

MA692-VI: Advanced Matrix Analysis
(2025 Spring semester)

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Office hours: Mon 4–5 pm

Course website: <http://people.iitgn.ac.in/~projesh/Teaching/MA692VI/MA692VI.2025.html>

Course goals: This course is an introduction to positive kernels, and developing essential tools. The emphasis will be more on totally positive kernels, Pólya frequency sequences, and functions.

PRE-REQUISITES

Basic knowledge of matrix analysis, complex analysis, functional analysis.

LIST OF TOPICS

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

- (1) Introduction to positive kernels, examples and basic properties.
- (2) Totally positive and sign regular kernels, definition, basic properties, characterizations
- (3) Pólya frequency (PF) sequences and their generating functions, location of zeros of polynomials and PF sequence, one sided PF sequences.
- (4) Pólya frequency functions, variation diminution, Laguerre–Pólya class of entire functions, Computing PF Functions from their Laplace transforms

SUGGESTED BOOKS AND REFERENCES

- (1) S. Karlin, *Total positivity*, Volume 1, Stanford University Press, 1968.
- (2) A. Pinkus, *Totally positive matrices*, Cambridge University press, 2010

LECTURES AND TUTORIALS

- **Lectures:** Wed, Fri 3.30–4.50 pm (Room AB 7/104)

ASSIGNMENT

Assignment 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

- **Exam II:** 40%
- **Assignment:** 20%
- **Presentation:** 30%
- **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.