MATH 35 Introduction to Linear Algebra

Course Code: MATH 200

Instructor: Professor Vadim Olshevsky

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Credit: 3

Course Description: This is a hybrid course that introduces basic concepts of linear algebra and differential equations. These two topics (put together) provide a very important toolkit for modeling real-world phenomena in science, engineering, business, etc. The course will cover linear algebra concepts such as vector spaces, linear dependence and independence, matrices, eigenvalues and eigenvectors, etc., and differential equation topics such as: uniqueness and existence of solutions to differential equations, first order equations, second order homogeneous and non-homogeneous equations, higher order equations, linear systems of differential equations, the heat equation and applications of differential equations.

Prerequisite: Calculus 2

Required Textbooks:

1) *Linear Algebra and Its Applications*, Fifth edition, by David C. Lay, Steven Lay, Judy McDonald Pearson, 2016.
Please do not buy this book before coming to class. The instructor will provide a direct link to the publisher's My Lab site, where you can get it with a discount as well as with an access to the online homework assignments.

2) Willian E. Boyce, Richard C. DiPrima: Elementary Differential Equations and Boundary ValueProblems, 11th edition, Wiley, 2018.

Please do not buy this book before coming to class. The instructor will provide a direct link to the publisher's WileyPlus site, where you can get it with a discount as well as with an access to the online homework assignments.

Course Objectives: The major objective of this course is to introduce students to the basic concepts of linear algebra, differential equations, and applications of differential equations. Students will be expected to understand the basic concepts of differential equations well enough to be able to decide when, how, and why to apply them to real-world phenomena and to be able to interpret and communicate the results. This course is designed to help students progress in developing analytical thinking, critical reasoning, problem-solving, and communication skills. The goal is to obtain a useful mastery of basic concepts and methods to fully understand and appreciate the theory and practice of differential equations. Additionally, the course is expected to prepare students for studies in other disciplines in the sciences, engineering, business, etc.

Homework: There will be online Pearson's My Lab and WileyPlus homework assignments for each section of the text. Each assignment will be made available on several days before the section is covered in class.

The due date for each assignment will be set by your instructor and will generally be two or three days after the material is covered in class. You will get five attempts for each question.

Course Schedule:

Week1 *Linear Algebra*: Introduction, linear systems, matrices, Gaussian elimination, reduced row echelon form, matrix operations, matrix inverses, determinants.

Week2 *Linear Algebra*: vector spaces, linear combinations, span and independence, subspaces, bases and dimension.

Week3 *Differential Equations*: Existence and uniqueness of solutions, first order linear, separable, exact, Bernoulli equations. Modeling with ordinary differential equations.

Week4 *Differential Equations*: Second order homogeneous and nonhomogeneous equations, mass-spring problem, and higher order equations. Laplace transforms and solutions of initial value problems. Power series solutions of differential equations.

Differential Equations: Systems of linear ordinary differential equations. Fourier series and introduction to partial differential equations (heat equation).

Detailed Course Outline:

Week	**Topic**
1	1.1 Systems of Linear Equations 1.2 Row Reduction and Echelon Forms
1	1.3 Vector Equations 1.4 The Matrix Equation Ax=b 1.5 Solution Sets of Linear Systems
1	1.7 Linear Independence 2.1 Matrix Operations 2.2 The inverse of a matrix
1	2.3 Characterizations of Invertible Matrices 2.5 Matrix Factorizations
2	2.9 Dimension and Rank 3.1 Introduction to Determinants 3.2 Properties of the determinants
2	3.3 Cramer's Rule 5.1 Eigenvalues and eigenvectors
2	5.2 The Characteristic Equation 5.3 Diagonalization
2	Exam 1
3	1.2 Solutions of some differential equations 1.3 Classification of some differential equations 2.1 Linear Equations. Integrating factors
3	2.2 Separable equations 2.4 Existence and uniqueness of solutions. Linear and nonlinear equations

3	2.8 Existence and Uniqueness 3.1 Homogeneous equations with constant coefficients 3.2 Complex roots of the characteristic 3.4 Repeated roots, reduction of order
3	3.5 Nonhomogeneous Equations. Method of undetermined coefficients 3.6 Variations of parameters
	4.1 Higher order differential equations
4	7.4 Systems of first order differential equations. 7.5 Homogeneous systems with constant coefficients.
4	7.7 Fundamental matrices 7.8 Repeated Eigenvalues 7.9 Nonhomogeneous linear systems
4	7.1 Laplace Transform 7.2 Solution to IVP
4	10.1 Partial differential equations 10.2 Fourier Series, Heat Equations Exam

Student responsibilities/expectations: The main course material will be presented through lectures.Students are advised to keep pace with the course material as it is being presented. Consequently, students should endeavor to attend class and discussion sessions, and spend sufficient time working on assigned homework problems. If for any reason a student misses a class, he/she should endeavor to obtain the notes and learn the missed material. Students should not hesitate to ask questions or seek additional assistance to ensure that they are staying on pace with the class.

Examinations: There will be two midterm exams plus one cumulative final exam. The exams will contain problems to solve and definitions, brief explanations of concepts, and simple proofs.

Grading Policy

Letter Grade Assignment

Final grades assigned for this course will be based on the percentage of total points earned and are assigned as follows:

Letter Grade	Percentage	Performance
A	93-100%	Excellent Work
A-	90-92%	Nearly Excellent Work
B+	87-89%	Very Good Work
B	83-86%	Good Work
B-	80-82%	Mostly Good Work
C+	77-79%	Above Average Work
C	73-76%	Average Work
C-	70-72%	Mostly Average Work
D+	67-69%	Below Average Work
D	60-66%	Poor Work
F	0-59%	Failing Work

Course Policies

Attend Class

Students are expected to attend all class sessions as listed on the course calendar.

Build Rapport

If you find that you have any trouble keeping up with assignments or other aspects of the course, make sure you let your instructor know as early as possible. As you will find, building rapport and effective relationships are key to becoming an effective professional. Make sure that you are proactive in informing your instructor when difficulties arise during the semester so that they can help you find a solution.

Understand When You May Drop This Course

It is the student's responsibility to understand when they need to consider disenrolling from a course. Refer to the Course Schedule for dates and deadlines for registration. After this period, a serious and compelling reason is required to drop from the course. Serious and compelling reasons includes: (1) documented and significant change in work hours, leaving

student unable to attend class, or (2) documented and severe physical/mental illness/injury to the student or student's family.

Commit to Integrity

As a student in this course (and at this university) you are expected to maintain high degrees of professionalism, commitment to active learning and participation in this class and also integrity in your behavior in and out of the classroom.

Academic Honesty Policy & Procedures

"The principles of truth and honesty are recognized as fundamental to a community of scholars and teachers. University expects that both faculty and students will honor these principles, and in so doing, will protect the integrity of academic work and student grades."

Definitions

"**Cheating** is the act of obtaining or attempting to obtain credit for academic work through the use of any dishonest, deceptive, or fraudulent means."

"Plagiarism is a form of cheating."

"Plagiarism is the use of distinctive ideas or works belonging to another person without providing adequate acknowledgement of that person's contribution."