MA504 – Introduction to Linear Algebra
(2024 Autumn semester)

Instructor: Projesh Nath Choudhury **Office:** AB-5/348
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Course website: http://people.iitgn.ac.in/ ∼projesh/Teaching/MA504_2024.html

Course description: MA 504 is a core course for the MSc Mathematics program at IITGN. These contents of this course are of fundamental importance in many areas of mathematics.

COURSE CONTENTS

(1) Review: System of linear equations.
(2) Vector spaces: Definition, Basis and dimension, change of bases, Direct sums.
(3) Linear transformations: Definition, Rank-nullity theorem, Algebra of linear transformations, representation of linear transformations by matrices, Multilinear functions and properties of the determinant function, linear functionals and annihilators, dual spaces.
(4) Eigenvalues and eigenvectors: Definition, the characteristic polynomial, the Cayley- Hamilton Theorem, the minimal polynomial, algebraic and geometric multiplicities, Diagonalization, Primary decomposition, Cyclic decomposition, Generalized Eigen vectors and The Jordan canonical form.
(5) Inner product spaces: Definition, orthonormal bases, Gram-Schmidt process; Adjoint operators, normal, unitary, and self-adjoint operators, Schur's theorem, spectral theorem for self-adjoint and normal operators, Symmetric bilinear forms, Sylvester's law of Inertia.

SUGGESTED BOOKS AND REFERENCES

(1) K. Hoffman and R. Kunze. *Linear Algebra*. 2nd Edition, Prentice Hall of India, 2012
(2) S. Axler. *Linear Algebra Done Right*. 2nd Edition, Springer UTM, 1997.
(3) M. Artin. *Algebra*. Prentice Hall of India, 2009.

LECTURES AND TUTORIALS

- **Lectures:** Tue, Fri 8.30–9.50 am (Room AB 7/209)
- **Tutorials:** Wed 3.30–4.50 pm (Room AB 10/102)

Tutorial and Assignments

Two types of problem sets will be posted in regular intervals: Tutorials and Assignments.

- **Tutorial problems:** The tutorial problems will be posted well in advance. It is the responsibility of the students to work on the problems before coming to a tutorial session.
- **Assignment problems:** Assignment problems will not be discussed in class. Students are expected to work out these problems and submit them by the appropriate deadline. Solutions to assignments will be provided after deadline.

Discussing in a group is allowed and encouraged; however, each student should hand in their independently written solutions, written in their own words. Mere copying of others' work is strictly prohibited.

POLICY FOR EVALUATION

- **Quiz I:** 10%
- **Examination I:** 30%
- **Quiz II:** 10%
- **Examination II:** 30%
- **Assignments:** 10%
- **Attendance:** 10%

ATTENDANCE POLICY

Class participation will help you in staying on track and developing a deeper understanding and interest in the subject. As a result, attendance at lectures will be recorded. The following is the policy for the marks based on the percentage in attendance:

% in Attendance	Marks
Above or equal to 80	10
60 to less than 80	5
Below 60	0

*If you miss a class due to medical reasons and want to record attendance for that day, you need to provide a medical certificate from the institute health center doctor stating that you are not fit to appear for the class on that day.

HONOR CODE

Students are expected to follow the Institute Honor Code at all times. Any suspected/alleged violations of the Honor Code will be investigated and may lead to disciplinary action, as per Institute policy.

GRADING POLICY

Relative grading policy will be followed.