MATH 3685: Introduction to Applied Linear Algebra

2021 Winter Session	
Total Class Sessions: 25	**Instructor: Staff**
Class Sessions Per Week: 6	**Classroom: TBA**
Total Weeks: 4	**Office Hours: TBA**
Class Session Length (Minutes): 145	**Language: English**
Credit Hours: 4	

Course Description:

The goal of this course is providing students with enough linear algebra knowledge for understanding of models, methods and theory and applying to different forms of optimization. Topics covered include: vectors and matrix, eigenvalues and diagonalization, dynamical systems, equilibrium points and their solutions, linear programming, graphs and simplex method, orthogonal projections, quadratic function optimization, least squares, SVD and PCA.

Course Materials:

Textbook:

Linear Algebra and Its Applications, 5th Edition
Author(s): David C. Lay, Steven R. Lay, Judi J. McDonald
Introduction to Linear Optimization, 1997
Author(s): Dimitris Bertsimas, John N. Tsitsiklis

Course Format and Requirements:

This course has 25 class sessions in total. Each class session is 145 minutes in length. Pre-reading the relevant chapter and attempting the assigned homework problems prior to each class is strongly recommended. Familiarizing with the course material before class, you will gain a better understanding of the information presented during the class. Students are strongly encouraged to ask questions on things they do not understand. Main learning points will be highlighted from the relevant textbook chapters.

Attendance

Students are expected to attend and participate in class. Strong attendance and participation are good indicators of success. Each student is responsible for all course material, announcements, quizzes and exams made in class, whether or not the student attended that day's class.

Course Assignments and Assessment:

Quizzes:

There will be 6 unannounced quizzes. Each student will be allowed to drop one and only one quiz grade, which may be a missed quiz or the lowest quiz grade. These quizzes will be designed based on materials covered in lectures, classroom discussions, and homework.

Homework:

There will be 5 homework assignments based on the material presented in the lectures. Practice through homework problems is an important part of the course. Discussion of homework problems with your classmates is encouraged, but all assignments must be completed individually. Late homework will receive a maximum of 60% of its grade.

Exams:

The exams will be closed book and closed notes. There will be two midterms and one cumulated final exam. Each exam will take 2 hours. A non-programmable calculator and one A4-sized page of formula sheet can be used during the exam.

Homework	10%
Quizzes	15%
Midterm Exam 1	20%
Midterm Exam 2	20%
Final Exam	35%
Total	**100%**

Grading Scale (percentage):

A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
98-100	**93-97**	**90-92**	**88-89**	**83-87**	**80-82**	**78-79**	**73-77**	**70-72**	**68-69**	**63-67**	**60-62**	**<60**

Academic Integrity:

Students are encouraged to study together, and to discuss lecture topics with one another, but all other work should be completed independently.

Students are expected to adhere to the standards of academic honesty and integrity that are described in the Chengdu University of Technology's *Academic Conduct Code.* Any work suspected of violating the standards of the *Academic Conduct Code* will be reported to the Dean's Office. Penalties for violating the *Academic Conduct Code* may include dismissal from the program. All students have an individual responsibility to know and understand the provisions of the *Academic Conduct Code*.

Special Needs or Assistance:

Please contact the Administrative Office immediately if you have a learning disability, a medical issue, or any other type of problem that prevents professors from seeing you have learned the course material. Our goal is to help you learn, not to penalize you for issues which mask your learning.

Course Schedule:

Week	Topics	Activities
1	Matrix Operations Vectors in R^n, Linear Combinations of vectors, Span of a set of vectors, Vector Space and subspaces Transformation matrix: Rotation, scaling, shear, reflection, projection Rotation in space, Projection in space Eigenvector and eigenvalue, Characteristic equation Diagonalization	Quiz 1 Homework
2	Solution of linear dynamical systems Stable equilibrium and unstable equilibrium, Real Eigenvalues, Complex eigenvalues Markov chain Recurrence Linear programming: general forms LP formulations	Quizzes 2 & 3 Homework Midterm Exam 1
3	Vertices of graphical solutions of LP Feasible region of LP Simplex method Simplex method: optimality conditions Computational efficiency Duality Dual theorem, marginal cost, dual simplex method Sensitivity analysis	Quizzes 4 & 5 Homework Midterm Exam 2

4	Orthogonal Vectors, Orthogonal sets, Orthogonal Projections Gram-Schmidt Process: Form an orthogonal basis for a subspace Least Square Approximations Quadratic optimization Singular-value decomposition Principal component analysis(PCA), iterative computation	Quiz 6 Homework Final Exam