Shanghai University of Finance & Economics

2021 Summer Program

MATH 200 Linear Algebra and Differential Equations

Course Outline

Class Hours: 08:00-09:50 (Monday through Friday)

Course Code: MATH 200

Instructor: Dr. Calistus Ngonghala

Home Institution: University of Florida

Office Hours: TBA and by Appointment

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Credit: 4

Class Hours: This course will have 52 class hours, including 32 lecture hours, professor 8 office hours, 8-hour TA discussion sessions, 4-hour review sessions.

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.

Required Textbooks: Willian E. Boyce, Richard C. DiPrima: Elementary Differential Equations and Boundary Value Problems, 10th edition

David C. Lay: Linear Algebra and Its Applications, 3rd edition

Grading & Evaluation:
Attendance and participation: 10%
Homework and quizzes:　　20%
Midterm:　　　　　　　　30%
Final:　　　　　　　　　　40%
Total:　　　　　　　　　100%

Grading System (1 ~ 100)

A : 94 - 100　　A- : 90 – 93

B : 83 - 89　　B- : 80 – 82

C : 73 - 79　　C- : 70 – 72

D : 63 - 69　　D- : 60 – 62

F : Fail

Course Schedule
Week1 *Linear Algebra*: Introduction, linear systems, matrices, Gaussian elimination, reduced row echelon form, matrix operations, matrix inverses, determinants, vector spaces, linear combinations.
Week2 *Linear Algebra*: Span pan 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:

Week	Chapter		Topic
			1.1 Introduction
			1.2 Linear systems
			1.3 Matrices
1	1	Linear Algebra	1.4 Gaussian elimination
			1.5 Reduced row echelon form

		1.6 Matrix determinants and inverses 1.7 Eigenvalues and eigenvectors
		2.1 Vector spaces 2.2 Linear combinations
	1　Linear Algebra	2.3 Span 2.4 Linear independence
2		2.5 Subspaces 2.6 Basis and dimension
		Exam 1
	2　First order ordinary differential equations	3.1 Existence and uniqueness of solutions 3.2 First order linear and separable 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
3	2　Second and higher order ordinary differential equations	4.1 Homogeneous equations 4.2 Non-homogeneous 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
4	3　Systems of linear differential equations	5.1 Systems of linear ordinary differential equations
	4　Partial differential equations	6.1 Fourier series 6.2 Introduction to partial differential equations (heat equation)
		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 all class meetings and discussion sessions, be early for class, 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 before the next class meeting. Students should not hesitate to ask questions or seek additional assistance to ensure that they are staying on pace with the class. Students will be expected to come to class prepared and ready to participate actively. Please, turn off your cell phones and put aside any unrelated material before class begins. Students should exhibit a sense of responsibility and respect towards fellow students. Late-coming to class or early departure from class meetings will not be allowed.

Examinations: There will be two exams plus one cumulative final exam. Each exam will consist of a

multiple choice and a problem (free-response) section. The free-response problem section will contain problems to solve and definitions, brief explanations of concepts, and simple proofs.

Quizzes: Quizzes will be administered periodically throughout course period. Quizzes are meant to test the understanding of covered topics, and to give a benchmark prior to the exams.

Homework: The purpose of homework is to develop more skills in the material covered. It will be the student's responsibility to solve the assigned homework problems in a timely manner. Students who intend to do well in the course are advised to solve the homework problems. Students should feel free to approach the instructor with difficulties from homework problems. Problems in which students encounter difficulties may also be discussed in class.