

**College of Natural and Mathematical Sciences**

**MATH 310 – Differential Equations (3,0)**

**Prerequisites:** MATH 152 with a grade of C or better

**Fall 2014**

**3 Credits**

**Instructors:** George Voutsadakis  
CASET 206-E  
906-635-2667  
gvoutsad@lssu.edu

**Office Hours:**

Monday	Tuesday	Wednesday	Thursday	Friday
9:00 – 9:50	9:00 – 9:50	9:00 – 9:50	9:00 – 9:50	9:00 – 9:50

**Required Texts:** *Elementary Differential Equations*, William E. Boyce, Richard C. DiPrima, 10<sup>th</sup> Edition, John Wiley & Sons, 978-0-470-45832-7

Your textbooks are available at the campus bookstore. New, used, rental and digital are options for purchase depending on title. You may use cash, checks, debit and credit cards as forms of tender, including financial aid checks. In addition to in-store purchase, the bookstore also offers the convenience of ordering your textbooks 24/7 online through My.LSSU (Anchor Access) or at [www.lssu.bncollege.com](http://www.lssu.bncollege.com).

**Course Description:** This course covers first-order differential equations, second and higher order linear differential equations, the Laplace transform, systems of first order linear equations and applications of linear, ordinary differential equations in mathematics, science and engineering.

**Course Goals:** Our goal is to meet the course objectives.

**Course Objectives:** At the conclusion of MATH 310 students will be able to do the following:

1. *Differential Equations:* Describe the terminology related to differential equations and classify differential equations (partial/ordinary, linear/nonlinear, etc.).
2. *First-Order Differential Equations:* Classify first-order differential equations as linear, separable, homogeneous, autonomous and exact., solve initial-value problems involving first-order differential equations, investigate the existence and uniqueness of solutions, obtain mathematical models and their solutions for applications in mathematics, sciences and engineering using first-order differential equations.
3. *Second and Higher-Order Linear Differential Equations:* Solve homogeneous equations with constant coefficients, investigate the linear independence of solutions and apply the principle of superposition, solve non-homogeneous equations using the method of undetermined coefficients and variation of parameters, obtain mathematical models and their solutions for applications in mathematics, sciences and engineering using second-order linear differential equations.
4. *Laplace Transforms:* Obtain the Laplace Transform and the inverse Laplace Transform of functions using the definition or a table of Laplace Transforms, solve initial-value problems using the Laplace Transform, describe the unit step and unit impulse functions, solve initial-value problems with discontinuous forcing functions, use the convolution integral in mathematical modeling.
5. *Systems of First-Order Differential Equations:* Obtain mathematical models for applications in mathematics, sciences and engineering using systems of first-order linear differential equations, generate the phase portrait for a system of equations, solve homogeneous and non-homogeneous systems of equations with constant coefficients using linear algebra methods.

Grading Scale and Policies:

Percent Values:

Midterm Exams	50%
Final Exam	25%
Quizzes	25%

Grading Scale:

98-100	A+	71-75	C
93-97	A	66-70	C-
90-92	A-	61-65	D+
88-89	B+	56-60	D
83-87	B	50-55	D-
80-82	B-	0-49.9	F
76-79	C+		

Ground Rules:

- 1. Calculator:** The TI-83/84 Plus is the recommended calculator for this course. Your instructor deserves the right to require work on quizzes, exams etc., without the use of calculators. (See *School of Mathematics and Computer Science Policy Sheet*.) All other electronic devices, including computers, PDAs and cell phones, must be turned off for all class lecture sessions. All exceptions to this rule must have prior instructor approval.
- 2. Purpose of Lecture:** Lectures are an opportunity for students to ask questions and seek clarification on material. This implies student preparation has been accomplished prior to class. Lecture is also the opportunity for the instructor to coordinate coverage of the material and present material that is historically or potentially difficult. It does not negate student preparation or study. (See the Time Utilization section of the *School of Mathematics and Computer Science Policy Sheet*.)
- 3. Attendance Policy:** Attendance is not required. If you miss a class, or are late, you are still responsible for class notes and assignments. Attendance will indirectly affect your final grade, since experience shows that students attending tend to do better.
- 4. Make-up Policy:** Each exam should be taken at the designated time. Your instructor will be very strict in allowing make-up quizzes and exams **only with proper documentation of valid excuses**. Hospitalization of the student, death of a close relative and orders of a doctor would be considered valid excuses. Most other things would not.
- 5. Academic Integrity:** Students are expected to perform all assigned work themselves. Any form of cheating or plagiarism will be handled in accordance with the Academic Integrity Procedures from the Student Handbook. Violations of the *University Academic Integrity Policy* may result in an F for the course grade.
- 6. Testing:** Use of head phones, cell phones, notes and caps during exams is prohibited.
- 7. Equity:** It is important that all students are provided with a classroom atmosphere that fosters learning without fear of prejudice or bias. It is expected that you will treat yourself and your classmates with dignity and respect.

***University Policies and Statements:***

**The Americans with Disabilities Act & Accommodations**

In compliance with Lake Superior State University policies and equal access laws, disability-related accommodations or services are available to students with documented disabilities.

If you are a student with a disability and you think you may require accommodations you must register with Disability Services (DS), which is located in the KJS Library, Room 149, (906) 635-2355 or x2355 on campus. DS will provide you with a letter of confirmation of your verified disability and authorize recommended accommodations. This authorization must be presented to your instructor before any accommodations can be made.

Students who desire such services should meet with instructors in a timely manner, preferably during the first week of class, to discuss individual disability related needs. Any student who feels that an accommodation is needed – based on the impact of a disability – should meet with instructors privately to discuss specific needs.

**IPASS (Individual Plan for Academic Student Success)**

If at mid-term your grades reflect that you are at risk for failing some or all of your classes, you will be contacted by a representative of IPASS. The IPASS program is designed to help you gain control over your learning through pro-active communication and goal-setting, the development of intentional learning skills and study habits, and personal accountability. You may contact 635-2887 or email [ipass@lssu.edu](mailto:ipass@lssu.edu) if you would like to sign up early in the semester or if you have any questions or concerns.

**Non-Discrimination**

It is the policy of Lake Superior State University that no person shall be discriminated against, excluded from participation in, denied the benefits of, or otherwise be subjected to discrimination in employment, or in any program or activity for which the University is responsible on the basis of race, color, national origin or ancestry, sex, age, disability, sexual preference, religion, height, weight, marital status or veteran status.

For more information see the entire policy in the Student Handbook on the University website.

<http://www.lssu.edu/campuslife/handbook/>

**Academic Integrity**

Academic integrity is a key component of the core values of Lake Superior State University. All members of the University community are expected to be honorable and ethical and observe standards of conduct appropriate to a community of scholars. Students are expected to behave in an ethical manner. The University community will not tolerate academic dishonesty as such behavior will cause harm to the reputation of students, faculty, and graduates of the institution. Such dishonorable behavior includes, but is not limited to, cheating, fabrication, plagiarism, and obtaining an unfair advantage. For more information see the entire policy on the University website.

<http://www.lssu.edu/academics/pdfs/Academic%20Integrity%20Policy.pdf>

**Tentative Course Schedule**

Week	Dates	Monday	Wednesday	Friday
1	08/25	1.1	1.2	1.3
2	09/01	BREAK	2.1	2.2
3	09/08	2.2	2.3	2.3
4	09/15	2.4	2.5	Exam 1
5	09/22	2.6	3.1	3.2
6	09/29	3.4	3.5	3.6
7	10/06	3.7	3.7	Exam 2
8	10/13	3.8	4.1	4.2
9	10/20	4.3	6.1	6.2
10	10/27	6.2	6.3	6.4
11	11/03	6.5	6.6	Exam 3
12	11/10	7.1	7.2	7.3
13	11/17	7.4	7.5	7.6
14	11/24	Exam 4	BREAK	BREAK
15	12/01	7.8	7.9	Review

**Tentative Course Outline**

Lesson	Topic	Section	ASSIGNMENT
1	Introduction; Direction Fields	1.1	p7: 15-20, 22
2	Solutions of some DEs; Classification of DEs	1.2,1.3	p15: 1b, 7; p24: 1-4, 8, 11, 17, 20
3	1 <sup>st</sup> order linear equations	2.1	p39: 14, 16, 18, 20
4	Separable equations	2.2	p48: 1, 2, 7, 9, 15
5	Modeling with 1 <sup>st</sup> order equations	2.3	p60: 1, 3, 4, 16
6	Modeling with 1 <sup>st</sup> order equations	2.3	p60: 20, 21a, 22a
7	Differences Between Linear and Nonlinear Equations	2.4	p76: 1, 4, 7, 8
8	Autonomous equations	2.5	p88: 3, 9, 13, 22
9	Exact Equations	2.6	p101: 1, 4, 7, 13, 16
10	2 <sup>nd</sup> order homogeneous equations	3.1	p144: 1, 5, 6, 9, 15, 21
11	Fundamental solutions; the Wronskian	3.2	p155: 1, 2, 23, 24, 25
12	Complex roots of the characteristic equation	3.3	p164: 7, 11, 12, 17, 18
13	Repeated roots	3.4	p172: 1, 2, 4, 12, 16
14	Method of Undetermined Coefficients	3.5	p184: 1, 3, 4, 14, 19a, 20a, 21a
15	Variation of Parameters	3.6	p190: 1, 7, 15
16	Mechanical & Electrical Vibrations	3.7	p203: 6, 7, 11
17	(continued)	3.7	p203: 8, 12, 13
18	Forced Vibrations	3.8	p217: 5, 6, 9, 10
19	Higher order differential equations	4.1 - 4.3	p233: 11, 14, 18, 31; p239: 2, 11, 13, 14, 15
20	Definition of the Laplace Transform	6.1	p315: 5, 6, 7, 12
21	Inverse Laplace Transform	6.2	p324: 1, 4, 7, 8
22	Solution of Initial Value Problems	6.2	p324: 11, 13, 14, 21, 24
23	Step Functions	6.3	p333: 1, 2, 7, 8, 11, 14, 15
24	Diff. Eq. w/ Discontinuous Forcing Function	6.4	p340: 1, 4, 6, 9
25	Impulse Functions	6.5	p348: 2, 5, 14
26	The Convolution Integral; Transfer Function	6.6	p355: 4, 5, 8, 11, 13, 14
27	Systems of First Order Linear Equations	7.1	p363: 1, 3, 5, 18
28	Review of Matrices; Eigenvalues, Eigenvectors	7.2, 7.3	p376: 1, 22, 23; p388: 15, 16, 17, 19
29	Homogeneous Linear Systems	7.4, 7.5	p405: 1, 2, 15, 16
30	Complex Eigenvalues	7.6	p417: 1, 2, 9, 10
31	Repeated Eigenvalues	7.8	p436: 1, 3, 7, 8
32	Nonhomogeneous Linear Systems	7.9	p447: 1, 5, 7