NJIT New Jersey's Science & Technology University

THE COLLEGE OF SCIENCE AND LIBERAL ARTS

THE DEPARTMENT OF MATHEMATICAL SCIENCES

MATH 689-002: Advanced Applied Mathematics II: Ordinary Differential Equations
Spring 2020 Graduate 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: A practical and theoretical treatment of boundary-value problems for ordinary differential equations: generalized functions, Green's functions, spectral theory, variational principles, and allied numerical procedures. Examples will be drawn from applications in science and engineering.

Number of Credits: 3

Prerequisites: Math 545 or Math 645, Math 613, and Math 631.

Course-Section and Instructor

Course-Section	Instructor
Math 689-002	Professor M. Siegel

Office Hours for All Math Instructors: Spring 2020 Office Hours and Emails

Required Textbook: *Green's Functions and Boundary Value Problems*. Third edition. By I. Stakgold and M. Holst. ISBN 0-470-60970-2.

Also Useful:

- *Boundary Value Problems of Mathematical Physics, Volumes I and II*. By Ivar Stakgold. SIAM Classics in Applied Mathematics vol 29. ISBN: 0-89871-456-7.
- *Principles and Techniques of Applied Mathematics*. By B. Friedman. ISBN 0-486-66444-9.
- *Applied Mathematics*. By J.D. Logan. ISBN 0-471-74662-2.

University-wide Withdrawal Date:The last day to withdraw with a **W** is **Monday, April 6, 2020**. It will be strictly enforced.

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	60%
Midterm Exam	15%
Final Exam	25%

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. AttendanceNote

Cellular Phones: All cellular phones and other electronic devices must be switched off during all class times.

ADDITIONAL RESOURCES

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 Kupfrian Hall, Room 201. 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:

- https://www.njit.edu/studentsuccess/accessibility/

Important Dates (See: Spring 2020 Academic Calendar, Registrar)

Date	Day	Event
January 21, 2020	T	First Day of Classes
January 31, 2020	F	Last Day to Add/Drop Classes
March 15 - 22, 2020	Su-Su	Spring Recess: No Classes/ University Open
April 6, 2020	M	Last Day to Withdraw
April 10, 2020	F	Good Friday - University Closed
May 5, 2020	T	Friday Classes Meet - Last Day of Classes
May 6 & 7, 2020	W & R	Reading Days
May 8 - 14, 2020	F - R	Final Exam Period

Course Outline

Week	Topic
1-1	Introduction. Linear two-point boundary value problem for an ODE. Examples. The inner product and adjoint operator.
2-3	Introduction to distributions (generalized functions). Test functions. The Dirac delta function. Green's functions. Examples of the use of the Dirac delta function.

4-6	General, linear, second order boundary value problems. Solution in terms of the Green's function. Discussion of the role of boundary conditions. Self-adjoint and non self-adjoint problems. Problems of general order. The Fredholm alternative and the modified Green's function. Applications and examples.
7-9	General theory of eigenfunction representations. Sturm-Liouville eigenvalue problems and their occurrence in the solution of PDE's. Overview of spectral theory of linear operators. Spectral representation. Eigenfunction expansion of the Green's function and modified Green's function.
10-12	The eigensystem of a general non self-adjoint operator. Discrete and continuous spectrum. Singular problems. Applications and examples.
13-14	Approximation of eigenvalues and eigenfunctions by variational methods. The Rayleigh-Ritz method. Applications and examples. Further topics.