NJIT New Jersey's Science & Technology University

THE COLLEGE OF SCIENCE AND LIBERAL ARTS

THE DEPARTMENT OF MATHEMATICAL SCIENCES

MATH 222: Differential Equations
Fall 2016 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 Y.-N. Young
Math 222-003	Professor C. Turc
Math 222-005	TBD
Math 222-007	Professor N. Tsipenyuk
Math 222-009	Professor M. Potocki-dul
Math 222-011	Professor M. Potocki-dul
Math 222-101	Professor J. Ratnaswamy
Math 222-103	TBD

Required Textbook:

Title	*Elementary Differential Equations and Boundary Value Problems*
Author	Boyce and DiPrima
Edition	10th
Publisher	John Wiley & Sons, Inc.
ISBN #	978-0470458310
Website	https://web.njit.edu/~yyoung/M222Fall2016/M222Fall16.html

University-wide Withdrawal Date:The last day to withdraw with a **W** is **Monday, November 7, 2016**. 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), and (b) understand the solution structure of linear ODEs in terms of independent homogeneous solutions and non-homogeneous solutions.
- 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 are 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	90 - 100	**C**	60 - 65
B+	85 - 89	**D**	45 - 59
B	75 - 84	**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 Policy: When there is no exam scheduled, homework will be collected once a week during those

weeks. Each week one or two problems will be graded. The selected problem(s) to be graded will be the same for all sessions.

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 28, 2016
Common Midterm Exam II	October 26, 2016
Common Midterm Exam III	November 30, 2016
Final Exam Period	December 16 - 22, 2016

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 their absence during a midterm or final exam, please review 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 during all class times.

ADDITIONAL RESOURCES

Math Tutoring Center: Located in Cullimore, Room 214 (See: Fall 2016 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. 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 2016 Academic Calendar, Registrar)

Date	Day	Event
September 6, 2016	T	First Day of Classes
September 12, 2016	M	Last Day to Add/Drop Classes
November 7, 2016	M	Last Day to Withdraw
November 22, 2016	T	Thursday Classes Meet
November 23, 2016	W	Friday Classes Meet
November 24 - 27, 2016	R - Su	Thanksgiving Holiday, University Closed
December 14, 2016	W	Last Day of Classes
December 15, 2016	R	Reading Day
December 16 - 22, 2016	F - R	Final Exam Period

Course Outline

Week + Dates	Section # + Topic		& HW Assignments	
WEEK 1: 09/06-09/09	1.1	Some Basic Models; Direction Fields	1	HWK 8, 10, 11, 17, 18, 23
	1.3	Classification of Differential Equations	2	HWK 1, 2, 5, 6, 8, 11
	2.1	Linear Equations; Integrating Factors	3	HWK 6(c), 9(c), 17, 19, 22(b,c)
WEEK 2: 09/12-09/16	2.1	Linear Equations; Integrating Factors (Continued)	3	HWK 27, 28, 31, 33, 34, 35
	2.2	Separable Equations	4	HWK 3, 6, 8, 9, 12, 16
	2.3	Modeling with First Order Equations	5	HWK 2, 4, 7, 9, 16, 18(a)
WEEK 3: 09/19-09/23	2.7	Numerical Approximation; Euler's Method	6	HWK 2, 18, 19
	3.1	Homogeneous Equations with Constant Coefficients	7	HWK 3, 6, 8, 10, 13, 17, 20, 22
	MATLAB PROJECT 1: DUE IN WEEK OF OCTOBER 10			
	REVIEW FOR EXAM 1			
WEEK 4: 09/26-09/30	**COMMON EXAM 1**			
	3.2	Solutions of Linear Homogeneous Equations: The Wronskian	8	HWK 2, 5, 6, 8, 12, 18, 22, 24, 25, 26, 31
WEEK 5: 10/03-10/07	3.3	Complex Roots of the Characteristic Equation	9	HWK 2, 3, 5, 7, 11, 17, 21, 27
	3.4	Repeated Roots; Reduction of Order	10	HWK 1, 6, 9, 11, 14, 16, 26, 28,30
WEEK 6: 10/10-10/14	3.5	Nonhomogeneous Equations; Undetermined Coefficients	11	HWK 3, 5, 9, 11, 17, 19
	3.5	Undetermined Coefficients (Continued)	11	HWK 22(a), 23(a), 25(a), 28(a)
	3.6	Variation of Parameters	12	HWK 3, 7, 8, 9, 12, 13, 15, 19
	3.7	Mechanical and Electrical Vibrations	13	HWK 2, 3, 5, 7, 11, 12
WEEK 7: 10/17-10/21	3.7	Vibrations (Continued)	13	HWK 14, 16, 17, 18, 20
	3.8	Forced Vibrations	14	HWK 2, 6, 9, 12
	REVIEW FOR EXAM 2		15	
WEEK 8: 10/24-10/28	**COMMON EXAM 2**			
	5.1	Review of Power Series	16	HWK 18, 20, 21, 23
	5.2	Series Solutions of Second Order Linear ODEs with Non-constant Coefficients; Solution Near an Ordinary Point	17	HWK 2(a,b), 4(a,b), 7(a,b),12(a,b)
	5.4	Euler's Equation; Regular Singular Points	18	HWK (5.4) 1, 3, 4, 8, 17, 20, 22
WEEK 9: 10/31-11/04	5.5	Series Solutions Near a Regular Singular Point, Part I	19	HWK 1, 2, 3, 12
	6.1 and 6.2	Definition of the Laplace Transform and Solution of Initial Value Problems	20	HWK (6.1) 3, 4, 6, 9, 13, 15, 21, 25, 26, 27 (6.2) 1, 2, 3, 5
	6.2	Initial Value Problems (Continued)	21	HWK (6.2) 7, 8, 13, 21, 24, 29, 30, 32, 33
	MATLAB PROJECT 2: DUE IN WEEK OF NOVEMBER 14			

WEEK 10: 11/07-11/11	6.3	Step Functions	22	HWK (6.3) 2, 4, 10, 11, 15, 17, 20, 21, 23 (6.4) 2, 3, 5, 7, 9, 11
	6.4	ODEs with Discontinuous Forcing Functions	23	HWK 18, 22
	6.5	Impulse Functions	24	HWK 1, 2, 5, 6, 9
WEEK 11: 11/14-11/18	6.6	The Convolution Integral	25	HWK 4, 5, 6, 8, 9, 10, 14, 18
	7.1	System of First Order Linear ODEs	26	HWK 2, 4, 5, 7(1,b)
	7.2	Review of Matrices (refer to suggested material)	27	HWK 1, 2, 4, 8, 22, 23
WEEK 12: 11/21-11/25	7.3	Review of Linear Algebraic Equations, Eigenvalues, and Eigenvectors (2X2)	28	HWK 16, 17, 18, 19
	7.5	Homogeneous Linear Systems with Constant Coefficients	29	HWK 2(a), 4(a), 7(a), 15, 16
	REVIEW FOR EXAM 3		30	
WEEK 13: 11/28-12/02	**COMMON EXAM 3**			
	7.6	Complex Eigenvalues	31	HWK 2(a), 6(a), 10, 13, 17, 28
	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: 12/05-12/09	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: 12/12-12/14	**REVIEW FOR FINAL EXAM**		37	
WEEK 16: 12/16-12/22	**FINAL EXAM PERIOD: DECEMBER 16 - 22, 2016**			