

The City College of New York

MATH 39100

METHODS OF DIFF. EQS.

SPRING 2023

INSTRUCTOR: Jania B.

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SECTION: H

WEBSITE: <https://jbjanias3.wixsite.com/hijmath>

SCHEDULE: M, W 6:30-7:45pm

DEPT. WEBSITE: <http://math.sci.ccny.cuny.edu/>

ROOM: NAC 6/121

OFFICE HOURS: M & W 5:50-6:20 pm

YouTube Channel: <https://www.youtube.com/janiab>

REQUIRED TEXT: *Elementary Differential Equations and Boundary Value Problems, 11th Edition* by Boyce, DiPrima, and Meade (10th Edition is also fine)

COURSE CONTENT: We will cover the following topics:

First Order Differential Equations

Higher Order Linear Equations with Constant Coefficients

Undetermined Coefficients

Variation of Parameters

Applications to 1st order & 2nd order ODEs

Euler's Equation

Series Solutions to DE

Elementary Partial Differential Equations and Separation of Variables

Fourier Series

Heat Conduction in a Rod

GENERAL ADVICE: This course will require a great deal of time because we will cover many topics over the course of the semester. Attending lectures, completing homework assignments, quizzes and exams will be an essential part of this course. If you **DO NOT** have adequate time to devote to this class, please consider postponing this class until a semester in which you have sufficient time. You must practice every day, as much or as little as you want to do well in this course!

ATTENDANCE: Unless there is some emergency in my life, I will be in class, on time. If you do happen to be absent due to an emergency you are required to make up the missed topics on your own. Please attend class regularly and be on time! Attendance will be taken occasionally.

HOMEWORK: This is the most pivotal element of any course. I strongly recommend that you form study groups to collaborate on homework problems. Quizzes and exam questions will resemble homework exercises very closely.

QUIZZES: Quizzes will be given biweekly and it will resemble exercises from the homework set. Quiz 1 (Monday 2/6), quiz 2 (Tuesday 2/21), quiz 3 (Monday 3/20), quiz 4 (Monday 4/3), quiz 5 (Monday 4/24), quiz 6 (Monday 5/8).

EXAMS: There are a total of **two exams**. All exams are closed books. All of the problems in the exams/quizzes are going to be similar to homework problems. There is absolutely **NO MAKE-UP** for a missed exam or a quiz.

EXAM 1: Monday, March 6, 2023

EXAM 2: Monday, May 1, 2023

EXAM 3 (OPTIONAL EXAM): Friday, May 12, 4pm-5:15pm (Room TBA)

FINAL EXAM: During final examination week

ACADEMIC DISHONESTY: I have zero tolerance for any form of academic dishonesty. Here is the Academic Integrity Policy link:

<http://www.cuny.edu/about/administration/offices/legal-affairs/policies-resources/academic-integrity-policy/>

Don't cheat. Work hard. Be kind. Love all people.

TUTORING: Take advantage of ccny free tutoring at Marshak Math/Physics Tutoring Center.

GRADES: In this course, you will earn a grade based on your performance on two exams, quizzes, and a final exam. Grading scheme is as follows:

Quizzes (top 5)	15%
Exam with higher score	35%
Exam with lower score	10%
Final Exam	40%

“There is no elevator to success; you must take the stairs.”

Course Official Syllabus

- 1.2-3 Solutions and Classification of Differential equations

CHAPTER 2

- 2.2 Separable equations & Homogeneous equations
- 2.1 Linear equations; Method of integrating factors
- 2.4 Existence and Uniqueness (optional)
- 2.6 Exact Equations (skip Integrating factors)
- 2.3 Modeling: Tank problems (1st order)

CHAPTER 3

- 3.1 Homogeneous with Constant Coefficients
- 3.2 The Wronskian
- 3.3 Complex Roots of the characteristic Equation
- 3.4 Repeated Roots & Reduction of Order
- 3.3/3.4 Cauchy-Euler Equations
- 3.5 Undetermined Coefficients
- 3.6 Variations of parameters
- 3.7/3.8 Modeling: Spring Problems (2nd order)

CHAPTER 4

- 4.1 n^{th} order DE
- 4.2 Higher Order Linear DE
- 4.3 Higher Order Undetermined Coefficients

CHAPTER 5

- 5.1 Review of Power Series
- 5.2 Series Solutions near Ordinary Points
- 5.4 Euler Equations & Regular Singular points
- 5.5 Series Solutions near a Regular Point, Part I

CHAPTER 6

- 6.1-2 Laplace Transforms

CHAPTER 10

- 10.1 Boundary Value Problems (BVP)
- 10.2 Fourier Series
- 10.3 Fourier Convergence Theorem
- 10.4 Even and Odd Functions
- 10.5 Heat Conduction Problems, separation of variables

Course Learning Outcome

Upon completion of this course, the student should be able to:

- Solve a variety of first order differential equations selecting from a variety of techniques covered in the syllabus.
- Likewise, solve a variety of second order differential equations, selecting from several techniques covered in the syllabus.
- Be able to analyze certain physical problems (tank flow, mechanical and electrical vibration), set up their determining differential equations, solve them using the techniques in 1. and 2. above, and use these solutions to answer questions about the physical system.
- Give series solutions (and approximations) for second order linear differential equations, both at ordinary points and at regular singular points.
- Have a fundamental understanding of Fourier series and be able to give Fourier expansions of a given function.
- Understand and be able to apply all the mathematical aspects that contribute to the solution of heat conduction of a rod problem with constant temperature boundary conditions (the method of separation of variables, the use of Fourier series, as well as the specific solution).
- Understand and be able to use various theoretical ideas and results that underlie the mathematics in this course covered in the syllabus (including various existence/uniqueness results, ideas of linear independence and the Wronskian, and convergence properties of Fourier series).