Shanghai University of Finance & Economics

2020 Summer Program

MATH 200 Linear Algebra and Differential Equations

Course Outline

Term: June 01-July 03,2020

Course Code: MATH 200

Instructor: Professor Vadim Olshevsky

Home Institution: University of Connecticut

Office Hours: By Appointment

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Credit: 4

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.

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.

Prerequisite: Calculus 2

Two 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 Value Problems, 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.

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.

Grading & Evaluation

Attendance and participation:	10%
Homework:	30%
Midterm:	30%
Final:	30%

Grade	**Range**
A	90-100
B	80-89
C	70-79
D	60-69
F	0-59

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.

Week5 *Differential Equations*: Systems of linear ordinary differential equations. Fourier series and introduction to partial differential equations (heat equation).

Detailed Course Outline:

	Chapter	**Topic**
	1 Linear Algebra	1.1 Introduction 1.2 Linear systems 1.3 Matrices
1		1.3 Matrix operations 1.4 Gaussian elimination
		1.5 Reduced row echelon form 1.6 Matrix determinants and inverses
		1.7 Eigenvalues and eigenvectors
	2 Linear Algebra	2.1 Vector spaces 2.2 Linear combinations
2		2.3 Span 2.4 Linear independence
		2.5 Subspaces 2.6 Basis and dimension
		Exam 1
		3.1 Existence and uniqueness of solutions 3.2 First order linear and separable equations
3	3 First order ordinary differential equations	3.3 Exact and homogeneous first order equations
		3.4 Special integrating factor, substitutions and Bernoulli equations
		3.5 Modeling with first order differential equations
		4.1 Homogeneous equations 4.2 Non-homogeneous equations

4	4 Second and higher order ordinary differential equations	4.3 Mass-spring problem 4.4 Higher order equations
		4.5 Laplace transforms and solutions of IVPs 4.6 Power series solution on IVPs
		Exam 2
	5 Systems of linear differential equations	5.1 Systems of linear ordinary differential equations
5	6 Partial differential equations	6.1 Fourier series 6.2 Introduction to partial differential equations (heat equation)
		Final Exam
		Discussion of final exam

Student responsibilities/expectations: The main course material will be presented through lectures. A discussion session, to be held every Friday will offer an opportunity for students to discuss course material and assigned problems with a teaching assistant (TA). 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.