NJIT New Jersey's Science & Technology University

THE COLLEGE OF SCIENCE AND LIBERAL ARTS

THE DEPARTMENT OF MATHEMATICAL SCIENCES

MATH 222: Differential Equations
Summer 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: 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 222-031	Professor J. Ratnaswamy
Math 222-032	Professor J. Ratnaswamy
Math 222-131	Professor V. Saini

Office Hours for All Math Instructors: Summer 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

Withdrawal Date: Please see the Summer 2019 Academic Calendar for the last day to withdraw based on the summer session you are registered for.

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 and Quizzes	15%
Common Midterm Exam I	25%
Common Midterm Exam II	25%
Final Exam	35%

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

A	88 - 100	**C**	60 - 66
B+	81 - 87	**D**	45 - 59
B	74 - 80	**F**	0 - 44
C+	67 - 73		

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 two common midterm exams held during the semester and one comprehensive common final exam. Exams are held on the following days:

Common Midterm Exam I	June 12, 2019
Common Midterm Exam II	July 17, 2019
Final Exam	August 5, 2019

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 during all class times.

ADDITIONAL RESOURCES

Math Tutoring Center: Located in the Central King Building, Room G11 (Summer Hours: TBA)

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: Summer 2019 Academic Calendar, Registrar)

Date	Event
May 20, 2019	First Day of Classes
May 21, 2019	Last Day to Add/Drop Classes for **FIRST, MIDDLE, AND FULL**
May 27, 2019	University Closed for Memorial Day
June 24, 2019	Last Day of **FIRST SUMMER SESSION**
July 1, 2019	First Day of Second Summer Session
July 4-5, 2019	University Closed for Independence Day
July 15, 2019	Last Day of **MIDDLE SUMMER SESSION**
August 6, 2019	Last Day of **FULL AND SECOND SUMMER SESSIONS**

Course Outline

Section	Topic	Homework
1.1	Some Basic Models; Direction Fields	HWK 5, 6, 7, 11, 12, 19
1.3	Classification of Differential Equations	HWK 1, 2, 4, 6, 9, 11, 12
2.1	Linear Equations; Integrating Factors	HWK 6(c), 8(c), 10, 11, 13(b,c)
2.1	Linear Equations; Integrating Factors (Continued)	HWK 17, 18, 21, 23, 24, 25
2.2	Separable Equations	HWK 2, 4, 6, 9, 12
2.3	Modeling with First Order Equations	HWK 2, 5, 7, 12, 14(a)
2.7	Numerical Approximation; Euler's Method	HWK 2
3.1	Homogeneous Equations with Constant Coefficients	HWK 3, 5, 6, 8, 10, 13, 15, 16
3.2	Solutions of Linear Homogeneous Equations: The Wronskian	HWK 2, 4, 5, 7, 9, 14, 17, 19, 20, 21, 23
3.3	Complex Roots of the Characteristic Equation	HWK 1, 2, 4, 5, 8, 12, 19

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