Math 3318–001: Differential Equations
Spring 2015, PKH 109, TTh 9:30–10:50 AM

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Office Hours: before class (with advance notice), after class, and by appointment

Pre/corequisite: MATH 2326
Text materials: Edwards & Penney, *Differential Equations and Boundary Value Problems*, 4th ed., Pearson/Prentice Hall, 2008.
Course home page: `http://mathed.uta.edu/kribs/3318.html`
Last day for withdrawal: April 1
Final exam: Thursday, May 12, 8:00–10:30 AM (note time)
Other exam dates (tentative): Tue Feb 17, Tue Apr 7, both in-class
Course content (from the Undergraduate Catalog): Ordinary differential equations with emphasis on the solutions and analysis of first and higher order differential equations drawn from fields of physics, chemistry, geometry, and engineering.

LEARNING OUTCOMES: The successful student will be able to:

- *solve linear systems of ordinary differential equations* including higher-order equations, and including initial or boundary value problems
- *apply standard methods to solve nonlinear ordinary differential equations*, including separation of variables, exact equations, integrating factors, undetermined coefficients, variation of parameters, Laplace transforms, and infinite series
- *analyze the qualitative behavior of systems of nonlinear ordinary differential equations*, using stability analysis for equilibria as well as phase portrait analysis for global behavior
- *write characteristic equations for linear [systems of] ordinary differential equations*, using techniques such as matrix representations (eigenvalues) and Laplace transforms
- *prove the linear independence of functions using the Wronskian*
- *use and explain standard numerical methods for solving systems of differential equations*, including Euler's method and Runge-Kutta 4th-order approximation
- *develop, use, and interpret systems of ordinary differential equations used as mathematical models of real-world systems*, including temperature, radioactivity, fluid flow, and populations
- *communicate effectively and clearly* the analysis and explanations of such models

GRADES: Course grades will be determined by five components: three exams (25% each), and pre-class (10%) and post-class (15%) graded homework assignments. Details on each component are provided later in this syllabus. Students are expected to keep track of their performance throughout the semester and seek guidance from available sources (including the instructor) if their performance drops below satisfactory levels.

POLICIES:

How our inverted classroom will work: (1) *Before* class, students watch the video(s) on Blackboard assigned for the given day, and complete a brief entry ticket (see pre-class homework). Students then try the homework problems assigned, and bring their work to class along with the entry ticket. (2) *During* class, after turning in their entry tickets, students will first have a chance to ask follow-up questions from the video, for up to 30 minutes. Next the instructor will distribute an in-class activity on which students will work in groups of 3 or 4, with the instructor circulating to troubleshoot. When students complete the activity, they check briefly with the instructor (to make sure they have completed it successfully), after which they work on homework problems. (3) *After* class: At the end of class each Thursday, the instructor will announce what homework is to be submitted at the next class period—the assigned homework problems (submitted individually, which may be given a completion grade or 1–2 problems may be graded for correctness) or one of the in-class activities (which may be submitted individually or as a group). See post-class homework.

Expectations for class time: This class meets every Tuesday and Thursday (except spring break) from January 20 to May 7. Students are expected: to be on time, prepared and ready to work at 9:30; to have watched the assigned video(s), to have tried the assigned homework problems (bringing their work to class), and to have completed the day's entry ticket (turning it in when they enter the room); not only to attend, but to actively participate in, class discussions, in order to maximize learning and help the instructor gauge the pace; to seek help (from the instructor, the Math Clinic, or others) on homework problems *before* the class session at which they are due. Class time will be available to address misconceptions and confusions common to many students in the class, but it is often not possible to devote time to going over every problem on which anyone had difficulty. As a sign of respect for your peers and our common work, please keep all cellular phones, computers, and other electronic devices turned off during class. In emergencies cell phones may be set to vibrate only, and brief calls taken in the hallway outside.

Expectations for out-of-class study: The general rule of thumb for college courses is that for every hour spent in class, a student should spend 3 hours per week outside of class working on the course (thus a 12-hour load is considered full-time: $12 \times 4 = 48$). This includes time spent reading, studying, working on homework, consulting the instructor or tutors, etc. What is unusual about how you spend such time in this course is that it represents your initial encounter with a topic, by watching videos and trying homework problems before class, rather than your final encounter.

Attendance: Class attendance has been shown to be directly correlated with students' grades in general. Although there is no explicit penalty for absences, students who miss class remain responsible for understanding the topics, vocabulary, techniques, and notation used in class (as much as possible this will be consistent with the text). Students are also expected to make every effort to arrive on time (important announcements are often made at the beginning of class and not repeated), and to minimize disruption if they arrive late.

Late papers: Each student is allowed one late submission during the semester. The paper must be submitted before the beginning of the class period following that in which it was due. Papers not submitted by the end of class time on the due date are considered late. Submission of a late paper constitutes the student's agreement that this is the one allowed late assignment.

Electronic submissions: Each student is allowed one electronic submission during the semester (for post-class work only). Electronic submissions must be complete and not missing any details necessary for grading. (If the electronic submission is made late, then it is both the only late paper allowed and the only electronic submission allowed.)

Make-up exams: No make-up exams will be given regardless of reason, unless the student presents, *before* the exam, sufficient justification to the instructor to convince him to make such arrangements. Due to grade reporting time constraints, no make-up final exams will be given.

Everything else: Class policy on drops, withdrawals, academic honesty, grade grievances, and disabilities follows the University policy on these matters. Copies can be obtained upon request.

1. Pre-class homework

The first task to complete prior to a given class meeting is to watch the corresponding lecture video, with textbook at hand, and taking notes just as if it were live (except, of course, that you can pause and rewind). Videos will be posted on Blackboard, which logs viewing statistics. Viewing logs will be used to determine 5% of the course grade, so it is important to note that at present Blackboard is unable to log views made from cell phones (my limited experiments suggest that iPhones are in fact unable to view the videos, while Android phones can view them but not zoom in enough to see some details clearly, so viewing them on cell phones may be undesirable for other reasons). Thus students should endeavor to watch videos from computers. I regret the inconvenience.

The second task is to try the homework problems assigned. A preliminary assignment sheet (subject to updating) is given in the calendar at the end of this syllabus. These usually begin with simpler, straightforward exercises and progress to more challenging or complex questions. Students should flag the ones they cannot answer, reviewing the video (and any other resources) as necessary.

The third task to complete prior to class is to complete an *entry ticket* to be turned in upon entering the classroom at the next class meeting. An entry ticket is an index card on which are written the student's name and brief responses to the following three questions:

(1) What did you learn best through this video? (2) What did you learn least well through it?

(3) Write one or more questions following up on the video, for discussion in class.

All three responses should be clearly so specific to the video and section in question that they could not apply to any other day/section. Note that one's responses to these questions immediately after watching the video may not be the same as those one would give after trying the homework. Entry tickets must be submitted in person, although of course students are encouraged to communicate freely with the instructor outside of class and seek help during office hours or via e-mail. Entry tickets will be used to determine 5% of the course grade.

At the end of the semester students are expected to have viewed at least 25 of the videos, and to have submitted at least 20 completed entry tickets, in order to earn full credit for these components.

2. Post-class homework

At the end of class each Thursday, the instructor will announce what homework to submit at the beginning of the following class: either the assigned homework problems for the week, or some subset of the week's in-class activities. Homework sets, which must be submitted individually, may be graded either for a simple completion grade or 1–2 problems may be graded for correctness. Which of these is the case will not be announced ahead of time. In-class activities will be graded for correctness, and may be submitted individually or in the 3-or-4-person in-class groups that worked on them together. In the latter case, each group member must hand-write on the last page the sentence "I contributed to this paper." and write or sign his/her name legibly. In any case, the intention is that the mathematical work be complete by the end of class Thursday, so that the only further time involved is cosmetic, making the completed work suitable for submission (careful students may be able to complete this during class). This is because there will then immediately be pre-class work to do for the next class meeting. After-class homework will thus be collected every Tuesday at the beginning of class and returned the following Thursday. Homework may be handwritten but is expected to be legible, *with the work and reasoning clearly communicated*.

Some of the papers collected based on in-class activities will involve a modeling project. Throughout the course we will study applications of differential equations as models of real-world systems from many fields. Toward the end of the course each student or group will complete a project on a topic of interest to them. The point of the project is twofold: first, to allow students to explore a little the areas in which they will later apply differential equations; and second, to demonstrate the ability to use technology and thoughtful exposition to communicate larger ideas than fit within the scope of a single homework or exam problem. This is the context in which differential equations are

used in the world outside our classroom. Further information will be given after the second exam, when the course is far enough advanced for students to begin work on the projects (in particular, some qualitative analysis of systems of equations is required, which is discussed in Chapter 6).

3. Exams

There will be two exams during the semester and one final exam during the assigned final exam period. All exams will be closed-book and closed-notes, but students will be allowed to prepare and use a single 5"×7" card with notes written on both sides, as insurance against "mental blanks". No computers or calculators of any kind will be permitted (rather, their use will be assessed through the project). Exams will not be explicitly cumulative in nature, although the nature of the material means that later problems will inevitably draw on mathematical issues covered earlier in the course. *All* electronic devices must be turned off and stored during exams, to avoid distracting others.

Calendar

A *tentative* schedule with topics is given below (subject to updating).

Date	Section(s)	Homework assignments
1/19	1.1,2	p.9 #11,19,28,36; p.17 #5,10,17,18,21,26,30
1/21	1.3	3,13,14,15,29,30
1/26	1.4	5,9,12,14,16,23,31,35,37,43,51,52,62
1/28	1.5	3,12,17,18,19,27,31,34,36
2/02	1.6	5,11,14,19,35,36,58,63,65
2/04	2.1	1,11,21,23,24,29,30
2/09	2.2	10,12,20,22,23,29
2/11	2.3,4,6	p.108 #10,19,24; p.121 #6,23,29; p.142 #6,23
2/16	**Exam 1**	
2/18	3.1	2,4,12,16,17,19,23,24,35,40,45
2/23	3.2	5,11,15,24,27,28,29,30,36,37
2/25	3.3	3,7,9,11,17,18,21,24,31,37,39,40,45
3/01	3.4	2,3,15,17,20
3/03	3.5	3,13,14,23,31,35,37,50,52,56
3/08	3.6	3,4,10,15,17
3/10	3.7;4.1,2	p.231 #1,2,15; p.255 #1,13,18; p.266 #6,8,9
(3/15,	3/17)	*spring break*
3/22	5.1	3,4,5,6,7,9,17,23,28,38,42
3/24	5.2	9,14,16,17,18,26,42,49
3/29	5.4	1,5,7,11,15,19,25,27,33
3/31	5.6	1,4,8,10,17,18,30
4/05	**Exam 2**	
4/07	6.1	3,5,7,8,14,16,17,20,24,28,30
4/12	6.2	1,4,7,10,11,19,25,28,31
4/14	6.3	1,3,7,10,11,12,13
4/19	7.1	2,3,8,10,11,13,20,25,28,32
4/21	7.2	1,3,10,16,17,20,21
4/26	7.3	4,6,15,21,30,34
4/28	8.1	2,6,8,14; *project rewrites due (optional)*
5/03	9.1	1,8,9,11,12,16,22
5/05		catch-up/review
5/12	**Exam 3**	

University Policies

Attendance: At The University of Texas at Arlington, taking attendance is not required. Rather, each faculty member is free to develop his or her own methods of evaluating students' academic performance, which includes establishing course-specific policies on attendance.

Drop Policy: Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance**. Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (http://wweb.uta.edu/ses/fao).

Americans with Disabilities Act: UT Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including the *Americans with Disabilities Act (ADA)*. All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Any student requiring an accommodation for this course must provide the instructor with official documentation in the form of a letter certified by the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability or by calling the Office for Students with Disabilities at (817)272-3364.

Title IX: The University of Texas at Arlington does not discriminate on the basis of race, color, national origin, religion, age, gender, sexual orientation, disabilities, genetic information, and/or veteran status in its educational programs or activities it operates. For more information, visit uta.edu/eos. For information regarding Title IX, visit www.uta.edu/titleIX.

Academic Integrity: Students enrolled in this course are expected to adhere to the UT Arlington Honor Code:

> *I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence. I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.*

UT Arlington faculty members may employ the Honor Code as they see fit in their courses, including (but not limited to) having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents' Rule* 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University. *Papers involving plagiarism will receive an indelible grade of zero.*

Electronic Communication: UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at http://www.uta.edu/oit/cs/email/mavmail.php.

To obtain your NetID or for logon assistance, visit https://webapps.uta.edu/oit/selfservice/. If you are unable to resolve your issue from the Self-Service website, contact the Helpdesk at helpdesk@uta.edu or (817)272-2208.

Student Feedback Survey: At the end of each term, students enrolled in classes categorized as lecture, seminar, or laboratory will be asked to complete an online Student Feedback Survey (SFS) about the course and how it was taught. Instructions on how to access the SFS system will be sent directly to students through MavMail approximately 10 days before the end of the term. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback data is required by state law; students are strongly urged to participate. www.uta.edu/sfs

Final Review Week: A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week *unless specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

Grade Grievances: Any appeal of a grade in this course must follow the procedures and deadlines for grade-related grievances as published in the current graduate catalog.

Emergency Exit Procedures: Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and make arrangements to assist individuals with disabilities.

Student Support Services: UTA provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to resources@uta.edu, or view the information at www.uta.edu/resources.

Emergency Phone Numbers: In case of an on-campus emergency, call the UTA Police Department at **817-272-3003**, or dial 911.