MATH 222: Differential Equations
Spring 2024 Course Syllabus

NJIT Academic Integrity Code: All Students should be aware that the Department of Mathematical Sciences takes the University Code on Academic Integrity at NJIT very seriously and enforces it strictly. This means that there must not be any forms of plagiarism, i.e., copying of homework, class projects, or lab assignments, or any form of cheating in quizzes and exams. Under the University Code on Academic Integrity, students are obligated to report any such activities to the Instructor.

COURSE INFORMATION

Course Description: Methods for solving ordinary differential equations are studied together with physical applications, Laplace transforms, numerical solutions, and series solutions.

Number of Credits: 4

Prerequisites: Prerequisite: MATH 112 with a grade of C or better or MATH 133 with a grade of C or better.

Course-Section and Instructors:

Course-Section	Instructor
Math 222-002	Professor P. Rana Concepcion
Math 222-004	Professor M. Potocki-Dul
Math 222-006	Professor P. Rana Concepcion
Math 222-008	Professor M. Potocki-Dul
Math 222-010	Professor J. Ratnaswamy
Math 222-012	Professor J. Ratnaswamy
Math 222-014	Professor Y. N. Young
Math 222-016	Professor C. Turc
Math 222-102	Professor J. Ratnaswamy

Office Hours for All Math Instructors: Spring 2024 Office Hours and Emails

Required Textbook:

Title	*Elementary Differential Equations and Boundary Value Problems*

Author	Boyce and DiPrima
Edition	11th
Publisher	John Wiley & Sons, Inc.
ISBN #	978-1119447399

University-wide Withdrawal Date: The last day to withdraw with a **W** is **Monday, April 1, 2024**. It will be strictly enforced.

COURSE GOALS

Course Outcomes

Students should:

- Learn elementary analytical solution techniques for the solution of ordinary differential equations (ODEs).
- Interpret the solutions using plots and methods of calculus.
- Understand the solution structure of linear ODEs in terms of independent homogeneous solutions and nonhomogeneous solutions.
- Understand, by exposure to examples, how systems and phenomena from science and engineering can be modeled by ODEs, a principal example being the linear spring subject to forcing and damping
- Understand how the solution of such a model ODE can be used to analyze or predict a system's behavior.
- Understand the role of initial value problems for ODEs in examples from science & engineering.
- Understand an elementary method for the numerical solution of ODEs and have some familiarity with the solution of ODEs using MATLAB.
- Be introduced to two-point boundary value problems and Fourier series.

Course Outcomes

- Improved problem-solving skills, including knowledge of techniques for the solution of ODES.
- An understanding of the importance of differential equations in the sciences and engineering
- Preparation for further study in science, technology, engineering, and mathematics.

Course Assessment: The assessment of objectives is achieved through homework assignments, weekly quizzes, and common examinations with common grading.

POLICIES

DMS Course Policies: All DMS students must familiarize themselves with, and adhere to, the Department of Mathematical Sciences Course Policies, in addition to official university-wide policies. DMS takes these policies very seriously and enforces them strictly.

Grading Policy: The final grade in this course will be determined as follows:

Homework	8%
Quizzes	12%
MATLAB Assignments	0%
Common Midterm Exam I	20%

Common Midterm Exam II	25%
Final Exam	35%

Your final letter grade will be based on the following tentative curve.

A	88 - 100	**C**	65-71
B+	83 - 87	**D**	60-64
B	77 - 82	**F**	0 - 59
C+	72-76		

Attendance: Attendance at all classes will be recorded and is **mandatory**. Please make sure you read and fully understand the Math Department's Attendance Policy. This policy will be strictly enforced. Quizzes and in-class MATLAB activities

Homework: Weekly homework assignments are listed on the course outline. They are to be handed or uploaded on the Canvas in according to your instructor's schedule. Each week, a 15—20 minute quiz will be given on the material covered in the previous week's homework.

Exams: There will be two common midterm exams held during the semester and one comprehensive common final exam. Exams are held on the following days:

Midterm Exam	
Final Exam Period	May 3 - May 9, 2024

The time of the midterm exams is **4:15—5:40 PM** for daytime students and **5:45—7:10 PM** for evening students. The final exam will test your knowledge of all the course material taught in the entire course. Make sure you read and fully understand the Math Department's Examination Policy. This policy will be strictly enforced.

Makeup Exam Policy: To properly report your absence from a midterm or final exam, please review and follow the required steps under the DMS Examination Policy found here:

- http://math.njit.edu/students/policies_exam.php

Cellular Phones: All cellular phones and other electronic devices must be switched off during all class times.

ADDITIONAL RESOURCES

Math Tutoring Center: Located in the Central King Building, Lower Level, Rm. G11 (See: Spring 2024 Hours)

Further Assistance: For further questions, students should contact their instructor. All instructors have regular office hours during the week. These office hours are listed on the Math Department's webpage for Instructor Office Hours and Emails.

Accommodation of Disabilities: The Office of Accessibility Resources and Services (OARS) offers long term and temporary accommodations for undergraduate, graduate and visiting students at NJIT.

If you are in need of accommodations due to a disability please If you need an accommodation due to a disability please contact the Office of Accessibility Resources and Services at oars@njit.edu. The office is

located in Kupfrian Hall, Room 201. A Letter of Accommodation Eligibility from the Office of Accessibility Resources and Services office authorizing your accommodations will be required.

For further information regarding self identification, the submission of medical documentation and additional support services provided please visit the Office of Accessibility Resources and Services (OARS) website at:

https://www.njit.edu/accessibility/

Important Dates (See: Spring 2024 Academic Calendar, Registrar)

Date	Day	Event
January 16, 2024	Tuesday	First Day of Classes
January 22, 2024	Monday	Last Day to Add/Drop Classes
March 10, 2024	Sunday	Spring Recess Begins
March 16, 2024	Saturday	Spring Recess Ends
March 29, 2024	Friday	Good Friday - No Classes
April 1, 2024	Monday	Last Day to Withdraw
April 30, 2024	Tuesday	Friday Classes Meet
April 30, 2024	Tuesday	Last Day of Classes
May 1, 2024	Wednesday	Reading Day 1
May 2, 2024	Thursday	Reading Day 2
May 3 - May 9, 2024	Friday to Thursday	Final Exam Period

COURSE OUTLINE

Week + Dates	Section # + Topic		Assignments
WEEK 1:	1.1	Some Basic Models; Direction Fields	5, 6, 7, 11, 12, 18
	1.2	Solutions of Some Differential Equations	2, 4, 11
	1.3	Classification of Differential Equations	2, 3, 6, 8, 11
WEEK 2:	2.1	Linear Equations; Integrating Factors	2, 6, 10, 18
	2.1	Integrating Factors (Continued)	23, 24
	2.2	Separable Equations	2, 4, 6, 9, 12
WEEK 3:	2.3	Modeling with First Order Equations	2, 5, 7, 12
	2.7	Numerical Approximation; Euler's Method	2
	MATLAB Project 1		

WEEK 4:	3.1	Homogeneous Equations with Constant Coefficients	2, 6, 8, 10, 13, 16
	3.2	Solutions of Linear Homogeneous Equations and the Wronskian	2, 4, 7, 9, 14, 17, 19, 20, 23
	3.3	Complex Roots of the Characteristic Equation	2, 4, 6, 8, 12, 19
WEEK 5:	3.4	Repeated Roots; Reduction of Order	1, 5, 9, 12, 19
	3.5	Nonhomogeneous Equations; Undetermined Coefficients	2, 4, 8, 13, 14
	REVIEW FOR EXAM 1		
WEEK 6:	3.5	Undetermined Coefficients (Continued)	16(a), 17(a), 21(a)
	3.6	Variation of Parameters	2, 6, 10, 12
	3.7	Mechanical and Electrical Vibrations	1, 3, 4, 6
WEEK 7:	3.7	Vibrations (Continued)	9, 11, 13
	3.8	Forced Vibrations	1, 4, 6
	7.1	System of First Order Linear ODEs	1, 3, 4, 7(a,b)
WEEK 8:	7.2	Review of Matrices	1, 4, 7, 17
	7.3	Review of Linear Algebraic Equations, Eigenvalues, and Eigenvectors (2x2)	15, 16, 17
	7.5	Homogeneous Linear Systems with Constant Coefficients	2(b), 3(b), 5(b), 11
WEEK 9:	7.6	Complex Eigenvalues	1(b), 4(b), 23
	MATLAB Project 2		
	6.1	Definition of the Laplace Transform	3, 5, 10, 12, 19
WEEK 10:	6.2	Laplace Transform Solution of Initial Value Problems	1, 3, 4, 10, 16
	6.3	Step Functions	1, 3, 8, 10, 14, 15
	6.4	ODEs with Discontinuous Forcing Functions	2, 3, 4, 7, 11
WEEK 11:	6.5	Impulse Functions	1, 2, 7
	6.6	The Convolution Integral	4, 5, 8, 9, 14
	5.1	Review of Power Series	15, 17, 18, 19

WEEK 12:	5.2	Series Solutions of Second Order Linear ODEs with Nonconstant Coefficients; Solution Near an Ordinary Point	3(a,b), 5(a,b), 7(a,b)
	5.4	Euler's Equation; Regular Singular Points	3, 6, 12, 17
	REVIEW FOR EXAM 2		
WEEK 13:	5.5	Series Solutions Near a Regular Singular Point, Part I	2, 3
	10.1	Two-Point Boundary Value Problems	1, 3, 5, 14, 15
	10.2	Fourier Series	1, 6, 7, 13, 15
WEEK 14:	10.2	Fourier Series (Continued)	1, 6, 7, 13, 15
	10.4	Even and Odd Functions	19(a,b), 27(a,b)
	REVIEW FOR FINAL EXAM		
WEEK 15:	**REVIEW FOR FINAL EXAM**		
FINAL EXAM PERIOD: May 5 - May 11, 2023			

Updated by Professor W. Choi - 1/12/2023
Department of Mathematical Sciences Course Syllabus, Spring 2024