NJIT New Jersey's Science & Technology University

THE COLLEGE OF SCIENCE AND LIBERAL ARTS

THE DEPARTMENT OF MATHEMATICAL SCIENCES

MATH 222: Differential Equations
Fall 2018 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: 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 222-001	Professor V. Barreto-Aranda
Math 222-003	Professor M. Michal
Math 222-009	Professor M. Michal
Math 222-011	Professor P. Ward
Math 222-013	Professor R. Bouayad
Math 222-017	Professor R. Bouayad
Math 222-023	Professor M. Potocki-Dul
Math 222-029	Professor M. Potocki-Dul
Math 222-101	Professor D. Blackmore

Office Hours for All Math Instructors: Fall 2018 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 12, 2018**. 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.

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	10%
Common Midterm Exam I	20%
Common Midterm Exam II	20%
Common Midterm Exam III	20%
Final Exam	30%

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

A	88 - 100	**C**	60 - 65
B+	83 - 87	**D**	45 - 59
B	75 - 82	**F**	0 - 44

C+	66 - 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.

Homework and Quiz Policy: Weekly homework assignments are listed on the course outline. They are to be handed in according to your instructor's schedule. Each week, a 15-20 minute quiz will be given on the material covered in the previous week's homework.

MATLAB Assignments: There will be several MATLAB assignments. Some helpful material is on the course homepage. Math Department MATLAB TAs hold office hours. See here for details.

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	September 26, 2018
Common Midterm Exam II	October 24, 2018
Common Midterm Exam III	November 28, 2018
Final Exam Period	December 15 - 21, 2018

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

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 2018 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: Fall 2018 Academic Calendar, Registrar)

Date	Day	Event
September 4, 2018	T	First Day of Classes
September 10, 2018	M	Last Day to Add/Drop Classes

November 12, 2018	M	Last Day to Withdraw
November 20, 2018	T	Thursday Classes Meet
November 21, 2018	W	Friday Classes Meet
November 22 - 25, 2018	R - Su	Thanksgiving Recess
December 12, 2018	W	Last Day of Classes
December 13 & 14, 2018	R & F	Reading Days
December 15 - 21, 2018	Sa - F	Final Exam Period

Course Outline

Week + Dates	Section #	Topic		HW Assignments
WEEK 1: 09/05-09/08	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: 09/11-09/15	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: 09/18-09/22	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: 09/25-09/29	**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: 10/02-10/06	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: 10/09-10/13	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: 10/16-10/20	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: 10/23-10/27	**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-	17	HWK 3(a,b),

		constant Coefficients; Solution Near an Ordinary Point		5(a,b),6(a,b),7(a,b)
	5.4	Euler's Equation; Regular Singular Points	18	HWK 1, 3, 12, 17
WEEK 9: 10/30-11/03	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: 11/06-11/10	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: 11/13-11/17	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: 11/20-11/24	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: 11/27-12/01	**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: 12/04-12/08	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: 12/11-12/13	**REVIEW FOR FINAL EXAM**		36	
WEEK 16: 12/15-12/21	**FINAL EXAM PERIOD: DECEMBER 15 - 21, 2018**			