University of International Business and Economics
International Summer School

MAT 220 Linear Algebra and Differential Equations

Term: May 27– June 27, 2019
Instructor: Jingzhi Tie
Home Institution: University of Georgia
Email: jtie@uga.edu Wechat ID: jingzhitie
Class Hours: Monday through Thursday, 120 minutes each day
Office Hours: TBD
Discussion Session: 2 hours each week

Total Contact Hours: 66 contact hours (45 minutes each)
Credit: 4 units

Course Description:

We present core topics in elementary differential equations and related concepts and methods of elementary linear algebra, with emphasis on real-world applications: First-Order and Second Differential Equations; Exact and separable Equations; Mathematical Models and Numerical Methods; Linear Systems and Matrices; Vector Spaces; Higher-Order Linear Differential Equations. The course has a prerequisite of one year of calculus (differential and integral calculus in one variable)

The textbook is supplemented by various course material and video lectures by the author, described at his web page http://math.mit.edu/~gs/dela/
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Course Goals:

A student who satisfactorily completes this course will be able to:

- ✧ understand what a differential equation is, especially linear differential equations;
- ✧ understand how differential equations are used to model real life phenomena;
- ✧ relate the theory to graphical and numerical methods of solution;
- ✧ understand the basics of linear algebra;
- ✧ relate linear algebra to techniques for solving linear differential equations.

Required Textbook:

Gilbert Strang: *Differential Equations and Linear Algebra*, ISBN-10: 0980232791 ISBN-13: 978-0980232790.

Grading Policy:

Grading will be determined by a combination of class attendance and participation, and the results of your exams. Attendance and Participation 10%. Two Tests 50%. Final Exam 40%.

Grading Scale:
Assignments and examinations will be graded according to the following grade scale:

A	90-100	**C+**	72-74
A-	85-89	**C**	68-71
B+	82-84	**C-**	64-67
B	78-81	**D**	60-63
B-	75-77	**F**	below 60

Class Rules:
Students are expected to come to lecture having read the material assigned for the day, and prepared to engage in active discussion about those ideas.

Attendance Policy:
Summer school is very intense and to be successful, students need to attend every class. Occasionally, due to illness or other unavoidable circumstance, a student may need to miss a class. UIBE policy requires a medical certificate to be excused. Any unexcused absence may affect the student's grade. Moreover, UIBE policy is that a student who has more than 1/3 (6 times) of the class in unexcused absences will fail the course.

Course Schedule:

Week One:
Four Examples: Linear versus Nonlinear
The Calculus You Need . . .
The Exponentials e^t and e^{at}
Four Particular Solutions . .
Real and Complex Sinusoids
Models of Growth and Decay .
The Logistic Equation . . . . .
Separable Equations and Exact Equations

Week Two:
Second Derivatives in Science and Engineering
Key Facts About Complex Numbers
Constant Coefficients A, B, C.
Forced Oscillations and Exponential Response
Electrical Networks and Mechanical Systems
Solutions to Second Order Equations.
Laplace Transforms $Y(s)$ and F(s)
Nonlinear Equations $y' = f(t, y)$
Sources, Sinks, Saddles, and Spirals
Linearization and Stability in 2D and 3D .
The Basic Euler Methods
Midterm Examination 25%.

Week Three:
Two Pictures of Linear Equations
Solving Linear Equations by Elimination .

Matrix Multiplication.
Inverse Matrices
Symmetric Matrices and Orthogonal

Week Four:
Chapters Four and parts of Five.
The Column Space of a Matrix
The Nullspace of A: Solving Av = 0
The Complete Solution to Av = b.
Independence, Basis and Dimension
The Four Fundamental Subspaces
Graphs and Networks
Midterm Examination 25%.

Week Five:
Chapter Six.
Systems of linear differential equations.
Linear systems $y'=Ay$.
The exponential of a matrix.
Second order systems.
The Exponential of a Matrix
Final Examination 40%.