NJIT New Jersey's Science & Technology University

THE COLLEGE OF SCIENCE AND LIBERAL ARTS

THE DEPARTMENT OF MATHEMATICAL SCIENCES

MATH 222-H01: Differential Equations - Honors
Fall 2020 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 Fall 2020: 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: 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 112H 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 J. Bechtold

Office Hours for All Math Instructors: Fall 2020 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
Website	http://web.njit.edu/~bechtold/222homepage.html

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, November 9, 2020**. 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 common examinations with common grading. Homework assignments chosen from the text are listed below. Students are required 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.

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:

Weekly Quiz/HW	25%
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	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.

New Policy for Exams and Quizzes: 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.

At the beginning of the semester, the DMS Exam Coordinator will provide students with a demonstration video and instructions of expected behavior and procedures, including what is expected in an environment check.

Quizzes: Quizzes will be given approximately once a week throughout the semester. They will be based on the lecture, homework and the in-class discussions. Quizzes will be administered in Canvas using the same method of proctoring as described in the DMS Policy for Exams and Quizzes. Students will have approximately 20 minutes to write solutions to their quiz, and then must upload their written work within 5 minutes of completing the quiz. If a student experiences difficulty uploading their work to Canvas, they MUST email their work to their instructor immediately.

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:s

Midterm Exam I	September 25/26, 2020
Midterm Exam II	October 16/17, 2020
Midterm Exam III	November 6/7, 2020
Final Exam Period	December 15 - 21, 2020

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 and put away during all class times.

ADDITIONAL RESOURCES

Math Tutoring Center: Located in the Central King Building, Lower Level, Rm. G11 (See: Fall 2020 Hours)

Accommodation of Disabilities: The Office of Accessibilty and Servuces (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 Office of Accessibility Resources and Services at 973-596-5417 or via email at 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 Disability Support Services (DSS) website at:

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

Important Dates (See: Fall 2020 Academic Calendar, Registrar)

Date	Day	Event
September 1, 2020	T	First Day of Classes
September 5, 2020	S	Saturday Classes Begin
September 7, 2020	M	Labor Day
September 8, 2020	T	Monday Classes Meet
September 8, 2020	T	Last Day to Add/Drop Classes
November 9, 2020	M	Last Day to Withdraw
November 25, 2020	W	Friday Classes Meet
November 26-29, 2020	R - Su	Thanksgiving Recess - University Closed
December 10, 2020	R	Last Day of Classes
December 11 & 14, 2020	F & M	Reading Days
December 15 - 21, 2020	T - M	Final Exam Period

Course Outline

Week + Dates	Section # + Topic			HW Problem Numbers
WEEK 1:	1.1	Some Basic Models; Direction Fields	1	HWK 5, 6, 7, 11, 12, 19
	1.2	Solutions of Some Differential Equations	2	HWK 1, 2, 4, 6, 9, 11, 12
	1.3	Classification of Differential Equations	3	HWK 6(c), 8(c), 10, 11, 13(b,c)
WEEK 2:	2.1	Linear Equations; Integrating Factors	3	HWK 17, 18, 21, 23, 24, 25
	2.2	Separable Equations	4	HWK 2, 4, 6, 9, 12

	2.3	Modeling with First Order Equations	5	HWK 2, 5, 7, 12, 14(a)
WEEK 3:	2.7	Numerical Approximation; Euler's Method	6	HWK 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	HWK 2, 4, 5, 7, 9, 14, 17, 19, 20, 21, 23
WEEK 5:	3.3	Complex Roots of the Characteristic Equation	9	HWK 1, 2, 4, 5, 8, 12, 19
	3.4	Repeated Roots; Reduction of Order	10	HWK 1, 5, 7, 9, 11, 12, 19, 22
WEEK 6:	3.5	Nonhomogeneous Equations; Undetermined Coefficients	11	HWK 2, 4, 8, 13, 14
	3.5	Undetermined Coefficients (Continued)	11	HWK 16(a), 17(a), 21(a)
	3.6	Variation of Parameters	12	HWK 2, 6, 7, 9, 10, 12, 13
	3.7	Mechanical and Electrical Vibrations	13	HWK 1, 2, 3, 4, 6, 7
WEEK 7:	3.7	Vibrations (Continued)	13	HWK 9, 11, 12, 13
	3.8	Forced Vibrations	14	HWK 1, 4, 6
	REVIEW FOR EXAM 2		15	
WEEK 8:	**COMMON EXAM 2**			
	5.1	Review of Power Series	16	HWK 15, 17, 18, 19
	5.2	Series Solutions of Second Order Linear ODEs with Non-constant Coefficients; Solution Near an Ordinary Point	17	HWK 3(a,b), 5(a,b),6(a,b),7(a,b)
	5.4	Euler's Equation; Regular Singular Points	18	HWK 1, 3, 6, 12, 17
WEEK 9:	5.5	Series Solutions Near a Regular Singular Point, Part I	19	HWK 1, 2, 3, 18
	6.1 and 6.2	Definition of the Laplace Transform and Solution of Initial Value Problems	20	HWK (6.1) 3, 5, 10, 12, 16, 19, 20, 21, (6.2) 1, 2, 3, 4
	6.2	Initial Value Problems (Continued)	21	HWK (6.2) 6, 10, 16, 17
WEEK 10:	6.3	Step Functions	22	HWK (6.3) 1, 3, 5, 8, 10, 12,14, 15; (6.4) 2, 3, 4, 7
	6.4	ODEs with Discontinuous Forcing Functions	23	HWK 11, 14
	6.5	Impulse Functions	24	HWK 1, 2, 7
WEEK 11:	6.6	The Convolution Integral	25	HWK 4, 5, 7, 8, 9, 14
	7.1	System of First Order Linear ODEs	26	HWK 1, 3, 4, 7(a,b)
	7.2	Review of Matrices	27	HWK 1, 2, 4, 7, 17
WEEK 12:	7.3	Review of Linear Algebraic Equations, Eigenvalues, and Eigenvectors (2x2)	28	14, 15, 16
	7.5	Homogeneous Linear Systems with Constant Coefficients	29	2b, 3b, 5b, 10, 11
	REVIEW FOR EXAM 3		30	
WEEK 13:	**COMMON EXAM 3**			
	7.6	Complex Eigenvalues	31	HWK 1(b), 4(b), 8, 11, 14,

				23
	10.1	Two-Point Boundary Value Problems	32	HWK 1, 3, 5, 10, 14, 15, 18
	10.2	Fourier Series	33	HWK 1, 5, 6, 7, 13, 15, 16
WEEK 14:	10.2	Fourier Series (Continued)	34	HWK 19(a,b), 20(a,b), 22(a,b)
	10.4	Even and Odd Functions	35	HWK 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, 2020**			