MATH 222 Honors: Differential Equations - Honors
Fall 2021 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 Fall 2021: In the event it is determined that DMS will conduct Common Exams online during Fall 2021, those exams will be administered in Canvas with proctoring using both Respondus LockDown Browser+Monitor on a computer (PC or Mac only; iPad and Chromebooks are not currently supported) and Webex on a phone or secondary device.

Please be sure you read and fully understand our DMS Online Exam Policy.

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 C. Frederick

Office Hours for All Math Instructors: Fall 2021 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 **Wednesday, November 10, 2021**. 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	17%
Common Midterm Exam I	17%

Common Midterm Exam II	17%
Common Midterm Exam III	17%
Final Exam	32%

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

A	85 - 100	**C**	65 - 69
B+	80 - 84	**D**	60 - 64
B	75 - 79	**F**	0 - 59
C+	70 - 74		

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 in order to gain a better understanding of the course material. Seven or eight additional problem sets will be assigned during the course of the semester. These are an extremely important component of the homework grade.

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	Tuesday, September 21
Midterm Exam II	Tuesday, October 19
Midterm Exam III	Friday, November 19
Final Exam Period	December 15 – 21, 2021

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 2021 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 contact Scott Janz, Associate Director of Disability Support Services at 973-596-5417 or via email at scott.p.janz@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/studentsuccess/accessibility/

Important Dates (See: Fall 2021 Academic Calendar, Registrar)

Date	Day	Event
September 1, 2021	Wednesday	First Day of Classes
September 4, 2021	Saturday	Saturday Classes Begin
September 6, 2021	Monday	Labor Day
September 8, 2021	Wednesday	Monday Classes Meet
September 8, 2021	Wednesday	Last Day to Add/Drop Classes
November 10, 2021	Wednesday	Last Day to Withdraw
November 25 to November 28, 2021	Thursday to Sunday	Thanksgiving Recess - Closed
December 10, 2021	Friday	Last Day of Classes
December 13 and December 14, 2021	Monday and Tuesday	Reading Days
December 15 to December 21, 2021	Wednesday to Tuesday	Final Exam Period

Course Outline

Week	Section # + Topic			Suggested Problems
WEEK 1:	1.1	Some Basic Models; Direction Fields	1	5, 6, 7, 11, 12, 19

	1.2	Solutions of Some Differential Equations	2	1, 2, 4, 6, 9, 11, 12
	1.3	Classification of Differential Equations	3	6(c), 8(c), 10, 11, 13(b,c)
WEEK 2:	2.1	Linear Equations; Integrating Factors	3	17, 18, 21, 23, 24, 25
	2.2	Separable Equations	4	2, 4, 6, 9, 12
	2.3	Modeling with First Order Equations	5	2, 5, 7, 12, 14(a)
WEEK 3:	2.7	Numerical Approximation; Euler's Method	6	2
	3.1	Homogeneous Equations with Constant Coefficients	7	3, 5, 6, 8, 10, 13, 15, 16
	REVIEW FOR EXAM 1			
WEEK 4:	**COMMON EXAM 1**			
	3.2	Solutions of Linear Homogeneous Equations and the Wronskian	8	2, 4, 5, 7, 9, 14, 17, 19, 20, 21, 23
WEEK 5:	3.3	Complex Roots of the Characteristic Equation	9	1, 2, 4, 5, 8, 12, 19
	3.4	Repeated Roots; Reduction of Order	10	1, 5, 7, 9, 11, 12, 19, 22
WEEK 6:	3.5	Nonhomogeneous Equations; Undetermined Coefficients	11	2, 4, 8, 13, 14
	3.5	Undetermined Coefficients (Continued)	11	16(a), 17(a), 21(a)
	3.6	Variation of Parameters	12	2, 6, 7, 9, 10, 12, 13
	3.7	Mechanical and Electrical Vibrations	13	1, 2, 3, 4, 6, 7
WEEK 7:	3.7	Vibrations (Continued)	13	9, 11, 12, 13
	3.8	Forced Vibrations	14	1, 4, 6
	REVIEW FOR EXAM 2		15	
WEEK 8:	**COMMON EXAM 2**			
	5.1	Review of Power Series	16	15, 17, 18, 19
	5.2	Series Solutions of Second Order Linear ODEs with Nonconstant Coefficients; Solution Near an Ordinary Point	17	3(a,b), 5(a,b),6(a,b),7(a,b)
	5.4	Euler's Equation; Regular Singular Points	18	1, 3, 6, 12, 17
WEEK 9:	5.5	Series Solutions Near a Regular Singular Point, Part I	19	1, 2, 3, 18
	6.1 and 6.2	Definition of the Laplace Transform and Solution of Initial Value Problems	20	(6.1) 3, 5, 10, 12, 16, 19, 20, 21, (6.2) 1, 2, 3, 4
	6.2	Initial Value Problems (Continued)	21	(6.2) 6, 10, 16, 17

WEEK 10:	6.3	Step Functions	22	(6.3) 1, 3, 5, 8, 10, 12,14, 15; (6.4) 2, 3, 4, 7
	6.4	ODEs with Discontinuous Forcing Functions	23	11, 14
	6.5	Impulse Functions	24	1, 2, 7
WEEK 11:	6.6	The Convolution Integral	25	4, 5, 7, 8, 9, 14
	7.1	System of First Order Linear ODEs	26	1, 3, 4, 7(a,b)
	7.2	Review of Matrices	27	1, 2, 4, 7, 17
WEEK 12:	7.3	Review of Linear Algebraic Equations, Eigenvalues, and Eigenvectors (2x2)	28	14, 15, 16
	REVIEW FOR EXAM 3		29	2b, 3b, 5b, 10, 11
	EXAM 3		30	
WEEK 13:	7.5	Homogeneous Linear Systems with Constant Coefficients	7.5	Homogeneous Linear Systems with Constant Coefficients
	7.6	Complex Eigenvalues	31	1(b), 4(b), 8, 11, 14, 23
	10.1	Two-Point Boundary Value Problems	32	1, 3, 5, 10, 14, 15, 18
	10.2	Fourier Series	33	1, 5, 6, 7, 13, 15, 16
WEEK 14:	10.2	Fourier Series (Continued)	34	19(a,b), 20(a,b), 22(a,b)
	10.4	Even and Odd Functions	35	2, 3, 4, 7, 9, 15, 16, 21,23(a,b), 27(a,b)
	REVIEW FOR FINAL EXAM		36	
WEEK 15:	**REVIEW FOR FINAL EXAM**		36	
WEEK 16	**FINAL EXAM PERIOD:** December 15 – 21, 2021			

Updated by Professor C. Frederick - 8/26/2021
Department of Mathematical Sciences Course Syllabus, Fall 2021