Seoul Campus 02450 서울특별시 동대문구 이문로 107 tel 02.2173.2093 fax 02.960.7898
107, Imun-ro, Dongdaemun-gu, Seoul, 02450, Korea
Global Campus 17035 경기도 용인시 처인구 모현면 외대로 81 tel 031.330.4114 fax 031.333.1708
81, Oedae-ro, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do, 17035, Korea

Hankuk University of Foreign Studies

2023 Winter Session

MATH 200 Linear Algebra and Differential Equations

Course Outline

Course Code: MATH 200

Instructor: Professor Vadim Olshevsky

Home Institution: University of Connecticut

Office Hours: By Appointment

Email: olshevsky@gmail.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 hybrid course that introduces basic concepts of linear algebra and differential equations. These two topics (put together) provide a very important tool 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

Seoul Campus 02450 서울특별시 동대문구 이문로 107 tel 02.2173.2093 fax 02.960.7898
107, Imun-ro, Dongdaemun-gu, Seoul, 02450, Korea
Global Campus 17035 경기도 용인시 처인구 모현면 외대로 81 tel 031.330.4114 fax 031.333.1708
81, Oedae-ro, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do, 17035, Korea

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 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.

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%

Grading System (1 ~ 100)

Seoul Campus 02450 서울특별시 동대문구 이문로 107 tel 02.2173.2093 fax 02.960.7898
107, Imun-ro, Dongdaemun-gu, Seoul, 02450, Korea
Global Campus 17035 경기도 용인시 처인구 모현면 외대로 81 tel 031.330.4114 fax 031.333.1708
81, Oedae-ro, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do, 17035, Korea

The final score with be scaled and the scaled score with be used to assign a Course grade.

A+ : 96 - 100	A : 91 - 95
B+ : 86 - 90	B : 81 - 85
C+ : 76 - 80	C : 71 - 75
D+ : 66 - 70	D : 60 - 65
Pa : Pass	
Fa : Fail	

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).

Seoul Campus 02450 서울특별시 동대문구 이문로 107 tel 02.2173.2093 fax 02.960.7898
107, Imun-ro, Dongdaemun-gu, Seoul, 02450, Korea
Global Campus 17035 경기도 용인시 처인구 모현면 외대로 81 tel 031.330.4114 fax 031.333.1708
81, Oedae-ro, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do, 17035, Korea

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 2.8 Subspaces and bases
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 2.6 Exact equations and integrating factor
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

Seoul Campus 02450 서울특별시 동대문구 이문로 107 tel 02.2173.2093 fax 02.960.7898
107, Imun-ro, Dongdaemun-gu, Seoul, 02450, Korea
Global Campus 17035 경기도 용인시 처인구 모현면 외대로 81 tel 031.330.4114 fax 031.333.1708
81, Oedae-ro, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do, 17035, Korea

3	3.5 Nonhomogeneous Equations. Method of undetermined coefficients 3.6 Variations of parameters
3	4.1 Higher order differential equations
4	7.4 Systems of first order differential equations. 7.5 Homogeneous systems with constant coefficients. 7.6 Complex eigenvalues
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.