MATH 690: Advanced Applied Mathematics III: Partial Differential Equations
Fall 2025 Course Syllabus

NJIT Academic Integrity Code: Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: NJIT Academic Integrity Code.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu

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 2025 Office Hours and Emails

Required Textbook: *NO BOOK REQUIRED*. A lot of the course material is drawn from the textbook "Partial Differential Equations of Mathematical Physics and Integral Equations" by R. B. Guenther and J. W. Lee.

University-wide Withdrawal Date: The last day to withdraw with a **M** is **Monday, November 10, 2025**. 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.

Religious Observance: NJIT is committed to supporting students observing religious holidays. Students must notify their instructors in writing of any conflicts between course requirements and religious observances, ideally by the end of the second week of classes and no later than two weeks before the anticipated absence.

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 14 - December 20, 2025

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

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.

Important Dates (See: Fall 2025 Academic Calendar, Registrar)

Date	Day	Event
September 1, 2025	Monday	Labor Day
September 2, 2025	Tuesday	First Day of Classes
September 8, 2025	Monday	Last Day to Add/Drop Classes
November 10, 2025	Monday	Last Day to Withdraw
November 25, 2025	Tuesday	Thursday Classes Meet
November 26, 2025	Wednesday	Friday Classes Meet
November 27 to November 30, 2025	Thursday to Sunday	Thanksgiving Recess - Closed
December 11, 2025	Thursday	Last Day of Classes
December 12, 2025	Friday	Reading Day 1
December 13, 2025	Saturday	Saturday Classes Meet
December 14 to December 20, 2025	Sunday to Saturday	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.