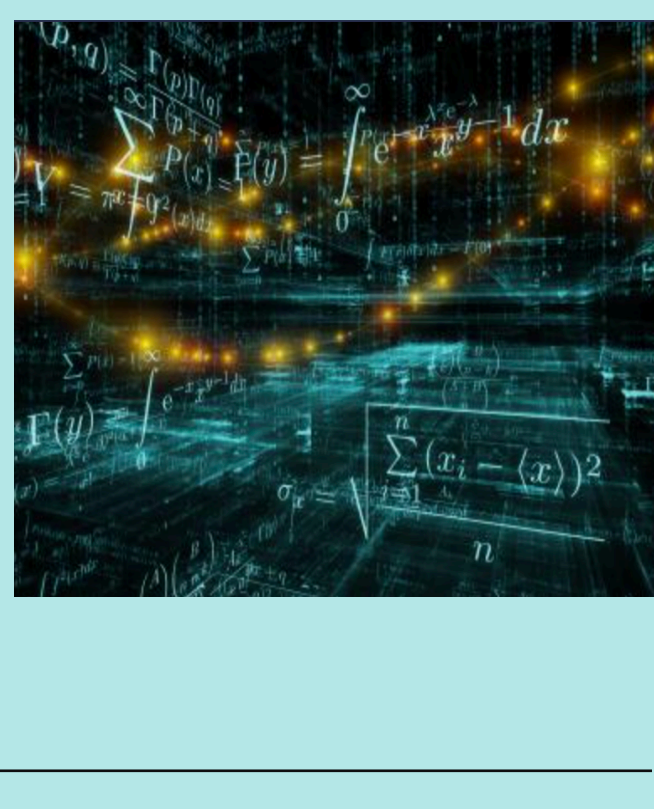


# Linear Algebra and Differential Equations



MST 205/605

**Dr. John Gemmer:** gemmerj@wfu.edu

**Office:** Manchester 388

**Course Website:** <http://users.wfu.edu/gemmerj/math205-605F21.html>

**Canvas:** The course syllabus and grades will be posted on Canvas

**Office Hours:** M 3:00-4:00, T 12:00-1:00, T 2:00-3:00 W 12:00-2:00

**Class Meeting Times:** MTWTh 5:00-5:50

**Class Location:** Manchester 125

**Teaching Assistant:** Evelyn Huszar (husze21@wfu.edu)

**Study Sessions:** Wednesday 7-8, Kirby 120

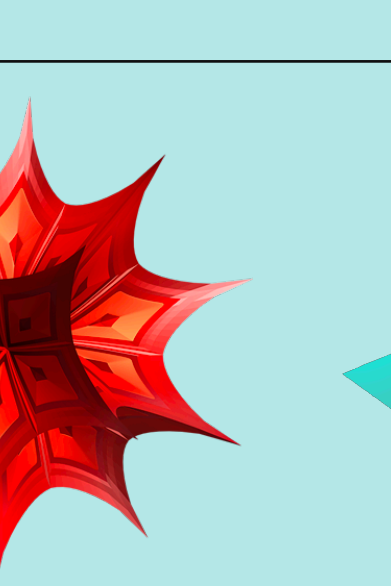
## COURSE DESCRIPTION

This course serves as an introduction to both linear algebra and differential equations. Both of these topics are crucial mathematical tools for engineers, physicists, and mathematicians. Differential equations are often used to model the dynamic change of many physical systems but can be notoriously difficult to solve explicitly. However, linear algebra provides a methodology for solving systems of linear differential equations that commonly arise in applications. To grow the students mathematical toolbox, this course will cover topics in matrices, determinants, vector spaces, first order differential equations, linear differential equations, linear transformations, eigenvalues, eigenvectors, systems of differential equations, and power series solutions. While this course is primarily about building up the students mathematical training, along the way, time permitting, we will discuss numerical solutions and applications of differential equations.

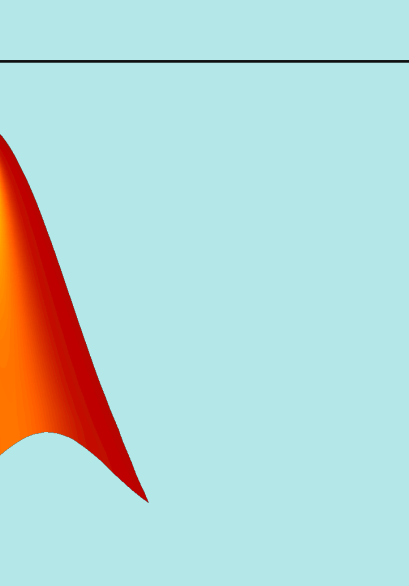
## REQUIREMENTS



**Prerequisites:**  
Calculus II



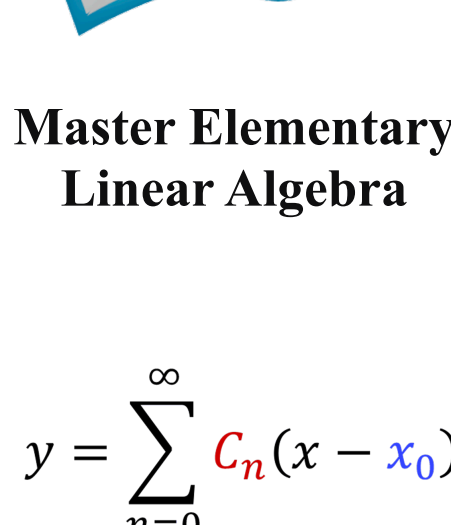
**Textbook**  
Peterson, Sochacki



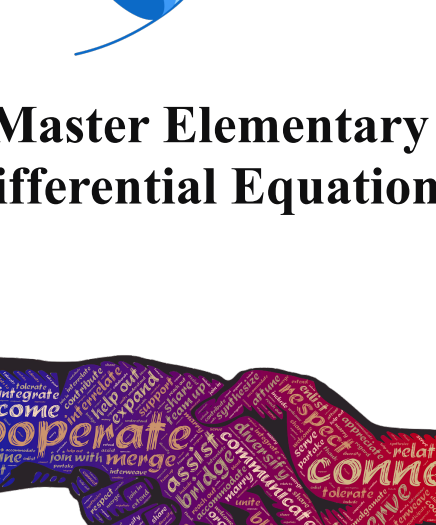
**Computer Access:**  
Laptop/Desktop

**Software:**  
Matlab, Mathematica: [WFU Software Link](#)

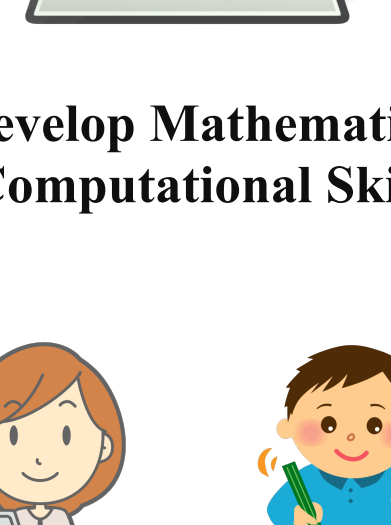
## OBJECTIVES



**Master Elementary Linear Algebra**



**Master Elementary Differential Equations**



**Develop Mathematical Computational Skills**

$$y = \sum_{n=0}^{\infty} C_n (x - x_0)^n$$

**Develop Skills in Power Series**

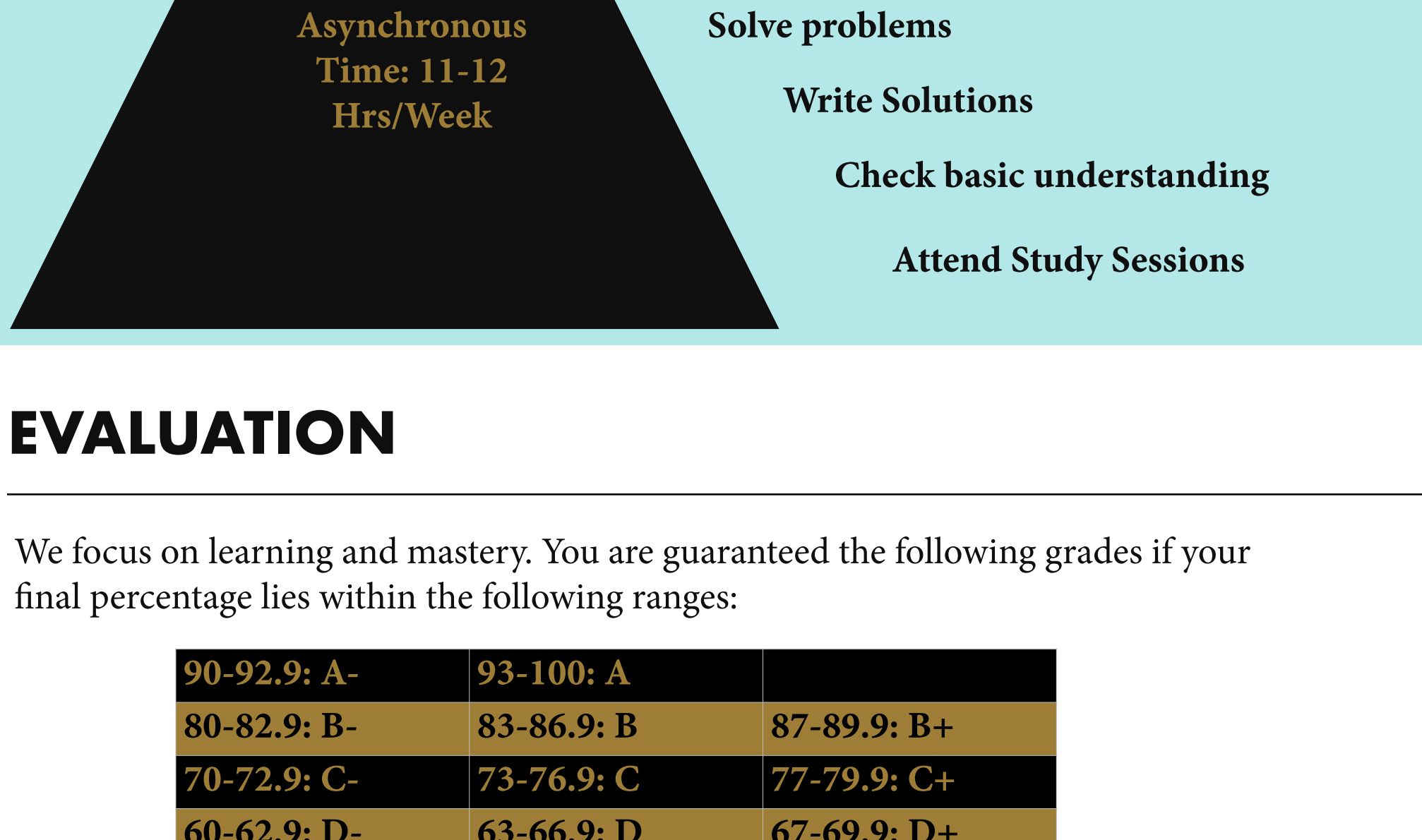


**Learning to collaborate**



**Write Effectively**

## CLASS STRUCTURE



## EVALUATION

We focus on learning and mastery. You are guaranteed the following grades if your final percentage lies within the following ranges:

90-92.9: A-	93-100: A	
80-82.9: B-	83-86.9: B	87-89.9: B+
70-72.9: C-	73-76.9: C	77-79.9: C+
60-62.9: D-	63-66.9: D	67-69.9: D+

- Classworks (5%)**  
Structured in class group assignments  
Grades based on attendance
- Quizzes (10%), at least 1 dropped**  
5-10 minutes  
In class on Thursdays
- Weekly Homework (20%), at least 1 dropped**  
Open book, collaboration allowed with citation  
Homework is due on Thursday in class
- Three summative assessments (30%)**  
In class, closed notes
- Final Exam (35%)**  
Comprehensive  
In class, closed notes

**Classworks:** Throughout the course there will be several class works. These consist of structured by assignments that will be completed during class time. These assignments will generally be exploratory allowing students to synthesize concepts through a “hands on” approach. Classworks will be graded based on attendance.

**Quizzes:** On most Thursdays there will be a short 5-10 minute in-class quizzes. These quizzes will consist of a very short problem that will test your knowledge of the prior lectures and homework. These quizzes are to help both the students and the instructor understand concepts that students may be struggling with. All quizzes will be announced in class. There will be no “pop” quizzes. There are no retakes for missed quizzes, however I will drop the lowest quiz score from your final grade.

**Weekly Homework:** Homework will be assigned most weeks on Friday and will be due Thursday in class the following week. Late homework will not be accepted under any circumstances. However, I will drop at least one homework assignment from your grade. While you are allowed to collaborate with your colleagues, homework must consist of solutions that show all steps, be your own work and be written clearly using complete sentences as appropriate (see homework policy). All homework will be submitted in class on paper. I will not accept digital versions of your homework.

**Summative Assessments:** There will be three in class summative assessments in the course and a cumulative final exam.

## COURSE ENVIRONMENT

**Names/Pronouns**  
You deserve to be addressed in the manner you prefer. To guarantee that I address you properly, you are welcome to tell me your pronoun(s) and/or preferred name at any time, either in person or via email.

**Diversity**  
We embrace diversity of age, background, beliefs, ethnicity, gender, gender identity, gender expression, national origin, religious affiliation, sexual orientation, and other visible and non-visible categories. **I do not tolerate discrimination.**

**Accessibility**  
I want you to succeed in this course and all of your courses. See [lac.wfu.edu/](http://lac.wfu.edu/) for learning accommodations. For personal issues, stress, health problems or life circumstances see [shs.wfu.edu/](http://shs.wfu.edu/). Contact me if you have other special circumstances. **I will find resources for you.**

**Title IX**  
You deserve a community free from discrimination, sexual harassment, a hostile environment, sexual assault, domestic violence, dating violence, and stalking. If you experience or know of a Title IX violation, you have many options for support and/or reporting; see [titleix.wfu.edu/](http://titleix.wfu.edu/).

**The Honor Code**  
At Wake Forest, we expect you to behave as honorable citizens of the class, the university, and the world as a whole. When you complete an assignment with your name on it, you are representing that everything you are turning in is your own work. That means that you do not copy from other students, textbooks, or websites. If at any time I become aware of cheating or plagiarism in this course, I will submit the information to the honor council.

## TENTATIVE COURSE CALENDAR

### Matrix Algebra and Introduction to Vector Spaces

- Week 1:
- 8/23: Systems of linear equations I, **Section 1.1**
  - 8/24: Systems of linear equations II, **Section 1.3**
  - 8/25: Matrices and matrix operations I, **Section 1.2**
  - 8/26: Group work day, **Quiz #1, Homework #1 Due.**

- Week 2:
- 8/30: Matrices and matrix operations II, **Section 1.2**
  - 8/31: Inverses of matrices I, **Section 1.3**
  - 9/01: Inverses of matrices II, **Section 1.3**
  - 9/02: Group work day, **Quiz #2, Homework #2 Due.**

- Week 3:
- 9/06: Determinants I, **Sections 1.5-1.6**
  - 9/07: Determinants II, **Sections 1.5-1.6**
  - 9/08: Determinants III, **Sections 1.5-1.6**
  - 9/09: Group work day, **Quiz #3, Homework #3 Due.**

- Week 4:
- 9/13: Vector Spaces I, **Section 2.1**
  - 9/14: Vector Spaces II, **Section 2.1**
  - 9/15: Group work day, **Homework #4 Due.**
  - 9/16: **Summative Assessment #1.**

### Vector Spaces and First Order Differential Equations

- Week 5:
- 9/20: Subspaces and spanning sets I, **Section 2.2**
  - 9/21: Subspaces and spanning sets II, **Section 2.2**
  - 9/22: Linear independence and bases I, **Section 2.3**
  - 9/23: Group work day, **Quiz #4, Homework #5 Due.**

- Week 6:
- 9/27: Linear independence and bases II, **Section 2.3**
  - 9/28: Dimensions; null space, row space, and column space I, **Section 2.4**
  - 9/29: Dimensions; null space, row space, and column space II, **Section 2.4**
  - 9/30: Group work day, **Quiz #5, Homework #6 Due.**

- Week 7:
- 10/04: Wronskians, **Section 2.5**
  - 10/05: Introduction to differential equations, **Section 3.1**
  - 10/06: Separable differential equations, **Section 3.2, Quiz #6, Homework #7 Due.**
  - 10/07: **Fall Break!!!**

- Week 8:
- 10/11: Exact differential equations, **Section 3.3**
  - 10/12: Linear differential equations, **Section 3.4**
  - 10/13: Group work day, **Homework #8 Due.**
  - 10/14: **Summative Assessment #2.**

### Linear Differential Equations and Linear Transformations

- Week 9:
- 10/18: Theory of linear order differential equations I, **Section 4.1**
  - 10/19: Theory of linear order differential equations II, **Section 4.1**
  - 10/20: Homogenous constant coefficient linear differential equations I, **Section 4.2**
  - 10/21: Group work day, **Quiz #7, Homework #9 Due.**

- Week 10:
- 10/25: Homogenous constant coefficient linear differential equations II, **Section 4.2**
  - 10/26: Method of undetermined coefficients I, **Section 4.3**
  - 10/27: Method of undetermined coefficients II, **Section 4.3**
  - 10/28: Group work day, **Quiz #8, Homework #10 Due.**

- Week 11:
- 11/01: Method of variation parameters, **Section 4.4**
  - 11/02: Linear transformations, **Section 5.1**
  - 11/03: Algebra of linear transformations and differential operators, **Section 5.2**
  - 11/04: Group work day, **Quiz #9, Homework #11 Due.**

- Week 12:
- 11/08: Matrices for linear transformations I, **Section 5.3**
  - 11/09: Matrices for linear transformations II, **Section 5.3**
  - 11/10: Group work day, **Homework #12 Due.**
  - 11/12: **Summative Assessment #3.**

### Eigenvalues, Eigenvectors, Systems of ODEs, and Power Series

- Week 13:
- 11/15: Eigenvalues and eigenvectors of matrices I, **Section 5.4**
  - 11/16: Eigenvalues and eigenvectors of matrices II, **Section 5.4**
  - 11/17: Similar matrices, diagonalization, and Jordan canonical form **Section 5.5**
  - 11/18: Group work day, **Quiz #10, Homework #13 Due.**

- Week 14:
- 11/22: Theory of systems of linear differential equations, **Section 6.1**
  - 11/23: Homogenous systems I, **Section 6.2**
  - 11/24: Homogenous systems II, **Section 6.2, Quiz #11, Homework #14 Due.**
  - 11/25: **Thanksgiving Break!!!**

- Week 15:
- 11/29: Introduction to power series solutions I, **Section 8.1**
  - 11/30: Introduction to power series solutions II, **Section 8.1**
  - 12/01: Series solutions for second order linear differential equations, **Section 8.2**
  - 12/02: Group work day, **Quiz #12, Homework #15 Due.**

**12/06: Final Exam at 7:00 PM**

## SUCCESS



Attend class



Participate constantly



Invest time



Concentrate on concepts in addition to calculations



Seek help when needed



Eliminate Virtual Distractions