

## MATH 222: Differential Equations *Spring 2021 Coordinated 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.

**DMS Online Exam Policy Spring 2021:** Exams will be proctored using both Respondus LockDown Browser+Monitor and Webex. Students will be required to join a Webex meeting from their phone with their cameras on, and to access the exam through LockDown Browser on a Mac or Windows PC with webcam. Students must follow all instructions related to environment checks and camera positioning.

Please be sure you read and fully understand our [DMS Online Exam Policy](#).

### 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 S. Alptekin
Math 222-004	Professor R. Goodman
Math 222-006	Professor J. Ratnaswamy
Math 222-008	Professor M. Potocki-Dul
Math 222-010	Professor J. Ratnaswamy
Math 222-012	Professor S. Alptekin
Math 222-014	Professor R. Goodman
Math 222-018	Professor B. Patiak
Math 222-020	Professor M. Potocki-Dul
Math 222-102	Professor J. Ratnaswamy
Math 222-104	Professor C. Turc

Office Hours for All Math Instructors: [Spring 2021 Office Hours and Emails](#)

Required Textbook:

Title	<i>Elementary Differential Equations and Boundary Value Problems</i>
Author	Boyce and DiPrima
Edition	11th
Publisher	John Wiley & Sons, Inc.
ISBN #	978-1119447399
Website	<a href="https://roygoodman.net/courses/math222/">https://roygoodman.net/courses/math222/</a>

**Additional Information:** Some review materials are on the [course homepage](#). Exam solutions, and MATLAB help are also posted there.

**University-wide Withdrawal Date:** The last day to withdraw with a **W** is **Monday, April 5, 2021**. It will be strictly enforced.

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## COURSE GOALS

### Course Objectives

- Students should:
  - learn elementary analytical solution techniques for the solution of ordinary differential equations (ODEs)
  - understand the solution structure of linear ODEs in terms of independent homogeneous solutions and non-homogeneous solutions
  - interpret the solutions using plots and methods of calculus.
  - understand by exposure to examples how systems and phenomena from science and engineering can be modeled by ODEs. A principle example will be 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, 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.
  - 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.
- Prepared for further study in science, technology, engineering, and mathematics.

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

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## 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	10%
Quizzes	10%

MATLAB Assignments	8%
Common Midterm Exam I	16%
Common Midterm Exam II	16%
Common Midterm Exam III	16%
Final Exam	24%

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

A	88 - 100	C	58 - 63
B+	83 - 87	D	45 - 57
B	73 - 82	F	0 - 44
C+	64 - 72		

**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.

**Homework Policy:** Homework is to be completed using the online WileyPLUS platform which is accessed through the Math 222 Commons Canvas page. Problems corresponding to each week's lectures are due Monday night of the following week. There is a 25% penalty for late work. In the few sections with no WileyPLUS problems available, students are to do the work assigned for that section in the syllabus and upload the work to the Commons Canvas page.

**WileyPLUS Regrading Policy:** WileyPLUS homework is worth 10% of the class grade. That's about one letter grade. Therefore it is imperative that students do all of the assignments. On the other hand, there are well over 100 problems assigned over the course of the semester, making each individual problem worth less than 0.1% of the overall grade and very unlikely to effect any student's letter grade. Therefore, our policy is not to adjust scores on individual problems.

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

Common Midterm Exam I	February 10, 2021
Common Midterm Exam II	March 10, 2021
Common Midterm Exam III	April 21, 2021
Final Exam Period	May 7 - 13, 2021

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](http://math.njit.edu/students/policies_exam.php)

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

## ADDITIONAL RESOURCES

**Math Tutoring Center:** Located in the Central King Building, Lower Level, Rm. G11 (See: [Spring 2021 Hours](#))

**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 contact Chantonette Lyles, Associate Director of the Office of Accessibility Resources and Services at [973-596-5417](tel:973-596-5417) or via email at [lyles@njit.edu](mailto:lyles@njit.edu). The office is located in Kupfrian Hall, Room 201. A Letter of Accommodation Eligibility from the Office of Accessibility Resources and Services 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 (OARS) website at:

- <https://www.njit.edu/studentsuccess/accessibility/>

**Important Dates** (See: [Spring 2021 Academic Calendar, Registrar](#))

Date	Day	Event
January 19, 2021	T	First Day of Classes
January 23, 2021	S	Saturday Classes Begin
January 25, 2021	M	Last Day to Add/Drop Classes
March 14 - March 21, 2021	Su - Su	Spring Recess - No Classes
April, 2, 2021	F	Good Friday - No Classes
April 5, 2021	M	Last Day to Withdraw
May 4, 2021	T	Friday Classes Meet
May 4, 2021	T	Last Day of Classes
May 5 & May 6, 2021	W & R	Reading Days
May 7 - May 13, 2021	F - R	Final Exam Period

## Course Outline

Week + Dates	Section # + Topic		HW Problem Numbers
<b>WEEK 1:</b> 1/19–1/22	1.1	Some Basic Models; Direction Fields	5, 6, 7, 11, 12, 19
	1.2	Solutions of Some Differential Equations	1, 7 (should say $dp/dt$ ), 10
	1.3	Classification of Differential Equations	1, 2, 4, 6, 9, 11, 12
<b>WEEK 2:</b> 1/25–1/29	2.1	Linear Equations; Integrating Factors	6(c), 8(c), 10, 11, 13(b,c), 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)
<b>WEEK 3:</b> 2/1–2/5 <i>Matlab Assignment #1 Due</i>	2.5	Autonomous Equations and Population Dynamics	2, 4, 6, 8, 10, 11
	2.7	Numerical Approximation; Euler's Method	2
	3.1	Homogeneous Equations with Constant Coefficients	3, 5, 6, 8, 10, 13, 15, 16

<b>WEEK 4:</b> 2/8–2/12	<b>COMMON EXAM 1: WEDNESDAY, FEBRUARY 10, 2021</b>		
	3.2	Solutions of Linear Homogeneous Equations and the Wronskian	2, 4, 5, 7, 9, 14, 17, 19, 20, 21, 23
	3.3	Complex Roots of the Characteristic Equation	1, 2, 4, 5, 8, 12, 19
<b>WEEK 5:</b> 2/15–2/19	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)
<b>WEEK 6:</b> 2/22–2/26 <i>Matlab assignment #2 due</i>	3.6	Variation of Parameters	2, 6, 7, 9, 10, 12, 13
	3.7	Mechanical and Electrical Vibrations	1, 2, 3, 4, 6, 7
<b>WEEK 7:</b> 3/1–3/5	3.8	Forced Vibrations	1, 4, 6
	5.1	Review of Power Series	15, 17, 18, 19
<b>WEEK 8:</b> 3/8–3/12	<b>COMMON EXAM 2: WEDNESDAY, MARCH 10, 2021</b>		
	5.2	Series Solutions of Variable Coefficient Second Order Linear ODEs	3(a,b), 5(a,b), 6(a,b), 7(a,b)
	6.1	Definition of the Laplace Transform	3, 5, 10, 12, 16, 19, 20, 21
<b>SPRING RECESS, MARCH 14 - 21, 2021</b>			
<b>WEEK 9:</b> 3/22–3/26	6.2	Laplace Transform Solution of Initial Value Problems	1, 2, 3, 4, 6, 10, 16, 17
	6.3	Step Functions	1, 3, 5, 8, 10, 12, 14, 15
	6.4	ODEs with Discontinuous Forcing Functions	2, 3, 4, 7, 11, 14
<b>WEEK 10:</b> 3/29–4/2	6.5	Impulse Functions	1, 2, 7
	6.6	The Convolution Integral	4, 5, 7, 8, 9, 14
<b>WEEK 11:</b> 4/5–4/9 <i>Matlab lab #3 due</i>	7.1	System of First Order Linear ODEs	1, 3, 4, 7(a,b)
	7.2	Review of Matrices	1, 2, 4, 7, 17
<b>WEEK 12:</b> 4/12-4/16	7.3	Review of Linear Algebraic Equations, Eigenvalues, and Eigenvectors (2x2)	14, 15, 16
	7.4	Some Theory for Linear Systems of ODE	none
	7.5	Homogeneous Linear Systems with Constant Coefficients	2b, 3b, 5b, 10, 11
<b>WEEK 13:</b> 4/19–4/23 <i>Matlab Lab #4 due</i>	<b>COMMON EXAM 3: WEDNESDAY, APRIL 21, 2021</b>		
	7.6	Complex Eigenvalues	1b, 4b, 8, 11, 14, 23
	10.1 + supplement	Two-Point Boundary Value Problems + Supplement	1, 3, 5, 10, 14, 15, 18 + problems from supplement
<b>WEEK 14:</b> 4/26–4/30	10.2	Fourier Series	1, 5, 6, 7, 13, 15, 16, 19(a,b), 20(a,b), 22(a,b)
	10.4 + supplement	Even and Odd Functions (plus PDF supplement on Fourier Series for BVP)	2, 3, 4, 7, 9, 15, 16, 21, 23(a,b), 27(a,b) + problems from supplement
	<b>REVIEW FOR FINAL EXAM</b>		

WEEK 15: 5/3-5/4, REVIEW FOR FINAL EXAM

FINAL EXAM PERIOD: MAY 7 - 13, 2021

*Updated by Professor R. Goodman- 2/15/2021  
Department of Mathematical Sciences Course Syllabus, Spring 2021*

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