Drexel University
Office of the Dean of the College of Engineering
ENGR 232 – Dynamic Engineering Systems
Spring 2020 Course Syllabus

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1. Course Overview

> **Alert:** Monday, April 6: Classes Begin

Provides an overview of dynamic systems and modeling; specifically using differential equations 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. Laplace transforms will be introduced as a means to study systems and solutions to differential equations. Basic control laws will also be introduced.

> **Alert:** Friday April 10 is the last day to secure a closed section override.

2. Course Objectives

Develop an understanding of the principles of dynamic engineered systems and create models that describe their state. Develop the ability to analyze problems related to these systems in a systematic and logical manner. Utilize different calculus applications in describing and solving dynamic system problems.

> **Alert:** Friday April 10 is the last day to Add/Drop a course with Academic Advisor assistance.

3. Staff

Lecturer: Dr. Robin Carr

Office Hours Saturday: 6PM via email and Zoom if requested. Emails welcome 24/7.

Email: DoctorRobinCarr@gmail.com   **Drexel Email**: rrc24@drexel.edu

Teaching Assistant:

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

Attendance will be taken during each recitation/lab and each Monday lecture via the chat in Zoom or via registration for the Zoom session.

Name	Email	Section	Time	Room
Zhuo Wang	**zw383@drexel.edu**	**60**	Tuesday 6:00-7:50PM	**ZOOM Room**
Zhuo Wang	**zw383@drexel.edu**	**62**	Wednesday 6:00-7:50PM	**ZOOM Room**

TA Office Hours:
Wednesday at 5PM
Available by email and ready to launch Zoom if requested.

> **Alert:** Friday May 22 is the last day to Withdraw from a course with Academic Advisor assistance.

> **Alert:** Monday May 25th is a University Holiday. (Memorial Day)

Invitations to Zoom Meetings will be posted in several ways including emails, notification from BBLearn and as links on our BBLearn course site.

> Monday June 8th. Term EXAMS begin.

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4. Textbooks and Course Material

Required Text: Purchase by logging into the course via Drexel Learn under the "Pearson MyLab Math" section [1] R. Kent Nagle; Edward Saff; David Snider - MyMathLab with Pearson EText -- Access Card Package -- for **Fundamentals of Differential Equations and Boundary Value Problems** (7th Edition) ISBN: 978-0-13-476477-1

Title	**MyMathLab with Pearson EText -- Standalone Access Card -- for Fundamentals of Differential Equations and Boundary Value Problems**
Author	R. Kent Nagle; Edward Saff; David Snider
ISBN	978-0-13-476477-1
Publisher	Pearson Education
Publication Date	May 9, 2017
Binding	Mixed Media; Online Resource; Online Resource
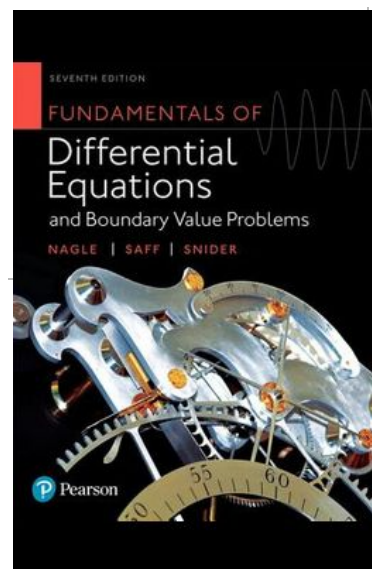
Purchase Options

You will need to purchase access to a **MyLab Math** version of this textbook. **To purchase, log into Pearson via the "Pearson MyLab Math" content area of this course's Drexel Learn portal (to your left).** This will ensure that you have the correct version, and in most cases, a discounted price will be offered compared to external sources. Descriptions of different versions of the textbook are shown below.

I believe you will be offered an 18-week student access for MyLab Math with eText for Nagle/Saff/Snider, Fundamentals of Differential Equations and Boundary Problems for around $69.99

An alternative 24-month deal costs about $104.99
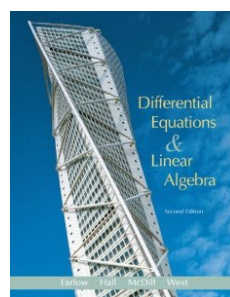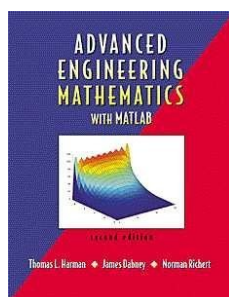
Supplementary material:
Additional material will be posted on BBLearn. For example:
  IEEE Booklet on Introduction to MATLAB (versions 1 and 2). This handout will be posted to Drexel Learn.

Optional Texts:

J. Farlow, J. Hall, J. McDill and B. West - Differential Equations and Linear Algebra (2nd Edition)
We will have a few at the library for reference.

5. Grading and Assessment Breakdown

Component	Percentage Weight
Attendance/Activities	5
Homework	10
Recitation and Labs	20
Online Quizzes	15
Midterm	15
MATLAB EXAM	10
FINAL EXAM	25

6. Attendance Policy

"**Virtual attendance**" at **BOTH** the weekly lectures and recitations/labs is mandatory and will be verified either by each student posting a comment in the Chat Window, or by registering for the Zoom meeting.

Absence from lecture 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 the recitation instructor at least 1 week in advance. Unexcused absenteeism may decrease your points under Attendance.

7. Course Structure

Weekly Meeting Time: Lecture - Section A: **Monday** 6:00 pm – 7:50 pm

                                     Room: Dr. Carr's ZOOM ROOM

Recitation and Lab: One 2-hour recitation and laboratory section per week

                                Section 60: Tuesday   **6:00 pm – 7:50 pm in Zhuo's ZOOM ROOM**

                                Section 62: Wednesday 6:00 pm – 7:50 pm in Zhuo's ZOOM ROOM

Final Exam: **Monday June 8th at 6PM. Exam will be administered online.**

COE ACE Tutoring:

ACE has gone Virtual!

- ACE is running
- All tutoring is being done virtually
- Sessions are by appointment-only (no walk-in hours)
- Tutors will be in touch once an appointment is made to inform the student about the method of communication (mostly Zoom but sometimes something else, particularly if a whiteboard is necessary)
- We are starting in Week 1, rather than our usual Week 2

Click on the link below for more information on the courses covered and how to make an appointment:

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

Drexel has moved all operations online in response to COVID-19. Please specify when making your appointment which contact method you'd prefer: phone or Zoom. Thank you!

Presentation Technique:

Lecture material will be presented via PowerPoint multimedia. Information on PowerPoint slides for some lectures will be hand written in so students are required to take notes. PDFs and animations may also be used.

Each student will be mandated to "virtually attend" the lectures and recitation/lab sessions each week. Multiple Online quizzes will be administered. These quizzes will test material covered that and up to the week of the previous quiz/midterm. 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 used for MATLAB exercises. Week 6 will be a midterm exam based on all the material covered up to that point. A MATLAB exam will be given during your last lab/recitation and will be cumulative. The final exam will be cumulative and given in finals week.

8. **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 Dishonesty 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 recitation instructor or teaching assistant for grade changes.

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

   iv.   There will be no make-up exams/quizzes 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 to an instructor.

   v.   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.

   vi.   Lectures will be conducted via ZOOM and notes will be posted in advance of each lecture.

   vii.   Labs will be due on **Friday** by 11:59pm for full grades. Late submission of labs will be allowed up to an additional 24 hours by 11:59 PM Saturday but with a small LATE-penalty.

   viii. 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 all the posted lab material.

8. Topical Course Outline: See lecture notes for reading assignments.
  Appropriate sections of the textbook along with class notes will be distributed weekly or announced in lecture.

Week	Material	Text Sections	Lab Coverage
1 Monday April 6	Overview of course – topical outlines and which techniques to solve D.E. considered in this course. Quick review of ENGR-231 intro Definitions and nomenclature: order, linear, non-linear, autonomous, time varying, D.E representation (matrix), ODE, homogeneous, forcing functions, equilibrium points; Solution satisfies D.E., Initial value problem; Explicit and Implicit Solutions, multiple solutions, integral curves; Qualitative solution of 1st order D.E – direction fields using dfield (Rice)	1.1 – 1.3	Use of **dfield** from Rice University solve 1st-order linear and non-linear D.E **Gompertz** Model of Tumor Growth
2 Monday April 13	Introduction to Numerical Method - Euler's Method; Numerical Methods cont.: Euler and Runge-Kutta; Introduction to Modeling; Solution of 1st order D.E. by Separation of Variables; Introduction to Integrating factor for 1st order D.E.;	1.4 3.6 – 3.7 2.1 – 2.3	Intro to ODE45 Solution of 1st-order with application questions
3 Monday April 20	Mathematical Modeling; 2nd order Linear differential Equations, existence theory, auxiliary equation, General Solution, Application Examples, use of pplane (Rice); Solution of 2nd order D.E. Homogeneous Linear D. E. case with complex roots;	3.1 – 3.5 4.1 – 4.3	Application problem using ODE45 and other tools
4 Monday April 27	Solution of non-homogeneous Linear D.E. – method of undetermined coefficients; and Superposition Principle; Free and Forced Mechanical Vibrations; Interconnected tanks; Introduction to Phase Plane; Biomathematics;	4.4 – 4.5 4.9 – 4.10 5.1 5.4 – 5.5	ODE45 for 2nd-order differential equations
5 Monday May 4	Solution of Linear Differential Equations by Laplace Transform method part 1;	7.1 – 7.3	Application lab either spring mass damper or RLC circuit oscillatory behavior
6 Monday May 11	Solution of Linear Differential Equations by Laplace Transform method part 2; **Midterm Exam, will start during our ZOOM lecture.**	7.4 – 7.5	Laplace workshop, problem solving by hand.
7 Monday May 18	Solution of Linear Differential Equations by Laplace Transform method part 3 Matrices and introduction to Eigenvalues and eigenvector	7.6 & 7.8 9.1 – 9.6	Laplace workshop, problem solving by symbolic toolbox
8 Monday May 25	Solution of homogeneous D.E. using Eigenvalues and Eigenvectors Solution of Matrix D.E. by Laplace Techniques, State Equation nomenclature **Memorial Day, please review this material as a reading assignment**		Numerical and analytic solution for 2nd-order eigenvalue problem.
9 Monday Nov 18	Phase Plane, instability and stability of equilibrium points and limit cycles, ROA for higher order non-linear D.E. Stability of linear systems, BIBO, simple linearization techniques.	12.2 & 12.6 12.3	**MATLAB EXAM**
10 Monday June 8	• **Final Exam – Monday June 8th at 6PM**		

Note: You are strongly encouraged to read the lectures posted and the text sections listed above and practice problems from them 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.