# Quinsigamond Community College School of Math, Science, & Engineering

# Instructor's Information

Instructor:Professor XX (she/her/hers)Office:200AEmail:xxxxx@qcc.mass.eduTelephone:508-854-xxxx

#### **Course Information**

Course:	MAT 238 Differential Equations – Section XX
Meets:	Mondays and Wednesdays from 9:30am - 10:45am
Room:	177A
Credits:	3 credits
Semester:	Fall 2024

#### **Course Description**

This course covers definition of differential equations, solution of differential equations, separation of variables, homogeneous and nonhomogeneous solutions, Wronskian, second and higher order equations, solution of systems of linear differential equations, numerical methods, linear independence, the Laplace transform, transforms of derivatives, derivatives of transforms, the Gamma function, inverse transforms, and convolution theorem. Students use mathematical software to solve differential equations for numerical methods.

#### Prerequisites

MAT 235 Calculus III

#### Required Textbook/Materials/Website

Textbook: Fundamentals of Differential Equations and Boundary Value Problems, by Nagle, 7<sup>th</sup> edition, Pearson © 2018 Materials: Graphing calculator (recommended)

Waterials: Graphing calculator (recommended

Website: Access to Pearson's MyLab Math

#### Student Learning Outcomes

Upon completion of this course, students will be able to:

- 1. Solve 1<sup>st</sup>, 2<sup>nd</sup>, and higher order differential equations.
- 2. Apply differential equations to solve a variety of application problems.
- 3. Apply operators and elimination method to solve systems of differential equations.
- 4. Apply Laplace Transform to solve initial value problems.
- 5. Solve differential equations using power series.

# Course Topics & Required Section Readings/Assignments

Introduction

- Background
- Solutions and Initial Value Problems
- Direction Fields
- The Approximation Method of Euler

First Order Differential Equations

- Separable Equations
- Linear Equations
- Exact Equations
- Special Integrating Factors
- Substitutions and Transformations

Mathematical Models and Numerical Methods Involving First- Order Equations

- Compartmental Analysis
- Heating and Cooling of Buildings
- Newtonian Mechanics
- Electrical Circuits

Linear Second Order Equations

- Homogeneous Linear Equations: The General Solution
- Auxiliary Equations with Complex Roots
- Nonhomogeneous Equations: the Method of Undetermined Coefficients
- Variation of Parameters

Introduction to Systems and Phase Plane Analysis

- Differential Operators and the Elimination Method for Systems
- Theory of Higher-Order Linear Differential Equations
  - Basic Theory of Linear Differential Equations
  - Homogeneous Linear Equations with Constant Coefficients
  - Undetermined Coefficients and the Annihilator Method
  - Method of Variation of Parameters (higher order differential equations)

Laplace Transform

- Definition of the Laplace Transform
- Properties of the Laplace Transform
- Inverse of Laplace Transform
- Solving Initial Value Problems
- Transforms of Discontinuous Functions
- Transforms of Periodic and Power Functions
- Convolution

Series Solutions of Differential Equations

- Power Series and Analytic Functions
- Power Series Solutions to Linear Differential Equations
- Equations with Analytic Coefficients
- Cauchy-Euler (Equidimensional) Equations
- Method of Frobenius

#### If time permits:

Partial Differential Equations

- Method of Separation of Variables
- Fourier Series
- Fourier Cosine and Sine Series
- The Heat Equation
- The Wave Equation

#### Instructional Objectives

- Solve first- order differential equations.
- Solve mathematical models involving first- order equations.
- Solve linear second- order differential equations.
- Solve systems of differential equations using differential operators.
- Solve higher- order linear differential equations.
- Use Laplace transform to solve differential equations.
- Solve differential equations using power series.
- Use method of separation of variables to solve partial differential equations.
- Compute Fourier series of a given function.
- Derive a formal solution to the heat equation.
- Derive a formal solution to the wave equation.

#### Grading Breakdown

- 20% Homework
- 10% Quizzes
- 10% <Attendance>
- 35% Exams
- 25% Comprehensive Final Exam

Grade	Range	Grade	Range	Grade	Range
А	95 – 100	В —	80 - 82	D +	67 – 69
A –	90 – 94	C +	77 – 79	D	63 – 66
B +	87 – 89	С	73 – 76	D –	60 - 62
В	83 - 86	C –	70 – 72	F	0 – 59

#### **Teaching Procedures**

Most classes will be a combination of lectures, group activities, and in-class assignments. You will be given homework assignments to be completed outside of class. Occasionally, a quiz or exam will be given in class.

# **Attendance Policy**

Students are expected to attend all classes for the entire period. Attendance will be taken in every class. If you are absent from class, proper documentation will excuse your absence.

# Diversity, Equity, and Inclusion Statement for the School of Math & Science

The School of Math and Science is motivated to teach and learn from the diverse community we have at QCC. In Science, Technology, Engineering, and Mathematics (STEM), it is advantageous to approach problems from multiple perspectives. The power of diversity, equity and inclusion allows us to persevere and overcome challenges.

The faculty of the School of Math and Science pledge to help students meet the demands of STEM regardless of race/ethnicity, gender identity and expression, sexual orientation, faith, abilities/disabilities, age, socioeconomic background, political leaning, ancestry, national origin, home language and all other identities. We are dedicated to nurturing a culture of collaboration, mutual respect and understanding; and to empowering members of our community to embrace their full potential.

#### **Accessibility Statement**

Quinsigamond Community College is committed to providing access and inclusion for all persons with disabilities. Students who require an accommodation in this course should notify the professor as soon as possible. Students are responsible for forwarding the Accommodation Letter to the professor (via email or hard copy). Students may request accommodations at any time during the semester, which begin upon receipt (accommodations are not retroactive). Please discuss any barriers which may arise during the semester with your professor or coordinator in the Student Accessibility Services office.

Contact Information for Student Accessibility Services (SAS):

Call: 508-854-4471 Sorenson Video Phone: 508-502-7647 Email: <u>disabilityservices@qcc.mass.edu</u>

# Services for Veterans

If you are a veteran of the US Armed Forces, please visit the Veteran Affairs Office located in 258A (Administration Building) or contact them at <u>veteranaffairs@qcc.mass.edu</u>.

# Academic Honesty and Plagiarism

Our purpose of education is to seek the truth; this work requires trust and honesty between teacher and student. If we are not honest about what we know and don't know, our learning will always be impaired. Because our teaching and learning depends on this honest communication, we expect all students to understand what plagiarism is and why it is unacceptable.

Plagiarism means taking someone else's ideas or words and presenting them as one's own. The offense can take many forms including cheating on a test, passing in a paper taken from the Internet or from another student, or failing to properly use and credit sources in an essay. Sometimes the issue is subtle, involving getting too much help on an assignment from someone else. In every instance, plagiarism means cheating both oneself and the owner of the source. Since cheating sabotages a student's learning experience, consequences range from no credit for the assignment to failure for the course and possible expulsion from the college.

The penalty for getting caught cheating in this course is a failure of the quiz or test, or failure of the entire course. This is solely at the discretion of the instructor.

For further information concerning plagiarism, refer to the QCC Student Handbook.

# Math Center & QCC Math YouTube Channel

The Math Center provides free, drop-in tutoring assistance for students in any QCC mathematics course. Located on the second floor of the Harrington Learning Center (HLC), the Math Center is a welcoming place where students have the opportunity to work collaboratively with tutors and classmates. Students can work intensively to improve their mathematical skills or simply drop by to ask a few questions. In addition to tutoring, the Math Center houses various math-related resources, and computers and software for math coursework. Visit their website for details and the semester schedule: <u>https://www.qcc.edu/services/tutoring/math-center</u>

# Assignment & Test Schedule

<list all assignments, quizzes, and exam dates>