MATH 690: Advanced Applied Mathematics III: Partial Differential Equations
Fall 2021 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 initial- and boundary-value problems for partial differential equations: Green's functions, spectral theory, variational principles, transform methods, and allied numerical procedures. Examples will be drawn from applications in science and engineering.

Number of Credits: 3

Prerequisites: MATH 689

Course-Section and Instructors:

Course-Section	Instructor
Math 690-001	Professor A. Oza

Office Hours for All Math Instructors: Fall 2021 Office Hours and Emails

Required Textbook:

Title	*Partial Differential Equations of Mathematical Physics and Integral Equations*
Author	R. B. Guenther and J. W. Lee
Edition	1st
Publisher	Dover
ISBN #	978-0486688893
Reference	Boundary Value Problems of Mathematical Physics, Volumes I and II, by Ivar Stakgold. SIAM Classics in Applied Mathematics Vol 29. ISBN 089871-456-7.

University-wide Withdrawal Date: The last day to withdraw with a **W** is **Wednesday, November 10, 2021**. 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	65%
Midterm Exam	10%
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.

Homework: Textbook assignments are due the class day following the section lecture and will be collected/reviewed at the beginning of class.

Exams: There will be one midterm exam held in class during the semester and one comprehensive final exam. The final exam will be held during the following week:

Midterm Exam	TBA
Final Exam Period	December 15 - 21, 2021

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 during all class times.

ADDITIONAL RESOURCES

Math Tutoring Center: Located in the Central King Building, Lower Level, Rm. G11 (See: Fall 2021 Hours)

Further Assistance: For further questions, students should contact their instructor. All instructors have regular office hours during the week. These office hours are listed on the Math Department's webpage for Instructor Office Hours and Emails.

Accommodation of Disabilities: The Office of Accessibility Resources and Services (OARS) 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 Scott Janz, Associate Director of

Disability Support Services at 973-596-5417 or via email at scott.p.janz@njit.edu. The office is located in Kupfrian Hall, Room 201. A Letter of Accommodation Eligibility from the Office of Accessibility Resources and 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 Office of Accessibility Resources and Services (OARS) website at:

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

Important Dates (See: Fall 2021 Academic Calendar, Registrar)

Date	Day	Event
September 1, 2021	Wednesday	First Day of Classes
September 4, 2021	Saturday	Saturday Classes Begin
September 6, 2021	Monday	Labor Day
September 8, 2021	Wednesday	Monday Classes Meet
September 8, 2021	Wednesday	Last Day to Add/Drop Classes
November 10, 2021	Wednesday	Last Day to Withdraw
November 25 to November 28, 2021	Thursday to Sunday	Thanksgiving Recess - Closed
December 10, 2021	Friday	Last Day of Classes
December 13 and December 14, 2021	Monday and Tuesday	Reading Days
December 15 to December 21, 2021	Wednesday to Tuesday	Final Exam Period

Course Outline

Weeks	Sections	Topic
1-4	Guenther & Lee, Chapters 5 & 9	The diffusion equation. The free-space Green's function or fundamental solution and its construction by various methods. Solution on an infinite, semi-infinite, or bounded domain in 1D. Comparison of different solution techniques: Green's function, eigenfunction expansion, and Laplace transform. Solution in higher space dimensions. Uniqueness of solutions.
5-8	Guenther & Lee, Chapter 8	The Laplace and Poisson equations. The free-space Green's function or fundamental solution. The potential due to distributions of monopoles and dipoles in free-space. Green's formula and fundamental properties of harmonic functions. The Poisson formula and solution of Dirichlet and Neumann problems. Construction of Green's functions for simple geometries. Uniqueness results. Solution in terms of an integral equation. The Helmholtz equation. Fundamental solution and examples.

9-12	Guenther & Lee, Chapters 4 & 10	The wave equation. The D'Alembert solution. The free-space Green's function or fundamental solution. Comparison of different solution techniques on unbounded and bounded domains in 1D. Solution in higher space dimensions. Uniqueness results.
13-14	Guenther & Lee Chapter 11, Lecture notes	Brief discussion of weak solutions of linear elliptic equations, Ritz-Galerkin method, Lax-Milgram theorem.

Updated by Professor A. Oza - 8/6/2021
Department of Mathematical Sciences Course Syllabus, Fall 2021