MA692 – Advanced Matrix Theory
(2022 Autumn semester)

Instructor: Projesh Nath Choudhury **Office:** AB-5/344
Email: projeshnc@iitgn.ac.in **Office hours:** Mon Fri 4–5 pm
Course website: http://people.iitgn.ac.in/ ∼projesh/Teaching/MA692_2022/MA692_2022wp.html

Course goals: This course is an introduction to matrix analysis, developing essential tools. The emphasis will be more on analytic aspects of matrix theory (things like variational principles, norms, and inequalities), as opposed to algebraic aspects (like canonical forms and multilinear algebra).

PRE-REQUISITES

Basic knowledge of linear algebra.

LIST OF TOPICS

(The selection of topics is variable depending on time constraints.)

(1) Review: eigenvalues, eigenvectors, special types of matrices.
(2) Schur triangular form, spectral theorem, singular value decomposition, polar decomposition, generalized inverse, least squares solutions.
(3) Variational principles of eigenvalues of Hermitian matrices, Rayleigh–Ritz theorem, Courant–Fischer theorem, Weyl theorem, Cauchy interlacing theorem.
(4) Matrix norms, spectral radius formula, relationship between matrix norms and singular values.
(5) Perron–Frobenius theory: Matrices with positive and non-negative entries.

SUGGESTED BOOKS AND REFERENCES

(1) R. Bhatia. *Matrix analysis*. vol. 169 of Graduate Texts in Mathematics, Springer, 1997.
(2) R.A. Horn and C.R. Johnson. *Matrix analysis*. Cambridge University Press, 2012.
(3) C.D. Meyer. *Matrix analysis and applied linear algebra*. SIAM, 2001.

LECTURES AND TUTORIALS

- **Lectures:** Mon Wed 8.05–9 pm (Room AB 7/101)
  Fri 8.05–9 pm (Room AB 7/105)
- **Tutorials:** TBA

HOMEWORK

Homework will be given fortnightly – posted on the course webpage. 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

- **Assignments:** 40%
- **Quiz:** 20%
- **End-sem exam:** 40%

GRADING POLICY

Relative grading policy will be followed.