

Online Short-Term Program on “Graphs, Matrices and Applications”

- **Dates: September 29, 2025 – October 04, 2025.**

Speakers

- [Prof. Sasmita Barik \(IIT Bhubaneswar\)](#)
- [Prof. Subrahmanyam Kalyanasundram \(IIT Hyderabad\)](#)
- [Prof. M. Rajesh Kannan \(IIT Hyderabad\)](#)
- [Prof. Manjunath Krishnapur \(IISc Bangalore\)](#)
- [Prof. A. Satyanarayana Reddy \(SNU, Delhi\)](#)
- [Prof. Rakesh Venkat \(IIT Hyderabad\)](#)

Time table

Date	Lecture 1 (9.30 - 11)		Lecture 2 (11.15-12.45)		Lecture 3 (2-3.30)		Lecture 4 (3.45-5.15)
29-09-25	MRK - 1	B	SK – 1		MRK-2	B	ASR – 1
30-09-25	MRK - 3	R	SK – 2		MK - 1	R	SK – 3
01-10-25	SB - 1	E	SK – 4		SB - 2	E	MK - 2
02-10-25	MK - 3	A	SB – 3		MK - 4	A	ASR - 2
03-10-25	RV -1	K	SB – 4		RV - 2	K	ASR - 3
04-10-25	RV – 3		MRK – 4		RV - 4		ASR - 4

- **MRK** - M. Rajesh Kannan
- **SK** – Subrahmanyam Kalyanasundaram
- **ASR** – A. Satyanarayana Reddy
- **MK** – Manjunath Krishnapur
- **SB** – Sasmita Barik
- **RV** – Rakesh Venkat

Topics

MRK: Spectral theorem for symmetric matrices, variational characterization of eigenvalues, Perron-Frobenius theorem. Adjacency matrices of graphs: Eigenvalues, eigenvectors and bipartiteness. Spectral bounds for the chromatic, clique and independence number of graphs.

SK: Asymptotic analysis, data structures to represent graphs, graph traversals (BFS and DFS), topological sort and strongly connected components, shortest path (Dijkstra's), minimum spanning tree (Kruskal's or Prim's algorithm), max flow-min cut and basic Ford Fulkerson algorithm.

ASR: Equitable partitions, Distance regular graphs, adjacency algebra.

MK: Markov chains on finite state spaces and their long-term behaviour. Electrical networks and connections to random walks and spanning trees. Karlin-McGregor-Lindstrom-Gessel-Viennot determinant formula and applications to some questions of counting and probability.

SB: Laplacian eigenvalues and eigenvectors, Matrix-tree theorem, Algebraic connectivity and Fiedler vectors, Cospectral graphs, Laplacian integral graphs and Laplacian eigenvalue distribution.

RV: Orthogonal representations, Lovasz theta function & SDP Formulations, Sandwich Theorem & Shannon Capacity, Applications, SDP in Optimization.