

Lamar University

Department of Mathematics

MATH 3301-05 Ordinary Differential Equations (3 hour course)
Fall 2017 Syllabus
TR 3:50 pm – 5:10 pm
Lucas 117

Instructor: Dr. J. W. Montgomery (a.k.a. Monty)
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Office Hours: TR 11:20-12:20 am and 2:30-3:30 pm.

Text: Elementary Differential Equations, 9th ed., Boyce and DiPrima
Prerequisites: Grade of C or better in MATH 2414 or its equivalent

Catalog 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. Prepares for: MATH 4302, 4315 Offered: Fall, Spring, Summer

MATH 3301 Learning Outcomes: Upon successful completion of this 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.

Lectures/Discussions: Class time, except for exam days, will be devoted to lectures (by the instructor) and, as appropriate, student presentation of problem solutions.

Lectures/Discussions/Classwork/Homework Topics:

<u>Lecture</u>	<u>SEC</u>	<u>TITLE</u>	<u>PAGE/PROBLEMS</u>
1	1.1	Basic Models/Direction Fields	7/1,2,12,14,20,23
2	1.3	Classification of Differential Equations	24/2,6,7,10,12
3	2.1	Linear Equations	39/1,7,15,20,21,22,25,26,28,29
4	2.2	Separable Equations	47/2,3,8,12,13,17,18,21,23,25,28
5	2.4	Linear & Nonlinear Eqs.	75/1,2,3,7,11,15,19
6	2.3	Modeling w/Linear Eqs.	59/2,3,4,5,6,8,13,15,21,22,24
7	2.5	Pop. Dynamics/Equilibrium Point	88/1,4,5,7,9,10,13,15,20,21
8	2.7	Euler's Method	109/1,2,4,11,12,13
9	3.1	Homogeneous Eqs. w/Constants	144/1,3,9,11,12,17,21-24,28

10	3.3	Complex Roots	163/1-6,9,10,12,17,18,24,26,29
11	3.4	Repeated Roots; Reduction	171/1,2,8,11,12,15,17,23,26
12	3.2	Linear Homogeneous Eqs.	155/1-4,8,10,12,13,14,15,17,21
13	3.5	Undetermined Coefficients	183/1,5,6,9,15,16,18,20,21,24
14	3.6	Variation of Parameters	189/1,5,7,8,15,16,18,22,23
15	3.7	Mech. & Electrical Vibrations	202/1-4,5,6,7,10,13,14,17,21
16	3.8	Forced Mech. Vibrations	215/1-8,12,19
17	6.1	Def. Laplace Transform	311/1,5,7-16,26
18	6.3	Step Functions	328/1,2,3,7-18,21,22,25,27
19	6.2	Initial Value Problems	320/1-10,11,13,15,21,22,25,28-34
20	6.4	Dif. Eqs. w/Forcing Functions	336/1,3,7,8,10,11,16
21	6.5	Impulse Functions	343/1,3,5,8,9,13,14
22	6.6	The Convolution Integral	350/3,4,10,13,14
23	7.1	Systems of Differential Equations	359/3,4,5,7,8
24	7.3	Eigenvalues and Eigenvectors	383/15,16,17,19,20,21
25	7.4	Basic Theory of Systems	389/2,3,4,6
		Homogeneous Linear Systems/Phase Plane	
26	7.5	Plane	398/1,2,6,7,15,16,24,25,26,27,29,31
27	7.6	Complex Eigenvalues/Phase Plane	410/1,3,5,9,10,11,13
28	7.8	Repeated Eigenvalues/Phase Plane	428/1,3,4,7,9

Grading Policies

The final grade is determined by weighting the aspects of the course as follows.

30% - A combination of homework, quizzes, and presentations

20% - Test 1

20% - Test 2

30% - Final Exam

Homework: Weekly homework assignments will be due each Thursday.

Quizzes: Quizzes will be given at the start of class on random days. Time allowed for the quizzes will vary depending on difficulty. No make-up quizzes will be offered. No extra time will be given for late arrivals.

Final Exam: Tuesday, December 12, 2017, 5:00 p.m. – 7:30 p.m.

Final Grade: $F < 60\% \leq D < 70\% \leq C < 80\% \leq B < 90\% \leq A$.

No extra credit will be given as the semester progresses.

Class Behavior: Students are expected to behave in a non-disruptive way in class. If a student is disrupting the learning environment, he or she will be asked to stop and/or to leave the class. Lamar University is a tobacco-free campus.

Cell Phone Policy: In order to limit classroom disruptions, as well as to protect against academic misconduct, the use of cell phones and other electronic communication devices is prohibited in the classroom. Students should be paying attention during class, and therefore all cell phones, pagers, and any other unnecessary technology, must be turned off or put in a silent (vibrate) mode and should not be taken out during class. Any student seen to be using technology inappropriately will be asked to stop.

Test Policy: The following rules are in effect on test day.

1. The student is allowed only pencils, erasers, and a calculator which is incapable of solving differential equations. All other property will be left at the front of the classroom.
2. If a student is found with any communication device, including a cell phone, at his or her seat then said student will receive a zero for the given test.
3. Once the first student has turned in the test, no late arrivals will be allowed to take the test.

Make-up Policy: No make-ups will be given. In the case of an excused absence, I will use the final exam grade as a grade replacement.

Additional Information: 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 us at once so that the other members of the class may be advised.

Lamar University
Department of Mathematics
Important Information for Students

Lamar University expressly prohibits intimidation and harassment of students, faculty, staff, or applicants. <http://dept.lamar.edu/studentaffairs/handbook.htm>

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 after 5:00 PM on February 4, 2015. 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://dept.lamar.edu/studentaffairs/handbook.htm>

Accommodations: It is the policy of Lamar University to accommodate students with disabilities, pursuant to federal and state law and to the University’s commitment to equal educational opportunities. Students with a documented disability should contact the Director of the Office of Services for Students with Disabilities (SFSWD) which is located in 105 Communication Building. Students may write to P.O. Box 10087, Beaumont, Texas 77710, call 409.880.8347, fax 409.880.2225 or e-mail SFSWD@lamar.edu. The Director will arrange to meet with the student to determine reasonable academic adjustments and/or accommodations. Additional information is available at <http://dept.lamar.edu/sfswd>.

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 (www.lamar.edu) for instructions about continuing courses remotely."

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.