**East China Normal University**
**International Summer Session**

**MAT 21   Linear Algebra**

**Term: July 5th –August 8th, 2018**
**Instructor: Dr. Edward Butz**
**Home Institution: University of British Columbia**
**Office hours: TBD**
**Email:   edward.butz@ubc.ca**
**Teaching Assistant: TBD**

## *Course Description*

Systems of linear equations. Matrix algebra. Linear transformations, linear independence. Determinants. Eigenvalues and eigenvectors, diagonalization of symmetric matrices, solution of system of differential equations.   Column space, null space, vector space. Least Squares

## Course Overview

 An introduction to linear mathematics. Although the real world is decidedly non-linear, linear approximations to physical systems are remarkably insightful. This is, in large part, due to the fact that linear models can incorporate an arbitrarily large number of variables. Physical systems typically have many variables.

## Course Goals:

A student who satisfactorily completes this course should

1. Solve systems of linear elimination by row reduction techniques
2. Understand vector and matrix operations
3. Evaluate transpose, inverse, and determinant of a matrix
4. Understand vector spaces, linear combinations, linear independence
5. Understand spanning, basis
6. Solve an eigenvalue problem
7. Understand diagonalization of matrices
8. Solve systems of linear ordinary differential equations
9. Solve least squares problem from matrix perspective

## *Required Text*

Linear Algebra and Its Applications (5th Edition)

By David C. Lay, Steven R. Lay, Judi McDonald

 **Publisher:** Pearson; 5 edition (Dec 24 2014)

- **ISBN-10:** 032198238X
- **ISBN-13:** 978-0321982384

   Note: [The 4th edition of Lay text is also acceptable]

## *Course Hours*

The course has 25 class sessions in total. Each class session is 110 minutes in length, for a total of 2750 minutes of in-class time. The course meets from Monday to Friday from July 5 to August 8. ECNU awards 4 credits for this course. Different universities may count course credits differently. Consult officials at your own home institution.

## *Attendance*

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.  ECNU policy requires a medical certificate to be excused. Any absence may impact on the student's grade. Moreover, **ECNU policy is that a student who has more than 3 absences will fail the course. Arriving late or leaving early will count as a partial absence.**

## *Grading Policy*

 In this course, grading will be based on the following:

**Mid-Term Test     25%**
**Assignments      25%**
**Final Exam       50%**

| Percentage  Interval | Letter Grade |
|---|---|
| [90,100] | A |
| [85, 89] | A- |
| [80,84] | B+ |
| [75,79] | B |

| [70,74] | B- |
| [65,69] | C+ |
| [60,64] | C |
| [50,59] | D |
| Below 50 | F |

## *General expectations:* ⌈SEP⌉

Students are expected to :

- Attend all classes and be responsible for all material covered in class and otherwise assigned. Any unexcused absence may impact a student's grade. Moreover,  ECNU policy is that a student who has more than $3$ absences will fail the course. Arriving late or leaving early will count as a partial absence.

- Participate in class discussions and complete required written work on time.
- Refrain from texting, phoning or engaging in computer activities unrelated to class

  during class  Students who do not do this will be asked to leave the class

While class participation is welcome, even required, you are expected to refrain from private conversations during the class period.

## *Course Schedules*

The planned schedule sketched out below may be modified to suit the interests or abilities of the enrolled students or to take advantage of special opportunities or events that may arise during the term.

**WEEK ONE   July5,6**
Thurs   Systems of Linear Equations,  Row Reduction & Echelon Forms
Fri       Vector Equations, The Matrix Equation Ax = b

**WEEK TWO**
Mon     Solution Sets of Linear Systems
Tues    Linear Independence
Wed     Linear Transformations: The Matrix of a Linear Transformation
Thurs  Matrix Operations, The Inverse of a Matrix
Fri       Characterizations of Invertible Matrices

**WEEK THREE**
Mon    Partitioned Matrices
Tues   Matrix Factorizations
Wed    Review
Thurs  **Mid-Term Test  25%**
 Fri       Subspaces of $R^n$,  Dimension and Rank

**WEEK FOUR**

Mon    Determinants
Tues    Vector Spaces and Subspaces
Wed    Null Spaces, Column Spaces, and Linear Transformations
Thurs   Eigenvectors and Eigenvalues,  The Characteristic Equation
Fri    Diagonalization

**WEEK FIVE**
Mon    Complex Eigenvalues
Tues    Applications to Differential Equations
Wed    Inner Product, Length, and Orthogonality
Thurs   Orthogonal Sets
Fri    Orthogonal Projections


**WEEK SIX    Aug 6,7,8**
Mon    The Gram—Schmidt Process
Tues    Least-Squares Problems
 Wed   **Final Examination   50%**


## *Academic Honesty*

 Students are expected to maintain high standards of academic honesty. Specifically, unless otherwise directed by the professor, students may not consult other students, books, notes, electronic devices or any other source, on examinations. Failure to abide by this may result in a zero on the examination, or even failure in the course.