Fall 2024

MATH 222-H01: Differential Equations

W. Choi

MATH 222 Honors: Differential Equations - Honors
Fall 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: Topics enhance those of Math 222 and concepts are studied in detail. Emphasizes science and engineering applications. Effective From: Fall 2012.

Number of Credits: 4

Prerequisites: MATH 112 H with a grade of B or better or MATH 112 with a grade of A.

Course-Section and Instructors:

Course-Section	Instructor
Math 222-H01	Professor Wooyoung Choi

Office Hours for All Math Instructors: Fall 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 #	WileyPLUS access only: 9781119499619 WileyPLUS access with print text: 9781119499688

University-wide Withdrawal Date: The last day to withdraw with a **W** is **Monday, November 11, 2024**. It will be strictly enforced.

STUDENT RESPONSIBILITIES

- Read and understand the syllabus
- Adhere to all policies and procedures
- Report conflicts and/or special circumstances in a timely manner
- Report any instances of violations of Academic Integrity to your Instructor
- Communicate directly with your Instructor on ALL course-related matters, including material, procedures, policies and exams.
- Effectively manage time and devote sufficient time to succeeding in this course
- Keep track of your grades
- Make use of all resources available to help you learn
- Be respectful of peers and your instructor
- Accept responsibility for your grades – requests for extra credit opportunities will be denied

COURSE GOALS

Course Objectives

- Students should (a) learn elementary analytical solution techniques for the solution of ordinary differential equations (ODEs), (b) understand the solution structure of linear ODEs in terms of independent homogeneous solutions and non-homogeneous solutions, and (c) interpret the solutions using plots and methods of calculus. Students should (a) understand by exposure to examples how systems and phenomena from science and engineering can be modeled by ODEs, and (b) how solution of such a model can be used to analyze or predict a system's behavior. A key example is the damped, forced, simple harmonic oscillator.
- Students should understand the role of initial value problems for ODEs in examples from science engineering, and should be introduced to the role of two-point boundary value problems and Fourier series.
- Students should understand an elementary method for the numerical solution of ODEs and have some familiarity with the solution of ODEs using MATLAB.

Course Outcomes

- Students have improved problem-solving skills, including knowledge of techniques for the solution of ODEs.
- Students have an understanding of the importance of differential equations in the sciences and engineering.
- Students should be prepared for further study in science, technology, engineering, and mathematics.

Course Assessment: The assessment of objectives is achieved through homework assignments and examinations.

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:

Quiz/HW	15%
Matlab Projects	10%
Common Midterm Exam I	15%
Common Midterm Exam II	15%
Common Midterm Exam III	15%
Final Exam	30%

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

A	88 - 100	**C**	61 - 65
B+	81 - 87	**D**	56 - 60
B	71 - 80	**F**	0 - 55
C+	66 - 70		

Attendance Policy: 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: Quizzes will be given approximately once a week throughout the semester. They will be based on the lecture, suggested problems in the course outline below, homework and the in-class discussions.

Homework: Suggested problems chosen from the text are listed below. Students are recommended to work through these problems after each lecture to gain a better understanding of the course material. Additional problem sets will be assigned during the semester.

In class participation: This course will incorporate inquiry-based learning, which heavily relies on classroom discussions, group work, and informal class presentations. Participation will be assessed for various activities from the Inquiry Oriented Differential Equations (IODE) course notes that will be provided during the semester (these activities are described after the course outline below).

Exams: There will be three midterm exams held during the semester and one comprehensive final exam. Midterm exams will be held during normal class hours on the following days:

Midterm Exam I	September 27, 2024 (Friday)
Midterm Exam II	October 29, 2024 (Tuesday)
Midterm Exam III	November 22, 2024 (Friday)
Final Exam Period	December 15 to December 21, 2024

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: There will be **NO MAKE-UP QUIZZES OR EXAMS** during the semester. In the event an exam is not taken under rare circumstances where the student has a legitimate reason for missing the exam, the student should contact the Dean of Students office and present written verifiable proof of the reason for missing the exam, e.g., a doctor's note, police report, court notice, etc. clearly stating the date AND time of the mitigating problem. The student must also notify the Math Department Office/Instructor that the exam will be missed.

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: Fall 2023 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 need accommodation due to a disability, please contact the Office of Accessibility Resources and Services at oars@njit.edu, or visit Kupfrian Hall 201 to discuss your specific needs. A Letter of Accommodation Eligibility from the office authorizing student accommodations is 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: Fall 2024 Academic Calendar, Registrar)

Date	Day	Event
September 2, 2024	Monday	Labor Day
September 3, 2024	Tuesday	First Day of Classes
September 9, 2024	Monday	Last Day to Add/Drop Classes
November 11, 2024	Monday	Last Day to Withdraw
November 26, 2024	Tuesday	Thursday Classes Meet
November 27, 2024	Wednesday	Friday Classes Meet
November 28 to December 1, 2024	Thursday and Sunday	Thanksgiving Recess - Closed
December 11, 2024	Wednesday	Last Day of Classes
December 12, 2024	Thursday	Reading Day 1
December 13, 2024	Friday	Reading Day 2
December 15 to December 21, 2024	Sunday to Saturday	Final Exam Period

Course Outline

Week	Textbook Section # + Topic		Assignments
WEEK 1:	1.1	Some Basic Models; Direction Fields	5, 6, 7, 11, 12, 19
	1.2	Solutions of Some Differential Equations	1, 2, 4, 6, 9, 11, 12
	1.3	Classification of Differential Equations	6(c), 8(c), 10, 11, 13(b,c)
WEEK 2:	2.1	Linear Equations; Integrating Factors	17, 18, 21, 23, 24, 25
	2.2	Separable Equations	2, 4, 6, 9, 12
	2.3	Modeling with First Order Equations	2, 5, 7, 12, 14(a)
WEEK 3:	2.7	Numerical Approximation; Euler's Method	2
	3.1	Homogeneous Equations with Constant Coefficients	3, 5, 6, 8, 10, 13, 15, 16
	3.2	Solutions of Linear Homogeneous Equations; the Wronskian	2, 4, 7, 9, 14, 17, 19, 20, 23
WEEK 4:	**REVIEW FOR EXAM 1**		
	EXAM 1		
WEEK 5:	3.3	Complex Roots of the Characteristic Equation	1, 2, 4, 5, 8, 12, 19
	3.4	Repeated Roots; Reduction of Order	1, 5, 7, 9, 11, 12, 19, 22
	3.5	Nonhomogeneous Equations; Undetermined Coefficients	2, 4, 8, 13, 14, 16(a), 17(a), 21(a)
WEEK 6:	3.6	Variation of Parameters	2, 6, 7, 9, 10, 12, 13
	3.7	Mechanical and Electrical Vibrations	1, 2, 3, 4, 6, 7, 9, 11, 12, 13
WEEK 7:	3.8	Forced Vibrations	1, 4, 6
	7.1	System of First Order Linear ODEs	1, 3, 4, 7(a,b)
	7.2	Review of Matrices	1, 2, 4, 7, 17
WEEK 8:	7.3	Review of Linear Algebraic Equations, Eigenvalues, and Eigenvectors (2x2)	14, 15, 16
	7.5	Homogeneous Linear Systems with Constant Coefficients	2b, 3b, 5b, 10, 11
	REVIEW FOR EXAM 2		
WEEK 9:	**EXAM 2**		
	7.6	Complex Eigenvalues	1(b), 4(b), 8, 11, 14, 23
	5.1	Review of Power Series	15, 17, 18, 19
WEEK 10:	5.2	Series Solutions of Second Order Linear ODEs with Nonconstant Coefficients; Solution Near an Ordinary Point	3(a,b), 5(a,b),6(a,b),7(a,b)

	5.4	Euler's Equation; Regular Singular Points	1, 3, 6, 12, 17
	5.5	Series Solutions Near a Regular Singular Point, Part I	1, 2, 3, 18
WEEK 11:	6.1 6.2	Definition of the Laplace Transform and Solution of Initial Value Problems	(6.1) 3, 5, 10, 12, 16, 19, 20, 21, (6.2) 1, 2, 3, 4, 6, 10, 16, 17
	6.3	Step Functions	(6.3) 1, 3, 5, 8, 10, 12,14, 15; (6.4) 2, 3, 4, 7
	6.4	ODEs with Discontinuous Forcing Functions	11, 14
WEEK 12:	**REVIEW FOR EXAM 3**		
	EXAM 3		
WEEK 13:	6.5	Impulse Functions	1, 2, 7
	6.6	The Convolution Integral	4, 5, 7, 8, 9, 14
WEEK 14:	10.1	Two-Point Boundary Value Problems	1, 3, 5, 10, 14, 15, 18
	10.2	Fourier Series	1, 5, 6, 7, 13, 15, 16,19(a,b), 20(a,b), 22(a,b)
	10.4	Even and Odd Functions	2, 3, 4, 7, 9, 15, 16, 21,23(a,b), 27(a,b)
WEEK 15:	**REVIEW FOR FINAL EXAM**		
WEEK 16:	**Final Exam Period**		