Drexel University
Office of the Dean of the College of Engineering

ENGR 231 – Linear Engineering Systems

Fall 2020 - 2021 Course Syllabus

1. Course Overview

Provides an overview of systems and modeling; specifically using linear algebra as the model. Specific emphasis will be placed on developing models of engineering systems and the use of computational tools for solutions of the problems. The focus of the lab will be the use of MATLAB for solution of contemporary engineering problems.

2. Course Objectives

Develop an understanding of the principles of linear engineered systems and create models that describes their state. Develop the ability to analyze problems related to these systems in a systematic and logical manner as a motivation for the need for linear algebra. Develop models of engineering systems based on systems of linear equations. Evaluate engineering systems with analytical and computational tools. Introduce basic MATLAB programming for solving systems of linear equations represented by matrix equations and vector equations.

3. Staff

Lecturer: Dr. Michael Ryan

Zoom Office Hours: Monday 2:00 – 3:00 pm – by appointment, otherwise flexible upon email request

Email: mor23@drexel.edu

Teaching Assistant:

The TAs who are responsible for each section are listed below. They are the primary point of contact for and has the responsibilities of the assigned sections which is comprised of the recitations and labs.

Name	Email	Sections	Office Hours	Room
Reza Kheirollahi	rk887@drexel.edu	60,61	TBD	Zoom
Kai Wei	kw588@drexel.edu	62,62	TBD	Zoom
Yao Wang	yw696@drexel.edu	64,65	TBD	Zoom

4. Textbooks and Course Material

Required Texts: **Purchase by logging into the course via Drexel Learn under the "Pearson MyLab Math" section**

[1] David C. Lay, Steven R. Lay, Judi J. McDonald - Linear Algebra and Its Applications Plus New MyMathLab with Pearson E-text -- Access Card Package (6th Edition) **ISBN-13: 9780135851159**

Supplementary material

[2] Handouts posted to Drexel Learn.

Optional Texts:

[3] J. Farlow, J. Hall, J. McDill and B. West - Differential Equations and Linear Algebra (2nd Edition)

5. COE ACE Tutoring:

Zoom Meetings (by appointment)

https://drexel.edu/engineering/academics/student-advising-support/current-students/academic-center-for-engineers/courses/

6. Grading and Assessment Breakdown

Weekly Online Tests	10%	(Thursday 11:59pm – Saturday 11:59pm)
Written Quizzes	10%	**Show all work** - (Thursday, Weeks 3, 5, 9)
Homework	10%	(pre-assignments before lectures)
In-Class Activities	5%	
In-Lab Activities	2%	
Recitation and Labs	13%	(by end of next day, 11:59pm - 100%; additional 24 hr - 80%)
Midterm Exam	15%	**Show all work** (Week 6 - cumulative)
MATLAB Exam	10%	(Week 11 - cumulative)
Final Exam	25%	**Show all work** (Week 12 – Finals Week - cumulative)

7. Attendance Policy

Attendance to **BOTH** the weekly lectures and recitations/labs is mandatory and will be checked using graded in-class/lab activities. Unexcused absenteeism will be penalized with 0-points assigned to missed in-class/lab activities. Absence from lecture/lab will be excused only with proper notification no later than 1 week in advance. Emergency situations will require valid documentation for verification, such as a doctor's note. Students may only attend the weekly recitation of the section they are enrolled in. Any student missing his/her recitation section may attend another section with explicit permission from Dr. Ryan at least 1 week in advance. See academic policy at: http://www.drexel.edu/provost/policyweb/absence.html.

8. Students with Disabilities

Drexel University provides, upon request, appropriate accommodations for qualified students with disabilities. Any student with a documented disability who requires academic accommodations should contact the Office of Disability Services as soon as possible. If you require accommodations for exams, please communicate with me about this at least 1-week prior to the exam.

9. Drop Policy

Students may drop the course at any point prior to the end of week 1. Students have until the end of week 7, to withdraw from the course. (Please confirm that these dates are correct.)

10. Course Structure

Weekly Meeting Times:	Lecture - Section A:	Monday and Wednesday 3:00 – 3:50 pm
	Lecture - Section B:	Monday and Wednesday 4:00 – 4:50 pm
	Zoom Room:	Links will be posted on BbLearn
Recitation and Lab:	One 2-hour combined recitation and laboratory section per week	
	Zoom Room:	Links will be posted on BbLearn
Quizzes and Midterm:	Thursdays 8:00 – 8:50 am (Week 3, 5, 6, 9)	
Final Exams:	Final Week (Week 12 - Time: TBD)	

11. Presentation Technique:

Lecture material will be presented via PowerPoint multimedia. Information on PowerPoint slides for some lectures may have missing sections and will be handwritten in so students are required to take notes.

Each student will be mandated to attend the lectures and recitation/lab sessions per week. Online tests will be scheduled weekly. Written (show all work) quizzes will be administered during the common exam hour of EXAM 081 on Thursday mornings 8:00 – 8:50 am based on schedule above. Recitations will also be held on a weekly basis and will be the first hour of the assigned sections and is dedicated to problem solving based on lecture material. The second hour of the assigned sections will be labs used for MATLAB exercises. Week 6 will be a Midterm exam that is based on all the material covered up to that point. A MATLAB exam will be given in week 11 and will be cumulative. The final exam will be cumulative and given in week 12, finals week, of the term. See General Course Policies for more details.

12. General Course Policies

i. All academic policies found at http://www.drexel.edu/provost/policies/ will be strictly followed. Please pay particular attention to the Academic Integrity section of the Student Handbook.

ii. Drexel Learn will be used for course communications, material distribution, and grade distribution. Please check your grades often and carefully. If you want to dispute any grade, it MUST be done within one week after the return of the homework or exam.
    a. Statute of Limitations: After the one week, no grade changes will be made. See your teaching assistant for grade changes.

iii. The overall grade will be a weighted sum of the Grading and Assessment Breakdown components listed above. Final grade cutoffs will be determined based on the course-wide grade distribution.

iv. In advance of lectures, student will be required to read the lecture slides and/or specified sections of the textbook and practice these topics via their study plan, complete homeworks and/or tests deliverables on these topics.

v. Lectures will be conducted using an active learning pedagogy using a mix of individual and group in-class activities/assignments, delivered principally using tools like Catalytics, etc. Presentations will be used primarily to address problem areas.

vi. Homework will be assigned weekly mostly via the MyLab Math portal and will be based on required advanced readings of the textbook before lectures. If homework exercises are assigned outside of the MyLab Math portal, solutions to these will be posted to Drexel Learn after student's submission.

vii. Weekly online tests will be assigned via the MyLab Math portal. These tests will contain problems similar to those assigned in that week's pre-lecture homework assignments.

viii. Written quizzes will be conducted weeks 3, 5, 9 of the term during the common exam period. These quizzes will test material covered from the week of the previous written quiz/midterm up to that week of that quiz.

ix. The midterm and final exams will be of the written format and will test on all cumulative work to that point.

x. There will be no make-up exams/quizzes/tests unless arrangements are made at least one week in advance of the exam/quiz date, or because of documented emergencies. A valid excuse must be presented.

xi. Labs will be due by the end of the next day (11:59 PM) of that lab session for full grades. An additional 24 hr. will be allowed for late submission for a maximum 80% credit.

xii. Any additional information required for the weekly recitation assignments and labs will be posted on Drexel Learn. It is the student's responsibility to ensure that they have read and understood the lab guidelines before coming to recitation that week.

13. Topical Course Outline

Appropriate sections of the textbook along with class notes will be distributed weekly or announced in lecture.

Week	Topics and Book Sections	Text Sections	Lab Coverage
1	Introduction to linear and dynamic systems and models. Systems of linear equations, existence and uniqueness, Row reduction and echelon forms, pivots, solutions (unique, non-unique, none).	1.1 – 1.2	MATLAB review
2	Vectors, linear combinations, span, vector equations, geometric interpretation, Matrix equations. Homogeneous linear systems, parametric vector form, Linear models such as: stoichiometry, mixing problem, traffic problem.	1.3 – 1.6 1.10	Systems of linear equations - intro
3	Linear dependence or independence, Introduction to linear transformations **Written Quiz 1**	1.7 – 1.9	Systems of linear equations – more complex
4	Matrix operations, The matrix inverse and its properties, Partitioned Matrices, Matrix Factorizations	2.1 – 2.5	Matrix Inverse
5	Application to computer graphics Introduction to span and vector spaces, Dimensionality and rank, Determinants, Cramer's rule **Written Quiz 2**	2.7 – 3.3	
6	Span, vector spaces, vector subspaces, Null space, Column space, Basis, Coordinate System, **MIDTERM Exam**	4.1 – 4.4	Intro to homogenous coordinates
7	Dimension of vector space, Rank, Row space, Change of basis	4.5 – 4.7	Transformation applications
8	Introduction to Eigenvector and eigenvalues, Characteristic equation, Diagonalization, Complex eigenvalues **Written Quiz 3**	5.1 – 5.3 5.5	Linear curve fitting
9	Dot products or inner products and orthogonality, Orthogonal set Orthogonal projections	6.1 – 6.3 6.7	Polynomial curve fitting
10	Orthogonal basis, Approximation theorem, Least squares Thanksgiving Holidays	6.4 – 6.5	
11	Linear and polynomial curve fitting	6.6	**MATLAB Exam**
12	**FINAL Exam**		

Note: You are required to read the text sections listed above and practice same in your study plan in advance of the lectures of weeks listed. HW will be assigned based on your advance readings. The syllabus sequence may also be modified depending on logistics.

Date modified: 09/13/2020