grade of 'C' or better.
Corequisites: None.
Course Description: This course emphasizes solution techniques. Topics include differential equations, vector spaces, linear transformation, matrix/vector algebra, eigenvectors, Laplace Transform and systems of equations.
Course modality: Students enrolled in traditional face-to-face courses will attend class in person, on campus, and on set schedules - the traditional way.

Textbook

(1) E. Gkioulekas (2014): "Lecture Notes on Ordinary Differential Equations", Edinburg, University of Texas Pan American (2014), 259 pp.
- Open Educational Resource
- This document can be downloaded as a pdf file, at no cost, from https://faculty.utrgv.edu/eleftherios.gkioulekas/Teaching/notes.html

Outline of Topics

- **Introduction to Ordinary Differential Equations**
- **First-order ODES**
  Separable ODEs
  Homogeneous ODEs
  Integrating Factors method
- **Linear Algebra Review**
- **Linear Differential Equations**
  Basic definitions
  Function operators and linear operators
  Homogeneous linear differential equations: The null space
  Homogeneous linear differential equations: The initial value problem
  Homogeneous linear differential equations: The Wronskian and it's properties
  Exam 1
  Solving homogeneous differential equations: Constant coefficient case
  Solving homogeneous differential equations: Equidimensional case
  Solving inhomogeneous linear differential equations
- **Series solution of ODEs**
  The Gamma function
  Review of power series
  Series solution of 2nd-order linear ODEs: Regular linear ODEs
  Series solution of 2nd-order linear ODEs: Regular singular linear ODEs (Frobenius method)
  Theory of Bessel functions
  Exam 2
- **Generalized Functions**
  Introduction–Motivation
  Schwarz definition of generalized functions
  The Dirac delta function
  Operations with distributions

Derivative of distributions
Algebra with delta functions
The Heaviside distribution
Distributional derivative of piecewise discontinuous functions
Side-limit evaluation of generalized functions
Distributions and Green's functions

- **Laplace transforms**
  Definition of Laplace transform
  Laplace transforms of elementary functions
  Operational properties of Laplace transforms
  Evaluating Laplace transforms
  Laplace transform of piecewise defined functions
  Laplace transforms of functions defined as a series
  Exam 3
  Fundamental properties of Laplace transforms
  Laplace transforms of functions defined as integrals
  Application to differential equations
  ODEs forced with generalized functions
  Systems of linear ODEs
  Laplace transform of a convolution
  Final Exam

Pedagogical objectives and expectations

The fundamental pedagogical objectives that students should strive for in every Mathematics course are:

(1) To understand, learn, and remember the formal and rigorous mathematical *definition* for every concept covered in the course.
(2) To understand, learn, and remember all the *theorems* and *propositions* that are applicable to previously defined concepts.
(3) To understand, learn, and practice the *methods* for applying theorems in the solution of routine problems, and to be able to creatively synthesize techniques to solve problems that are non-routine and may require creative thinking.
(4) To master *rigorous mathematical writing*, understand and use *logic and quantifier notation*, and realize and appreciate that every mathematical argument, from basic arithmetic, to advanced mathematics, with almost no exceptions, is a mathematical proof.
(5) To master the course material to a level of excellence that will ensure sustained success in more advanced mathematics courses.

To be successful in this course, it is expected that you should:

(1) Spend about 12 hours each week working homework problems, reviewing lecture notes, reading the textbook and online lecture notes, studying for exams, and seeking help from the tutors and instructor;
(2) Complete all homework problems, check the correctness of your work, and understand the methods and principles they illustrate;
(3) Master the designed course topics before each test, and if necessary, complete additional problems beyond those assigned and consult other sources if you find the assigned problems and text are insufficient;
(4) Recognize that mastery of the solution to a problem is not demonstrated by simply obtaining the correct numerical answer, but only by a clear, systematic, and detailed solution that traces the given information to the final numerical answer and that employs knowledge developed in this and previous courses;
(5) When you experience difficulty in the course, seek help from the tutors and instructor immediately;
(6) Attend class meetings regularly, pay attention, and do not hesitate to ask questions; and
(7) Write your solutions to homework, test, and quiz problems in an organized and legible way, similarly to the presentation shown in the solution sets and similarly to the examples covered in the lecture notes and in class.

In short, I expect you to ***learn what I am teaching you in class***, and to rely on the examples included in the lecture notes and the examples covered in class to ***learn how to write precise and rigorous mathematical arguments***.

Grading Policies

- **Grading:** There will be 3 major exams, and a comprehensive final exam. The time and location of exams will be announced in class. Exams count for 75% and final exam for 25% of your grade. Combined, you get a numerical grade on a scale 0-20. Each exam question is graded on a 0-4 scale with $4 = A$, $3 = B$, $2 = C$, $1 = D$, $0 = F$. Combining all exams, as explained above, gives a weighted average score on a 0-20 scale. This score is then mapped to a letter grade as follows: A: 16-20; B: 12-16; C: 10-12; D; 7-10; F: 0-7. There will be no curve and no extra credit.
- **Explanation of grades:** Your exams are graded question by question on a 0-4 scale per question. Overall, if you are planning to take future Mathematics or STEM courses, I would like to see you score 3 or 4 on all questions on all major examinations. If you score less than that on any questions, it indicates weaknesses in understanding the material. You should be proactive about addressing these weaknesses.
- **Missed exams:** If a major exam is missed during an excused absence, your score for that exam will be replaced with your final exam score.
- **Homework:** Homework will be assigned and will be collected via Brightspace discussion forums on a weekly basis. It is crucial to do the homework as part of your preparation for the exams. To keep up, I recommend that **after every lecture you should solve the homework problems corresponding to the material covered on that day's lecture. Thus you need to work on a continuous basis!** Maintain a well-organized written record of your homework solutions by **writing the statement of each problem** (so that your document is stand-alone and can be read by itself), followed by your detailed solution, and clearly indicate the problem, section, and chapter number of the question. Most homework problems require more than simply writing the answer, and so you must write all steps of your solution and provide appropriate justification, as illustrated by the instructor's solved examples, as you would on a test. Write neatly and legibly, using rigorous mathematical notation. While you are encouraged to discuss homework problems with other students, tutors, your instructor, and other faculty, the write-up of your solutions must be your own work and not simply copied from another student or another source. Use a ring binder to collect your homework, and write with a black pen, as that will help you to later scan the ring binder as a PDF file, for possible future use, and as a form of backup. This will provide you with a readily available resource to prepare for tests and quizzes, as well as providing documentation of the homework problems should you have a question about a problem and seek help from the instructor or a tutor.
- **Make-ups:** There are no make-up exams. In the case of **excused** absences the final exam will be used as a make-up exam. **Each student MUST take the final exam at the scheduled date and time.** There will be no make-ups for the final exam, after the official final exam date!
- **Regrading policy:** If you believe that a mistake in grading has been made you may request that your paper be regraded. Such request must be submitted **in writing** within one week from the day the graded test has been returned in class, and must be accompanied by the original (unaltered) paper. If you make any changes to the paper your request will be denied. Please note that if you request regrading, all problems are subject to review. Thus, your overall grade may be increased or decreased.

Attendance Policy

- **Attendance Policy:** Attendance will be taken during most class meetings. **The instructor has the prerogative to drop any student with four (4) or more unexcused absences.** Two (2) tardies will count as one (1) unexcused absence. A tardy is defined as entering the class late or leaving the class early. **If you miss any major exam, you will be dropped from the course.**
- **How to Excuse an Absence:** To excuse an absence, you must notify the instructor **in writing** and attach **documentation**, before the date you will be absent, or no more than **three (3)** bussiness days after the date. UTRGV's attendance policy excuses students from attending class if they are participating in officially sponsored university activities, such as athletics; for observance of religious holy days; or for military service.

Other Policies

- **Extra Help:** You are strongly encouraged to form a study group with two or three of your classmates. The group should have no more than 4 students. The group will serve to help each other in doing homework, studying for tests, and whenever possible, teaching each other. The idea is to help each other keep up with the class and hopefully, be successful.
  (1) Contact your instructor during their office hours.

(2) Get free Math tutoring from Learning Assistance Center (LAC) building in Room 114 phone # 665-2532. (Edinburg Campus)
(3) Get free Math tutoring from Math Lab in Math building (MAGC) in room MAGC 1.106 (Edinburg Campus)
(4) Visit the Math Tutoring Lab at SETB 1.408 (Brownsville Campus)
(5) Visit the Math and Natural Sciences Learning Center at Cavalry Hall; Phone number: (956) 882-7058, (956) 882-8208 (Brownsville Campus)
(6) Additional tutoring support is available via the UTRGV Mathematics Society in EMAGC 2.312.

- **Calculators:** The problems you will encounter in my exams will not require a calculator, and you are better served in the long-term by minimizing your dependence on calculators. Don't use the calculator to approximate roots, exponentials, logarithms, etc. Mathematical problems require **exact** answers. Approximations are reasonable **only** on application problems where the numbers given may be approximate themselves, and thus the best answer that can be deduced is unavoidably approximate.
- **Classroom Conduct:** Common courtesy requires that students arrive in class on time, and stay the entire class period. Turn your cellphones and pagers off. You are required to treat your classmate and instructor with respect and courtesy. Use of any electronic devices, except for calculators, is not allowed in class, and I reserve the option to remove you from the classroom without warning for any behaviour that I deem as disrespectful or disruptive. You agree to indemnify and hold harmless the professor with respect to all actions undertaken by the professor to enforce classroom conduct or to properly proctor exams. Taking my course implies your consent to this policy.
- **Scholastic dishonesty:** As members of a community dedicated to Honesty, Integrity and Respect, students are reminded that those who engage in scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and expulsion from the University. Scholastic dishonesty includes but is not limited to: cheating, plagiarism (including self-plagiarism), and collusion; submission for credit of any work or materials that are attributable in whole or in part to another person; taking an examination for another person; any act designed to give unfair advantage to a student; or the attempt to commit such acts. Since scholastic dishonesty harms the individual, all students and the integrity of the University, policies on scholastic dishonesty will be strictly enforced.

Technical Requirements

- **Computer Hardware:** To participate in this course, you should have easy access to a computer less than 5-years old with high-speed internet connection via cable modem, LAN or DSL. It is strongly recommended that you also have a printer (to print lecture notes) and scanner (to scan homework and take-home exams).
- **Student Technical Skills:** You are expected to be proficient with installing and using basic computer applications and have the ability to send and receive email attachments.
- **Software:**
  - Mozilla's Firefox or Google Chrome
  - Adobe Acrobat
  - Zoom
  - Media player software (e.g. Quicktime, Windows Media Player, etc.)
  - Virus protection Software
  - Microsoft Word or TeXLive

Document Scanning

- Take home exams and homework assignments should be submitted as ONE PDF file per submission. Name your file: **Lastname-Firstname.pdf** using your First and Last name.
- **DO NOT JUST TAKE PHOTOGRAPHS OF YOUR PAPERS WITH A PHONE!!!!! DON'T SEND ME IMAGE FILES!!! I need a PDF document that can be printed, and just taking pictures will not work.**
- **WRITE WITH A DARK PEN. DO NOT USE A PENCIL, ESPECIALLY A LIGHT ONE.** Your document may be barely readable on screen but not print well.
- **I won't be able to grade an exam that looks unreadable on paper.**
- To scan with a printer/scanner, please use the following settings:
  - 400 dpi (less than 300dpi will not look good)
  - Black and White
  - Scan as PDF file

  The printer/scanner will then create a pdf file.

- To scan with a phone **YOU MUST USE A SCANNING APP**. For both Android phones and iphones, I recommend using Mobile Doc Scan. To use the app, you take a photograph of the paper and then adjust the bounding box to the four corners of your paper. Image processing algorithms then produce an image that looks as if you fed the document through a real scanner. You need to do this for each page, so this is less convenient than an actual scanner. The app can be used to generate a PDF file, which you can then transfer to a computer and submit by email.

Mathematics Major Student Learning Outcomes

Students completing the B.S. program in Mathematics will:

(1) Demonstrate in-depth knowledge of Mathematics, its scope, application, history, problems, methods, and usefulness to mankind both as a science and as an intellectual discipline.
(2) Demonstrate a sound conceptual understanding of Mathematics through the construction of mathematically rigorous and logically correct proofs.
(3) Identify, formulate, and analyze real world problems with statistical or mathematical techniques.
(4) Utilize technology as an effective tool in investigating, understanding, and applying mathematics.
(5) Communicate mathematics effectively to mathematical and non-mathematical audiences in oral, written, and multi-media form.
(6) Demonstrate an appreciation of and enthusiasm for lifelong scientific inquiry, learning, and creativity.

Student Learning Outcomes

After completing this course students will be able to

(1) Solve separable and homogeneous ordinary differential equations, as well as differential equations solvable with the integration factors method.
(2) Understand the general theory of linear differential equations of order greater than one, linear independence, and results related to the Wronskian.
(3) Solve certain types (constant coefficients and equidimensional) of linear differential equations of order greater than one.
(4) Solve second-order linear differential equations using series techniques around points that are regular or regular-singular, and apply these methods to the theory of Bessel functions.
(5) Understand the concept of generalized functions, the Dirac delta function, the Heaviside function, distributional derivatives of non-differentiable functions.
(6) Use Laplace transforms to solve various types of ordinary differential equations, including ordinary differential equations forced by generalized functions.