NJIT New Jersey's Science & Technology University

THE COLLEGE OF SCIENCE AND LIBERAL ARTS

THE DEPARTMENT OF MATHEMATICAL SCIENCES

MATH 222: Differential Equations

Spring 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. Effective From: Fall 2012.

Number of Credits: 4

Prerequisites: 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 222-002	Professor N. Tsipenyuk
Math 222-004	Professor P. Petropoulos
Math 222-006	Professor Y.-N. Young
Math 222-008	Professor M. Potocki-Dul
Math 222-010	Professor M. Michal
Math 222-012	Professor M. Potocki-Dul
Math 222-016	Professor A. Bose
Math 222-102	Professor J. Hunter
Math 222-104	Professor O. Varfolomiyev

Required Textbook:

Title	*Elementary Differential Equations and Boundary Value Problems*
Author	Boyce and DiPrima
Edition	10th
Publisher	John Wiley & Sons, Inc.

ISBN #	978-0470458310

University-wide Withdrawal Date: Please note that the last day to withdraw with a **W** is **March 28, 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	February 17, 2016
Common Midterm Exam II	March 9, 2016
Common Midterm Exam III	April 13, 2016
Final Exam Period	May 6 - 12, 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: Spring 2016 Hours)

Accommodation of Disabilities: NJIT is committed to providing students with documented disabilities equal access to programs and activities. If you have, or believe that you may have, a physical, medical, psychological, or learning disability that may require accommodations, please contact the Coordinator of Student Disability Services located in the Center for Counseling and Psychological Services, in Campbell Hall, Room 205, (973) 596-3414. Further information on disability services related to the self-identification, documentation and accommodation processes can be found on the webpage at:

- http://www.njit.edu/counseling/services/disabilities.php

Important Dates (See: Spring 2016 Academic Calendar, Registrar)

Date	Day	Event
January 19, 2016	T	First Day of Classes
January 25, 2016	M	Last Day to Add/Drop Classes
March 13 - 20, 2016	Su - Su	Spring Recess - No Classes, University Open
March 25, 2016	F	Good Friday - No Classes, University Closed
May 3, 2016	T	Friday Classes Meet/ Last Day of Classes
May 4 & 5, 2016	W & R	Reading Days
May 6 - 12, 2016	F - R	Final Exam Period

Course Outline

Week + Dates	Section # + Topic		& HW Assignments	
WEEK 1: 01/19-01/22	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
WEEK 2: 01/25-01/29	2.1	Linear Equations; Integrating Factors	3	HWK 6(c), 9(c), 17, 19, 22(b,c)
	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
WEEK 3: 02/01-02/05	2.3	Modeling with First Order Equations (Continued)	6	HWK 16, 18(a)
	2.7	Numerical Approximation; Euler's Method	7	HWK 2,18,19
		MATLAB PROJECT 1 ASSIGNED, DUE IN THE WEEK OF 02/22		
	3.1	Homogeneous Equations with Constant Coefficients	8	HWK 3, 6, 8, 10, 13, 17, 20, 22, 23
WEEK 4: 02/08-02/12	3.2	Solutions of Linear Homogeneous Equations: The Wronskian	9	HWK 2, 5, 6, 8, 12, 18
	3.3	The Wronskian (Continued); Review for Exam 1	10	HWK 22, 24, 25, 26, 31
	REVIEW FOR EXAM 1		11	
WEEK 5: 02/15-02/19	**COMMON EXAM 1**			
	3.3	Complex Roots of the Characteristic Equation	12	HWK 2, 3, 5, 7, 11, 17, 21, 27
	3.4	Repeated Roots; Reduction of Order	13	HWK 1, 6, 9, 11, 14, 16, 26, 28, 30
WEEK 6: 02/22-02/26	3.5	Nonhomogeneous Equations; Undetermined Coefficients	14	HWK 3, 5, 9, 11, 17, 19
	3.5	Undetermined Coefficients (Continued)	15	HWK 22(a), 23(a), 25(a), 28(a)
	3.6	Variation of Parameters	16	HWK 3, 7, 8, 9, 12, 13, 15, 19
	3.7	Mechanical and Electrical Vibrations	17	HWK 2, 3, 5, 7, 11, 12
WEEK 7: 02/29-03/04	3.7	Vibrations (Continued)	18	HWK 14, 16, 17, 18, 20
	3.8	Forced Vibrations	19	HWK 2, 6, 9, 12

	REVIEW FOR EXAM 2		20	
WEEK 8: 03/07-03/11	**COMMON EXAM 2**			
	5.1	Review of Power Series	21	HWK 18, 20, 21, 23
	5.2	Series Solutions of Second Order Linear ODEs with Non-constant Coefficients; Solution Near an Ordinary Point	22	HWK 2(a,b), 4(a,b), 7(a,b), 12(a,b)
	5.2 5.4	(Continued) Euler's Equation; Regular Singular Points	23	HWK (5.4) 1, 3, 4, 8, 17, 20 22
WEEK 9: 03/14-03/18	**SPRING RECESS**			
WEEK 10: 03/21-03/25	5.5	Series Solutions Near a Regular Singular Point, Part I	24	HWK 1, 2, 3, 12
	6.1 and 6.2	Definition of the Laplace Transform and Solution of Initial Value Problems	25	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)	26	HWK (6.2) 7, 8, 13, 21, 24, 29, 30, 32, 33
	MATLAB PROJECT 2 ASSIGNED, DUE IN THE WEEK OF 04/04			
WEEK 11: 03/28-04/01	6.3	Step Functions	27	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		
	6.4	ODEs with Discontinuous Forcing Functions (Continued)	28	HWK 18, 22
	6.5	Impulse Functions	29	HWK 1, 2, 5, 6, 9
WEEK 12: 04/04-04/08	6.6	The Convolution Integral	30	HWK 4, 5, 6
	6.6	Convolution (Continued)	31	HWK 8, 9, 10, 14, 18
	REVIEW FOR EXAM 3		32	
WEEK 13: 04/11-04/15	**COMMON EXAM 3**			
	7.1	System of First Order Linear ODEs	33	HWK (7.1) 2, 4, 5, 7(1,b) (7.2) 1, 2, 4, 8, 22, 23
	7.2	Review of Matrices (refer to suggested material)		
	7.3	Review of Linear Algebraic Equations, Eigenvalues, and Eigenvectors (2X2)	34	HWK 16, 17, 18, 19
	7.5	Homogeneous Linear Systems with Constant Coefficients	35	HWK 2(a), 4(a), 7(a), 15, 16

WEEK 14: 04/18-04/22	7.6	Complex Eigenvalues	36	HWK 2(a), 6(a), 10, 13, 17, 28
	10.1	Two-Point Boundary Value Problems	37	HWK 1, 3, 5, 10, 14, 15, 18
	10.2	Fourier Series	38	HWK 1, 5, 6, 7, 13, 15, 16
WEEK 15: 04/25-04/29	10.2	Fourier Series (Continued)	39	HWK 19(a,b), 20(a,b), 22(a,b)
	10.4	Even and Odd Functions	40	HWK 2, 3, 4, 7, 9, 15, 16, 21, 23(a,b), 27(a,b)
	REVIEW FOR FINAL EXAM		41	
WEEK 16: 05/02-05/06	**REVIEW FOR FINAL EXAM**		42	
WEEK 17: 05/09-05/13	**FINAL EXAM PERIOD: MAY 6 - 12, 0216**			

Updated by Professor Y.-N. Young - 1/19/2015
Department of Mathematical Sciences Course Syllabus, Spring 2016