Shanghai University of Finance & Economics

2019 Summer Program

MATH 200 Linear Algebra and Differential Equations

Course Outline

Term: June 3 – June 28, 2019

Class Hours: 14:00-15:50PM (Monday through Friday)

Course Code: MATH 200

Instructor: Anja Bankovic

Home Institution: Boston College

Office Hours: TBA and by appointment

Email: anja289@yahoo.com

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 lower division course in linear algebra and differential equations. Linear algebra is one of the fundamental tools in mathematics. The theory was first developed to study the systems of linear equations. The obtained tools ended up being useful in studying differential equations, operator theory, quantum mechanics, probability theory, combinatorics, and almost every other branch of mathematics, physics, and computer science.

Differential equations are equations involving functions and their derivatives. They appear frequently in physics, biology, and economics when complicated processes are approximated with mathematical models. We will learn how to solve first and second order differential equations, linear systems, and certain partial differential equations.

We will start with an introduction of vector spaces. Then we will introduce linear transformations, their matrices, and determinants. We will further study linear transformations and operators, their characteristic and minimal polynomials, spectral theorems, diagonal and Jordan forms. The course will then proceed to the study of differential equations. The course will finish with the study of quadratic forms, Hermitian spaces, and Hilbert spaces.

Required Textbooks:
David C. Lay: Linear Algebra and Its Applications, 3rd edition
Willian E. Boyce, Richard C. DiPrima: Elementary Differential Equations and Boundary Value Problems, 7th edition

Grading & Evaluation:
Quizzes: 30%
Midterm: 30%
Final: 40%

Course Schedule:

Week 1:
Session 1: Systems of Linear Equations; Row Reduction and Echelon Forms; Vector Equations
Session 2: The Matrix Equation; Solution Sets of Linear Systems; Linear Independence;
Session 3: Introduction to Linear Transformations; The Matrix of a Linear Transformation;
Session 4: Matrix Operations; The Inverse of a Matrix; Characterizations of Invertible Matrices;

Week 2:
Session 1: Introduction to Determinants; 3.2 Properties of Determinants; 3.3 Cramers Rule, Volume, and Linear Transformations;
Session 2: Vector Spaces and Subspaces; Null Spaces, Column Spaces, and Linear Transformations.
Session 3: Linearly Independent Sets; Bases; Coordinate Systems; The Dimension of a Vector Space;
Session 4: Rank; Change of Basis;

Week 3:
Session 1: Midterm.
Session 2: Eigenvectors and Eigenvalues; The Characteristic Equation; Diagonalization; Eigenvectors and Linear Transformations;
Session 3: Complex Eigenvalues; Applications to Differential Equations; Inner Product, Length, and Orthogonality; Orthogonal Sets; Orthogonal Projections;
Session 4: Direction Fields, First Order Differential Equations

Week 4:
Session 1: Second Order Linear Equations
Session 2: Systems of Linear Equations, Laplace Transformation
Session 3: Fourier Series; Review