Syllabus.
MATH-294-1328: Differential Equations, Spring 2021.

Instructor Information Including Contact Information.

Instructor Name: Kit Newton.
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Office: MA-128
Phone: 925-969-2674

Office Hours and Location:
Monday 9:45-11 AM
Tuesday 9:45-11 AM
Wednesday 2-3:15 PM
Thursday 12-1:15 PM
All office hours will be held online through Zoom.

General Course Information.

Course #: 294
Section: 1328
Days/Times: Monday, 12:45 PM – 2:00 PM
Wednesday, 12:45 PM – 2:00 PM
Location/Instruction Mode: Off Campus/Online
Units: 5
Semester: Spring
Year: 2021

Textbook/Materials/Supplies Required.

Textbook: Our recommended book is "Elementary Differential Equations with Boundary-Value Problems" by Zill, 9th edition. You do not necessarily have to purchase the book to participate in the class. Reading will be recommended from the book. Please note that we are not using Webassign. Homework assignments will be distributed through Canvas, no WebAssign or WebWork is required. Calculators are not required, we will use the CAS "SageMath" available free, as needed.

Technology: your computer needs to support synchronously joining our class over Zoom. Ideally, you have a webcam, microphone, and strong enough internet connection that we can video chat. If this isn't feasible for you, please email me and we can figure out how you can participate in the class.

Course Description.

This course presents an introduction to the theory and applications of ordinary differential equations and an introduction to partial differential equations.

Course Outline.

A. First order equations:

1. Exact, separable, homogeneous and linear equations

2. Integrating factor a function of x and y alone

3. Bernoulli's Equation

4. Equations with x missing or y missing

5. Applications (e.g., circuits, hanging chain, escape velocity, steady state heat problem)

6. Substitutions

B. First order qualitative theory

1. Sketching of solutions by methods of isoclines

2. Sketching of solution curves of first order autonomous equations

C. Existence and Uniqueness Theorem and singular solutions

D. Linear higher order equations

1. y =y(sub c) + y(sub p)

2. Fundamental solutions, independence, Wronskian

3. Operator notation

4. Construction a 2nd solution from a known one

5. Solving homogeneous equations

6. Solving non-homogeneous equations by variation of parameters

7. Solving non-homogeneous equations by undetermined coefficients or inverse operators

8. Application to the vibrating spring – simple harmonic motion, overdamped, critically damped, and underdamped motion. Resonance

E. Taylor Series method

F. Runge-Kutta method and intuitive discussion of Euler's method

G. Laplace Transform

1. Definition and use of tables
2. Solving Linear IVPs and problems involving unit step and Dirac delta functions
3. Electrical applications

H. Fourier Series and PDEs

1. Properties of Fourier Series and Dirichlet's Theorem
2. Sine and Cosine series
3. Separation of variables to solve a PDE
4. Solving the wave equation, Laplace's equation, or the heat equation using Fourier series.

I. Systems

1. Converting a second order equation to a 2x2 system and vice versa
2. Solving systems by the method of elimination

Prerequisites.

MATH-292 or equivalent.

Attendance Policy.

We have synchronous class meetings online at the scheduled meeting time for our class. We will do graded activities during class that will be counted towards "Participation". If you must miss a class, please email me as soon as possible. We may be able to work out other arrangements for you to complete the graded activity.

Communication Plan for Faculty and Students.

I aim to respond to email within 24 hours. This excludes weekends, except in case of emergency. Course related announcements will be posted on the Announcement Page on Canvas and sent to the class email list. Although I will try to make the same announcements during our class time, it will still be important for you to check your student email account and Canvas regularly to make sure you're not missing anything.

Homework and Late Submission Policies

We will have three midterm exams, weekly homework, weekly quizzes, and a final exam. During synchronous classes, we will have graded activities that will be counted towards "Participation". We will have Canvas discussion that will also count towards "Participation". If

you have school or career obligations that conflict with tests, email me at least a week ahead of time for possible accommodations. If you have an emergency and must miss a test, email me as soon as possible.

Out of the four exams (the three midterms and the final), two of the exams will be oral exams, meaning one-on-one and synchronous. I will provide a way to schedule the exam, but is the student's responsibility to schedule it. We can have the exam over Zoom, or if internet issues prevail, we can have the exam by phone. You may use a translator during the exam if needed. You may type in the chat or write answers on paper and show me, if needed.

In case of emergency, extensions on assignments may be possible. Please contact me about an extension **before** the due date/time. I will let you know if an extension has been granted and provide you with the updated due date/time. Assignments submitted after the due date/time without prior approval will receive zero credit.

Submission of Assignments

Assignments will be turned in on Canvas.

Student Learning Outcomes.

Students will be able to:

A. Solve first order differential equations by a variety of methods.
B. Apply the Existence and Uniqueness theorem and theory of singular solutions to differential equations.
C. Apply qualitative, numerical, and series methods to differential equation problems.
D. Solve homogeneous linear differential equations.
E. Solve non-homogeneous linear differential equations by the method of variation of parameters, and by either undetermined coefficients or inverse operators.
F. Use Laplace Transforms to solve initial value problems, including ones involving the unit step and Dirac delta functions.
G. Construct Fourier Series for various functions.
H. Solve partial differential equations by separation of variables.
I. Apply Fourier Series to the wave equation, the heat equation, or Laplace's equation.
J. Solve systems of differential equations.
K. Solve various science and engineering application problems using differential equations.

Support and Resources.

- MathLab (available remotely, see video for instructions!)
- Online Learning at DVC
- Counseling (available remotely)
- Disability Support Services (for students seeking accommodations)
- Library
- Multicultural Center

- Financial Aid (including COVID assistance)
- Basic Needs (food, shelter, health services)

Evaluation Criteria and Grading Standards.

Assignment	Percentage of Final Grade
Homework	10
Quizzes	15
Participation	10
Exam 1	15
Exam 2	15
Exam 3	15
Final Exam	20
Total	100

Grading Scale:

Grade	A	B	C	D
Score	90-100	80-89	60-79	50-59

Final grades are recorded as A=4.0, B=3.0, C=2.0, D=1.0, F=0

Syllabus Changes.

I may modify the syllabus or schedule with reasonable notice to you. Look for an Announcement in Canvas and an email.

ADA.

Diablo Valley College has Disability Support Services available. For information about accommodations for this and other courses, please visit the DSS page at the DVC website. If approved for accommodations, DSS will provide you with an accommodation plan. Please share your accommodation plan with me and discuss your approved accommodations as early in my class as possible. If your accommodation needs are not being met, please inform me and Disability Support Services as soon as possible.

Equity and Inclusion.

This class aims to be a safe and affirming learning space for all students, regardless of age, race, ethnicity, citizen status, gender, sex, sexual orientation, parental status, religion, ability, or socioeconomic status. As an instructor, I pledge to respect all students based upon these factors, including the use of preferred names and pronouns, and I encourage open communication. Students are welcome and encouraged to share any/all viewpoints relevant to course material.

Academic Integrity.

Academic dishonesty, including cheating and plagiarism, is a violation of the DVC Student Code of Conduct and will not be tolerated. This includes giving or receiving assistance on any assignment, quiz, or exam unless specifically authorized by your instructor. These actions are grounds for academic consequences, such as receiving no credit for the assignment or a reduced grade in the class, and disciplinary consequences from the college. If you have any questions about academic dishonesty or plagiarism, please see the DVC Academic Integrity Policy. Unless otherwise specified, your work in this class is individual work; helping or being helped on assessments is cheating; the penalty is up to a zero on the test for one offense, and an F in the class for a second offense.

Tentative Schedule.

Week:	**Topic:**	**Reading:**
1/25-1/29	Introduction to Differential Equations	Chapter 1
2/1-2/4	First order equations	Chapter 2
2/8-2/12	First order equations and modeling	Chapter 2
2/15-2/19	2/15 Holiday – no class. Modeling	Chapter 3
2/22-2/26	**Exam 1**	
3/1-3/5	Higher order equations	Chapter 4
3/8-3/12	Modeling with higher order equations	Chapter 5
3/15-3/19	Series solutions	Chapter 6
3/22-3/26	**Exam 2**	
3/29-4/2	**Spring break**	
4/5-4/9	Laplace Transforms	Chapter 7
4/12-4/16	Systems of Differential Equations	Chapter 8
4/19-4/23	**Exam 3**	
4/26-4/30	Modeling with Systems	Chapter 9
5/3-5/7	Fourier Series	Chapter 11
5/10-5/14	Integral Transforms	Chapter 14
5/17-5/21	Review and **Final Exam**	