MATH 712: Numerical Methods II
Fall 2022 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: Numerical methods for the solution of initial- and boundary-value problems for partial differential equations, with emphasis on finite difference methods. Consistency, stability, convergence, and implementation are considered.

Number of Credits: 3

Prerequisites: MATH 614, MATH 331 or departmental approval, and proficiency in a computer programming language (MATLAB, C, C++, Fortran, etc.)

Course-Section and Instructors:

Course-Section	Instructor
Math 712-001	Professor P. G. Petropoulos

Office Hours for All Math Instructors: Fall 2022 Office Hours and Emails

Required Textbook: Course material and homework assignments will be drawn from the following two textbooks.

1) "Numerical Partial Differential Equations: Finite Difference Methods," Thomas, J.W., Springer-Verlag New York, 1995; ISBN 978-1-4419-3105-4

2) "Finite Difference Schemes and Partial Differential Equations," by J. Strikwerda, SIAM, 2004; ISBN 0-898715679

University-wide Withdrawal Date: The last day to withdraw with a **M** is **Monday, November 14, 2022**. 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	50%
Midterm Exam	20%
Final Exam	30%

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

A	90 - 100	**C**	70 - 74
B+	85 - 89	**D**	60 - 69
B	80 - 84	**F**	0 - 59
C+	75 - 79		

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 one midterm exam held in class during the semester and one comprehensive final exam. Exams are held on the following days:

Midterm Exam	October 20, 2022
Final Exam	December 16 – 22, 2022

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: There will be **NO MAKE-UP QUIZZES OR EXAMS** during the semester. In the event an exam is not taken under rare circumstances where the student has a legitimate reason for missing the exam, the student should contact the Dean of Students office and present written verifiable proof of the reason for missing the exam, e.g., a doctor's note, police report, court notice, etc. clearly stating the date AND time of the mitigating problem. The student must also notify the Math Department Office/Instructor that the exam will be missed.

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 at:

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

Important Dates (See: Fall 2022 Academic Calendar, Registrar)

Date	Day	Event
September 5, 2022	Monday	Labor Day
September 6, 2022	Tuesday	First Day of Classes
September 12, 2022	Monday	Last Day to Add/Drop Classes
November 14, 2022	Monday	Last Day to Withdraw
November 22, 2022	Tuesday	Thursday Classes Meet
November 23, 2022	Wednesday	Friday Classes Meet
November 24 to November 25, 2022	Thursday and Friday	Thanksgiving Recess - Closed
November 26, 2022	Saturday	Saturday Classes Meet
December 14, 2022	Wednesday	Last Day of Classes
December 15, 2022	Thursday	Reading Day
December 16 to December 22, 2022	Friday to Thursday	Final Exam Period

Course Outline

	Topics
1	Review of classification of Partial Differential Equations (PDEs), Fourier analysis of PDEs, symbols of operators, dispersion relations. Well-posedness of Initial-Value Problems (IVP) and Initial-Boundary-Value Problems (IBVP) for PDEs.
2	Numerical differentiation on a grid. Fourier analysis on a grid. The Evaluation, Truncation, and Interpolation operators.
3	Explicit & implicit Finite Difference (FD) numerical schemes for solving PDEs.
4	The concepts of Order of Accuracy, Stability, Consistency, and Convergence of FD numerical schemes for PDEs.
5	Stability of single- and multi-step FD schemes. Introduction to the effect of boundary conditions.

6	Numerical Dispersion and Numerical Dissipation of FD schemes.
7	FD schemes for Hyperbolic and Parabolic PDEs and systems in 1 and 2 dimensions.
8	Well-posedness of Initial-Boundary-Value-Problems for model PDEs. Stability analysis of FD schemes for Initial-Boundary-Value-Problems for PDEs
9	Applications to nonlinear PDEs and to Elliptic PDEs

Updated by Professor P. G. Petropoulos - 8/17/2022
Department of Mathematical Sciences Course Syllabus, Fall 2022