NJIT New Jersey's Science & Technology University

THE COLLEGE OF SCIENCE AND LIBERAL ARTS

THE DEPARTMENT OF MATHEMATICAL SCIENCES

MATH 222H: Differential Equations - Honors
Spring 2019 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 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-H02	Professor J. Bechtold

Office Hours for All Math Instructors: Spring 2019 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, April 8, 2019**. It will be strictly enforced.

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:

Homework, Quizzes, and MATLAB	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.

Exams: There will be three midterm exams held during the semester and one comprehensive final exam. **NOTE: Honors Midterm Exams will be held during normal class hours the Thursday after Non-Honors Common Exams.** The Non-Honors Common Exam schedule is as follows:

Common Midterm Exam I	February 13, 2019
Common Midterm Exam II	March 13, 2019
Common Midterm Exam III	April 24, 2019
Final Exam Period	May 10 - 16, 2019

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: Spring 2019 Hours)

Accommodation of Disabilities: Disability Support Services (DSS) 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 Disability Support Services at 973-596-5417 or via email at lyles@njit.edu. The office is located in Fenster Hall Room 260. A Letter of Accommodation Eligibility from the Disability Support 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 Disability Support Services (DSS) website at:

- http://www5.njit.edu/studentsuccess/disability-support-services/

Important Dates (See: Spring 2019 Academic Calendar, Registrar)

Date	Day	Event
January 22, 2019	T	First Day of Classes
February 1, 2019	F	Last Day to Add/Drop Classes
March 17 - 24, 2019	Su - Su	Spring Recess - No Classes, NJIT Open
April 8, 2019	M	Last Day to Withdraw
April 19, 2019	F	Good Friday - No Classes, NJIT Closed
May 7, 2019	T	Friday Classes Meet/ Last Day of Classes
May 8 & 9, 2019	W & R	Reading Days
May 10 - 16, 2019	F - R	Final Exam Period

Course Outline

Week +			

Dates	Section # + Topic			HW Assignments
WEEK 1	1.1	Some Basic Models; Direction Fields	1	HWK 5, 6, 7, 11, 12, 19
	1.3	Classification of Differential Equations	2	HWK 1, 2, 4, 6, 9, 11, 12
	2.1	Linear Equations; Integrating Factors	3	HWK 6(c), 8(c), 10, 11, 13(b,c)
WEEK 2	2.1	Linear Equations; Integrating Factors (Continued)	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	HWK 3, 5, 6, 8, 10, 13, 15, 16
	REVIEW FOR EXAM 1			
WEEK 4	**COMMON EXAM 1**			
	3.2	Solutions of Linear Homogeneous Equations: 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: MAY 10 - 16, 2019**			