

Course Description : First order equations: modeling and population dynamics, stability, existence and uniqueness theorem for nonlinear equations, Euler's method. Second order equations: nonlinear equations via reductions methods, variation of parameters, forced mechanical vibrations, resonance and beat. Laplace Transform: general forcing functions, the convolution integral. Systems of ODEs: eigenvalues and phase plane analysis.

Prerequisites : Grade of C or better in MATH 2414 or its equivalent

Prepares for : MATH 4302, 4315

Text : No required text. Notes available online.

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<http://www.math.lamar.edu>

<http://tutorial.math.lamar.edu>

Office Hours : 12:45 – 2:30 Monday thru Thursday or by appointment.

Grading : Grades will come from the following sources in this class.

Written Homework : Homework will typically be due 1- 1½ weeks after I hand the set out. Each homework assignment will be typically worth a total of 10 points and only selected problems from each assignment will be graded. I will post complete solutions to the homework set shortly after I have graded the homework. Homework is due at the start of class (*i.e.* the moment that I walk into the classroom and start talking) on the day that it is due. Any homework handed in after this point is late and will not be accepted. I will drop your lowest homework score at the end of the semester. The total homework grade is **usually** worth about the same as one exam. **Homework assignments/solutions can be found at <http://www.math.lamar.edu>.**

Hour Exams : There will be four hour exams each worth 100 points. The material covered on each exam and tentative date for the exam is listed on the Syllabus for my notes. Because I'm fixing the material on each exam at this point scheduling will be very tentative at best. It is your responsibility to get to class and find out the actual date of the exam!

Comprehensive Final Exam : There will also be a comprehensive final exam worth 200 points. The final will be on Monday, December 11 from 8:00 AM --- 10:30 AM (provided I read the exam schedule right). At the end of the semester if you have gotten at least 90% of the total possible points (*i.e.* you have an A in the course) you will be exempt from taking the final. For ALL OTHERS the final exam is MANDATORY. The 90% is a hard cutoff point and will not be changed for any reason. Even an 89.9% will be required to take the final exam.

Lowest Test Score Replacement : After final exams are given I will replace your lowest test score with the percentage on your final exam provided it will help your grade. For example if your lowest grade is a 72 and you have a final exam score of 164 then I will replace the 72 with $164/200 (\times 100) = 82$. If on the other hand your final exam score is 128 I will not replace the 72 with your final exam percent ($128/200 (\times 100) = 64$) since it is lower than the 72.

Attendance : Attendance will be taken every day and will be used in any way I see fit in setting final grades.

Grading & Scale : I have a very simple grading scale. At the end of the semester I add up all the points that you have received and then divide that number by the total possible number of points. I then compare this percentage to the following scale and assign your grade. You should figure your grade after every exam so you know where you stand.

100% - 90% A, 89% - 80% B, 79% - 70% C, 69% - 60% D, 59% - 0% F

Makeup Exams : I do not give makeup exams. Because I replace your lowest test score with the final exam percentage if you miss **ONE** exam then that will be the exam that is replaced by the final exam percentage provided you notify me in writing no later than 3 days after the exam was given with the reason you missed the exam. If you miss two exams I will expect verifiable proof of very good reasons (my call on what is very good) for BOTH exams. If you provide such proof we will take care of the second missed exam at that point. To date no one has convinced me they had a good reason for missing two exams.

Lectures Session : This class meets three days a week. We will be lecturing each day.

Web Pages : The web page for this class can be accessed at <http://www.math.lamar.edu>. Click on the faculty link, my name, then the class link from the menu as the top of the page. On this page you will find things like exam dates, homework assignments, homework solutions and other handouts. Information put on this site is NOT official. If there is ever any discrepancy between the web site and anything announced in class, then follow what was announced in class! Notes for the class may be downloaded from <http://tutorial.math.lamar.edu>. Please note that the assignment problems on <http://tutorial.math.lamar.edu> are **NOT** your homework assignments. Those are for other purposes. **Your homework assignments/solutions are at <http://www.math.lamar.edu>.**

Learning Outcomes : Upon completion of the course, students will:

1. Identify homogeneous equations, homogeneous equations with constant coefficients, and exact and linear differential equations.
2. Solve ordinary differential equations and systems of equations using:
 - a) Direct integration
 - b) Separation of variables
 - c) Reduction of order
 - d) Methods of undetermined coefficients and variation of parameters
 - e) Series solutions
 - f) Operator methods for finding particular solutions
 - g) Laplace transform methods
3. Determine particular solutions to differential equations with given boundary conditions or initial conditions.
4. Analyze real-world problems in fields such as Biology, Chemistry, Economics, Engineering, and Physics, including problems related to population dynamics, mixtures, growth and decay, heating and cooling, electronic circuits, and Newtonian mechanics.
5. Sketch a direction field of first order differential equations and interpret solution behavior from the direction field;
6. Identify and classify equilibrium points/solutions for a differential equation;
7. Use numerical methods to approximate the solution to a differential equation;
8. Work basic modeling problems such as Population Dynamics, Falling Body, and Mixing Problems;
9. Find the Fundamental Set of Solutions for a differential equation;
10. Find and apply the Wronskian to a second order differential equation;
11. Apply the techniques used to solve second order differential equations to higher order differential equations;
12. Work with the Heaviside function in the transform and inverse transform process;
13. Work with the Dirac-Delta function in the transform and inverse transform process;
14. Work with convolution integrals in the transform and inverse transform process;
15. Sketch the phase portrait for a system of differential equations;
16. Solve a system of differential equations using eigenvalues and eigenvectors.

Dates To Know :

September 4 : Labor Day. No classes.

November 23 & 24 : Thanksgiving. No classes.

December 5 : Last day of classes.

Drop Dates : See Important Student Information handout for drop dates.

Disclaimer : While I have made a sincere effort to ensure that this syllabus is correct, changes may be required. I will announce any substantive changes during a regularly scheduled class. If you find an error or omission, please advise me at once so that the other members of the class may be advised.

Class Policies

I expect my students to work for and earn their grade. I will, to the best of my ability, give you the information that will allow you to pass the course. However, if you aren't willing to do the work that I ask you to do then you will find it very difficult to pass this course. None of the following policies are designed to hurt your grade or to discourage you in any way. They are designed to encourage you to put forth the effort that will be required of you in order to pass. If you are a responsible student and are willing to do the work in this class then you will not need to worry about these policies. If, however, you aren't willing or are unable to do the work in this class you need to be aware of these policies as they may affect your grade and/or chances of dropping the course.

Ignorance of these policies will not protect you from their consequences. They will be applied evenly to all students in the class.

Contesting Homework/Exam Grades

If you feel that I've made a mistake in grading a homework set or exam (which can happen) I will be more than willing to discuss it with you. However, in order for any corrections to be made you **MUST** contact me within 2 days (excluding Saturday and Sunday) of me handing the homework/exam back to the class. After this time I will not discuss any potential grading errors.

Attendance

I will take attendance at the beginning of each class by asking you to sign in on a "sign-in" sheet. If you walk into class after I've picked up the sign-in sheet you will not be allowed to sign it. In other words, the only students allowed to sign the sheet are those that are in the class when I pass it around. Attendance data will be used in assigning final grades in any way that I see fit.

Tardies

Tardiness is disruptive to all those around you as you walk in. I understand that emergencies or unforeseen circumstances will require you to be tardy once in a great while and I do not have a problem with that. I will not, however, tolerate tardiness on a continual basis whether by one person or many.

So, if I find that tardiness is becoming a problem I will, without warning, start taking points off for each tardy from that point on. The formula that I will use is $2^{n-1} - 1$ where n is the number of times you've been tardy.

I realize this is a silly looking and strange formula, but it is designed to not hurt you if you're tardy a couple of times, it will only hurt those that are continually tardy.

Homework

In pretty much every class of every semester I have a student or two who chooses to not do the homework. If you are one of those students who choose to not do the homework that is your choice. However, you need to be aware that your final grade will be based on your **OVERALL** percentage and that includes the homework. Failure to do homework will seriously affect your grade. If your exam average is a passing average, but your overall average drops below a passing percentage because of your homework grade then you will not pass my course.

I will **NOT** base your grade solely on exam percentages. This is not fair to all the students who diligently did the homework throughout the semester. I have never had a student who refused to do homework pass my class, I have however, had several students who did not pass solely because of their lack of homework!

Drops

In order to drop my class with a Q after the second drop date you **MUST** talk to me and get my permission. I will only give permission for drops if you have a C or better (according to the standard scale) at the point that

you talk to me.

In other words, if you know that you are going to drop the course take care of it right away and do not wait until the last possible time to ask for the drop. Any missed work will be figured into your grade and if it drops your grade below a C you will not be allowed to drop the course with a Q.

No drops are allowed after 4:00 P.M. on the last drop date except under extreme extenuating circumstances and must be approved by the instructor, department chair, college dean and provost (this is a University policy not mine!). Note as well that it will take a VERY extreme extenuating circumstance that I can independently verify in order for me to approve a late drop.

Incompletes

A grade of Incomplete will only be given in the case of a medical emergency that is fully documented and if the student is passing at the time of the emergency. In order to receive a grade of Incomplete you must make the request in writing and include a plan for completion of the course by the end of the next long semester, *i.e.* Fall/Spring semester, (as per University policy). If the course is not completed by the end of the next long semester the grade will automatically convert to an F (as per University policy).

Academic Dishonesty

I expect my students to behave in an ethical manner in this class. This falls into two categories.

Homework: I do not have a problem with students working in groups on my homework. In fact, I encourage students to work in groups on their homework. However, I do expect you to participate in the group and not just copy the homework from others in your group.

Exams : Cheating on exams however will not be tolerated. If you are caught cheating on an exam, depending on the offense, you will suffer anything from a zero on the exam to expulsion from the class with an F.

Syllabus for Paul Dawkins Math 3301

This is the order of topics that I hope to follow this semester. Time sometimes gets away from me in this course so I may have to change up this list a little bit in terms of both topics covered as well as order in which they are covered. I will always try to warn you of any changes in the schedule before they happen.

Topic

Basic Concepts

- Definitions
- Direction Fields

First Order Differential Equations

- Linear Differential Equations
- Separable Differential Equations
- Exact Differential Equations**
- Bernoulli Equations**
- Substitutions**
- Intervals of Validity
- Modeling With 1st Order Differential Equations
- Equilibrium Solutions
- Euler's Method

Exam 1 – Tentative Date : September 25, 2017

Second Order Differential Equations

Basic Concepts
Real, Distinct Roots
Complex Roots
Repeated Roots
Reduction of Order
Fundamental Sets of Solutions
More on the Wronskian
Nonhomogeneous Differential Equations
Undetermined Coefficients
Variation of Parameters
Mechanical Vibrations

Exam 2 – Tentative Date : October 16, 2017

Laplace Transforms

The Definition
Laplace Transforms
Inverse Laplace Transforms
Step Functions
Solving IVP's with Laplace Transforms
Nonconstant Coefficient IVP's*
IVP's with Step Functions
Dirac Delta Function
Convolution Integral

Exam 3 – Tentative Date : November 10, 2017

Systems of Differential Equations

Review : Systems of Equations
Review : Matrices and Vectors
Review : Eigenvalues and Eigenvectors
Systems of Differential Equations
Solutions to Systems
Phase Planes
Real, Distinct Eigenvalues
Complex Eigenvalues
Repeated Eigenvalues
Nonhomogeneous Systems **
Laplace Transforms**
Modeling

Exam 4 – Tentative Date : December 1, 2017

Series Solutions, Higher Order, Boundary Value Problems, Partial Differential Equations

These chapters are not covered in this course. They do present some interesting material however and I'd invite you to check them out.

* These sections are not on the syllabus and I cover them if I have the time.

** These sections are not on the syllabus and while I'd like to cover them never have the time.

Lamar University Department of Mathematics Important Information for Students

Lamar University expressly prohibits intimidation and harassment of students, faculty, staff, or applicants. <http://students.lamar.edu/academic-support/code-of-conduct.html>

Drop Policy: Please make note of the three dates indicated in this drop policy. Any drop will be your responsibility; I will not drop a student from the course.

September 13, 2017: (Census Date-Six Drop Rule does not apply) A student may drop or withdraw without consulting with the instructor. The Six Drop Rule does not apply to a drop before 5:00 PM.

September 29, 2017: (Six Drop Rule applies) A student may drop or withdraw from the course without academic penalty and receive a Q, however, the Six Drop Rule applies. The student will consult with the instructor and the Records Office to initiate a drop.

November 3, 2017: (Six Drop Rule applies) Last day to drop or withdraw with academic penalty; the student must be passing the course at the time of the requested drop in order to receive a Q. The drop form, including all required signatures, must arrive in the Records Office by no later than 4:00 PM. No drop is allowed after this date except in extreme extenuating circumstances. Any "late drop" must be approved by the instructor, department chair, college dean, and provost.

Academic Integrity: Students are expected to maintain complete honesty and integrity in their academic experiences both in and out of the classroom. Any student found guilty of dishonesty in any phase of academic work will be subject to disciplinary action. Students are specifically warned against all forms of cheating and plagiarism. The *Lamar University Student Handbook* clearly reads: "Any student found guilty of academic dishonesty in any phase of academic work will be subjected to disciplinary action. Punishable offenses include, but are not limited to, cheating on an examination or academic work which is to be submitted, plagiarism, collusion, and the abuse of source materials." One aspect of the *Handbook's* definition of cheating includes "purchasing or otherwise acquiring and submitting as one's own work any research paper or other writing assignment prepared by an individual or firm." Plagiarism is defined as "the appropriation and the unacknowledged incorporation of another's work or ideas into one's own and submitted for credit." Faculty members in the College of arts and Sciences investigate all cases of suspected plagiarism. Any student who is found cheating in this course will receive a course grade of F. <http://students.lamar.edu/student-handbook.html>

Accommodations: Lamar University is committed to providing equitable access to learning opportunities for all students. The Disability Resource Center (DRC) is located in the Communications building room 105. Office staff collaborate with students who have disabilities to provide and/or arrange reasonable accommodations. If you have, or think you may have, a disability (e.g., mental health, attentional, learning, chronic health, sensory, or physical), please contact the DRC at [409-880-8347](tel:409-880-8347) or drc@lamar.edu to arrange a confidential appointment with the Director of the DRC to explore possible options regarding equitable access and reasonable accommodations. If you are registered with DRC and have a current letter requesting

reasonable accommodations, we encourage you to contact your instructor early in the semester to review how the accommodations will be applied in the course.

<http://www.lamar.edu/disability-resource-center/>

Campus Closure: In the event of an announced campus closure in excess of four days due to a hurricane or other disaster, students are expected to login to Lamar University's website's homepage for instructions about continuing courses remotely. <http://lamar.edu>

Emergency Procedures: Many types of emergencies can occur on campus; instructions for severe weather or violence/active shooter, fire, or chemical release can be found at:

<http://www.lamar.edu/about-lu/administration/risk-management/index.html>

Following are procedures for the first two:

Severe Weather:

- Follow the directions of the instructor or emergency personnel.
- Seek shelter in an interior room or hallway on the lowest floor, putting as many walls as possible between you and the outside.
- If you are in a multi-story building, and you cannot get to the lowest floor, pick a hallway in the center of the building.
- Stay in the center of the room, away from exterior walls, windows, and doors.

Violence/Active Shooter:

- **CALL** - 8-3-1-1 from a campus phone (880-8311 from a cell phone). Note: Calling 9-1-1 from either a campus phone or cell phone will contact Beaumont City Police Dispatch rather than University Police.
- **AVOID**- If possible, self-evacuate to a safe area outside the building. Follow directions of police officers.
- **DENY**- Barricade the door with desks, chairs, bookcases or any other items. Move to a place inside the room where you are not visible. Turn off the lights and remain quiet. Remain there until told by police it is safe.
- **DEFEND**- Use chairs, desks, cell phones or whatever is immediately available to distract and/or defend yourself and others from attack.

Course Evaluations: You will have an opportunity to evaluate all aspects of this course in a formal process to be completed online near the end of the term. You will receive an email reminder through your LU account.