

MATH 453: High-Performance Numerical Computing *Spring 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: This course covers state-of-the-art numerical algorithms for solving large scale problems accurately and efficiently. Topics include iterative methods for linear systems and eigenvalue computations, introduction to parallel programs and parallel numerical algorithms, and spectral methods. An instructor selected advanced topic will be included in the course.

Number of Credits: 3

Prerequisites: **MATH 391** with a grade of C or better and **MATH 440** with a grade of C or better.

Course-Section and Instructors

Course-Section	Instructor
Math 453-002	Professor M. Siegel

Office Hours for All Math Instructors: [Spring 2021 Office Hours and Emails](#)

Required Textbook:

- *Parallel Programming in OpenMP* by R. Chandra et al.
- *Numerical Analysis of Spectral Methods: Theory and Applications* by D. Gottlieb and S. Orszag, SIAM.
- *Numerical Linear Algebra* by L. N. Trefethen and D. Bau, SIAM.
- *Spectral Methods in Matlab* by L. N. Trefethen, SIAM.

University-wide Withdrawal Date: The last day to withdraw with a **W** is **Monday, April 5, 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	50%
Midterm Exam	25%
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

Math Tutoring Center: Located in the Central King Building, Lower Level, Rm. G11 (See: **Spring 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**.

All students must familiarize themselves with and adhere to the Department of Mathematical Sciences Course Policies, in addition to official university-wide policies. The Department of Mathematical Sciences takes these policies very seriously and enforces them strictly.

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 Chantonette Lyles, Associate Director of the Office of Accessibility Resources and 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 Office of Accessibility Resources and Services 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/studentssuccess/accessibility/>

Important Dates (See: **Spring 2021 Academic Calendar, Registrar**)

Date	Day	Event
January 19, 2021	T	First Day of Classes
January 23, 2021	S	Saturday Classes Begin
January 25, 2021	M	Last Day to Add/Drop Classes
March 14 - March 21, 2021	Su - Su	Spring Recess - No Classes
April, 2, 2021	F	Good Friday - No Classes
April 5, 2021	M	Last Day to Withdraw
May 4, 2021	T	Friday Classes Meet
May 4, 2021	T	Last Day of Classes
May 5 & May 6, 2021	W & R	Reading Days
May 7 - May 13, 2021	F - R	Final Exam Period

Course Outline

Week #	Subject Topic
1	Introduction to high-performance computing
2	Introduction to parallel computing, speedup, efficiency, cost optimality
3	Introduction to Open MP
4	Parallel matrix and vector operations
5	Parallel matrix operations (continued)
6	Iterative methods, GMRES
7	Conjugate Gradient
8	MIDTERM EXAM
9	Fast Poisson Solver
10	Spectral methods I: Introduction to FFT
11	Spectral methods II: Interpolation, integration and differentiation, boundary value problems.
12	Spectral methods III: Boundary values problems for PDE, Chebychev methods
13	Other applications of spectral methods
14	Instructor selected advanced topic
15	FINAL EXAM

*Updated by Professor M. Siegel - 1/19/2021
Department of Mathematical Sciences Course Syllabus, Spring 2021*
