# University of International Business and Economics
## International Summer School

## MAT 220 Linear Algebra and Differential Equations

**Term:** July 2 – August 2, 2018
**Instructor:** Colin McLarty
**Home Institution: Case Western Reserve University**
**Email: colin.mclarty@case.edu**
**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) and will require use of a laptop computer.

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 20%.   In class short assignments 20%. Midterm Exam, 20%. 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:**
Chapter One.
First order differential equations.
Four examples, linear versus nonlinear, exponentials and sinusoids, the logistic equation, separable and exact equations.
Begin Chapter Two.
Examples of second order equations.

**Week Two:**
Chapter Two.
Second order differential equations.
Constant coefficients, forced oscillations and exponential response.
Electrical network and mechanical systems.
General results on solving second order equations.
Midterm Examination 20%.

**Week Three:**
Chapter Three.
Graphical and numerical solutions.
Nonlinear equations.
Sources, sinks, and saddles.
Linearization and stability.
Basic Euler Methods.
Begin Chapter Four.

**Week Four:**
Chapters Four and parts of Five.
Linear equations and vector spaces.
Solving linear equations by elimination.
Matrix multiplication and inverse.
Column and row space of a matrix, and null-space and image space of a linear transform.
Independence, basis, and dimension.
Introduction to eigenvalues of a matrix.

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