

# M. Rajesh Kannan

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## Research Interests

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Spectral Graph Theory, Matrix Theory and Functional Analysis.

## Education

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- Ph.D. in Mathematics, IIT Madras 2014
- M.Sc. in Mathematics, ANJA College, Sivakasi 2008
- B.Sc. in Mathematics, ANJA College, Sivakasi 2005

## Academic Positions

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- Associate Professor, Department of Mathematics, IIT Hyderabad September 2025–till date.
- Assistant Professor, Department of Mathematics, IIT Hyderabad July 2022–September 2025.
- Assistant Professor, Department of Mathematics, IIT Kharagpur July 2016–June 2022
- Postdoctoral Fellow, University of Manitoba, Canada Nov 2015–Jun 2016
- Postdoctoral Fellow, Technion – Israel Institute of Technology, Israel Mar 2014–Aug 2015
- Postdoctoral Fellow, Indian Statistical Institute, Delhi Sep 2013–Feb 2014
- Summer Student, Technion – Israel Institute of Technology, Israel Aug 2013
- Senior Research Fellow, IIT Madras Jul 2010–Jul 2013
- Junior Research Fellow, IIT Madras Jul 2008–Jul 2010

## Academic Achievements

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- "Excellent Young Teacher Award - 2020", IIT Kharagpur (Rs 2,00,000 cash award).
- Postdoctoral fellowship 2015, University of Manitoba, Winnipeg, Canada.
- Postdoctoral fellowship under German-Israeli Foundation for Scientific and Research development 2014, The Technion Israel Institute of Technology, Haifa, Israel.
- Visiting Scientist fellowship Indian Statistical Institute 2013 (Postdoctoral fellowship).
- Awarded full Scholarship for attending the summer school in Nonnegative matrices and its application by The Technion, Israel Institute of Technology, August 2013.
- Post doctoral fellowship, National Board for Higher Mathematics, 2013.
- Qualified in the NBHM, CSIR, UGC, and GATE research fellowship examinations.

## Grants and Awards

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- SERB National Post doctoral fellowship (Mentor), ANRF(2025).
- Core Research Grant, (Principal Investigator), ANRF(2024).
- International Travel Support (ITS) grant, ANRF(2023).
- Seed Grant (Principal Investigator), SRC, IIT Hyderabad(2023).
- MATRICS (Principal Investigator ), DST-SERB(2019).
- Early Career Research Award (Principal Investigator ), DST-SERB(2018).
- SERB National Post doctoral fellowship (Mentor), DST-SERB(2017).
- ISIRD project (Principal Investigator), SRIC, IIT Kharagpur(2017).

## Supervision

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### PhD students:

1. Dr. Aniruddha Samantha (2017-2022)
2. Dr. Amrita Mondal (2016 - 2022)(Jointly with Dr Bibhas Adhikari)
3. Dr. Iswar Mahato (2018-2023)
4. Mr. Abhay Jayarajan (2023-)
5. Mr. Rahul Roy (2023-)

### Post-doctoral fellows:

1. Dr. Ranjit Mehatari (2017 - 2018)(NPDF(DST-SERB))
2. Dr. Brahadeesh Sankaranarayanan (2025) (ANRF-CRG)
3. Dr. Priti Prasanna Mondal (2025-) (ANRF-CRG)

## Teaching Experience

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### At IIT Kharagpur

- MA20103 - Partial differential equation (Autumn 2016, Autumn 2017, Autumn 2018)
- MA10002 - Mathematics- II (Spring 2017, Spring 2018)
- MA30003/MA41003 - Linear Algebra (Autumn 2017)
- MA10001 - Mathematics- I (Autumn 2018, Autumn 2019)
- MA60053 - Computational Linear Algebra (Spring 2019, Spring 2020)
- MA20013 - Discrete Mathematics (Spring 2019, Spring 2020)
- TS70007 - Advanced Mathematical Techniques (Autumn 2019, Autumn 2020)
- MA11003 - Advanced Calculus (Autumn 2020)
- MA11004 - Linear Algebra, Numerical and Complex Analysis (Spring 2021, Spring 2022)

- MA21201/MA31005 - Real Analysis (Autumn 2021)
- MA51121/MA60041/MA61003 - Graph Theory and Algorithms (Autumn 2021)

### At IIT Hyderabad

- MA5010 - Combinatorics and Graph Theory (Autumn 2022, Autumn 2023, Autumn 2024).
- MA5510 - Spectral Graph Theory (Spring 2023).
- MA1130 - Vector Calculus (Spring 2023).
- MA1240 - Combinatorics (Autumn 2023).
- MA 50300 - Algebraic Graph Theory (Autumn 2023).
- MA5510 - Spectral Graph Theory (Spring 2024).
- MA1120 - Calculus - II (Autumn 2024)
- MA5040 - Topology (Spring 2025, Spring 2026)
- MA5020 - Functional Analysis (Autumn 2025)

### Publications

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(\*Underlined name indicates B.Tech/M.Sc., students\*)

1. Aniruddha Samanta and M. Rajesh Kannan, *Bounds and extremal graphs for the energy of complex unit gain graphs*, Linear Algebra and its Applications, 721 (2025), 844–866.
2. Iswar Mahato and M. Rajesh Kannan, *Minimizers for the energy of eccentricity matrices of trees*, Linear Multilinear Algebra, Linear Multilinear Algebra 73 (2025), no. 1, 49–66.
3. Amrita Mandal, Bibhas Adhikari and M. Rajesh Kannan, *On the eigenvalue region of permutative doubly stochastic matrices of order up to 4*, Bull. Iranian Math. Soc. 51 (2025), no. 1, Paper No. 4, 44 pp.
4. M. Rajesh Kannan, Shivaramakrishna Pragada and Hitesh Wankhede, *Constructing cospectral graphs by unfolding non-bipartite graphs*, Discrete Applied Mathematics, Volume 357 (2024) 264-273.
5. Aniruddha Samanta and M. Rajesh Kannan, *On the spectrum of complex unit gain graph*, J. Ramanujan Math. Soc. 39, No.2 (2024) 131–142.
6. Iswar Mahato and M. Rajesh Kannan, *A note on the distance and distance signless Laplacian spectral radius of complements of trees*, Linear Algebra and its Applications, 675(2023), 344-350.
7. Iswar Mahato and M. Rajesh Kannan, *Extremal problems for the eccentricity matrices of complements of trees*, Electronic journal of Linear Algebra Volume 39, pp. 339-354, June 2023.
8. Iswar Mahato and M. Rajesh Kannan, *Squared distance matrices of trees with matrix weights*, AKCE International Journal of Graphs and Combinatorics, no. 2, vol. 20(2023), 177–184.

9. M. Rajesh Kannan and Shivaramakrishna Pragada, *Signed spectral Turań type theorems*, Linear Algebra and its Applications, 663(2023), 62-79.
10. Iswar Mahato and M. Rajesh Kannan, *On the eccentricity matrices of trees: Inertia and spectral symmetry*, Discrete Mathematics, Volume 345, Issue 11, November 2022, 113067.
11. M. Rajesh Kannan, Shivaramakrishna Pragada and Hitesh Wankhede , *On the construction of cospectral nonisomorphic bipartite graphs*, Discrete Mathematics, Volume 345, Issue 8, August 2022, 112916.
12. M. Rajesh Kannan, Navish Kumar and Shivaramakrishna Pragada, *Normalized Laplacians for Gain Graphs*, American Journal of Combinatorics, Volume 1 (2022), Pages 20-39.
13. Iswar Mahato and M. Rajesh Kannan, *Eccentricity energy change of complete multipartite graphs due to edge deletion*, Special Matrices, (10) 2022, 193-202. (Special Issue: Contemporary Spectral Graph Theory)
14. Iswar Mahato, R. Gurusamy, M. Rajesh Kannan and S. Arockiaraj, *On the spectral radius and the energy of eccentricity matrix of a graph*, Linear and Multilinear Algebra, (71)2023, 5-15.
15. Aniruddha Samanta and M. Rajesh Kannan, *Distance matrices for complex unit gain graphs*, Discrete Mathematics, 345 (2022), no. 1, Paper No. 112634, 12pp.
16. Mainak Basunia, Iswar Mahato and M. Rajesh Kannan, *On the  $A_\alpha$ -spectra of some join graphs*, Bulletin of the Malaysian Mathematical Sciences Society, 44 (2021), 4269–4297.
17. M. Rajesh Kannan, Navish Kumar and Shivaramakrishna Pragada, *On the extremal eigenvalues of gain Laplacian matrices*, Linear Algebra and its Applications, 625 (2021), 212-240.
18. Projesh Nath Choudhury, M. Rajesh Kannan and Apoorva Khare, *Sign non-reversal property for totally positive matrices and testing total positivity on their interval hull*, Bulletin of the London Mathematical Society, 53 (2021), no. 4, 981-990.
19. Projesh Nath Choudhury and M. Rajesh Kannan, *Interval hulls of  $N$ -matrices and almost  $P$ -matrices*, Linear Algebra and its Applications, 617 (2021), 27-38.
20. Aniruddha Samanta and M. Rajesh Kannan, *Bounds for the energy of a complex unit gain graph*, Linear Algebra and its Applications, 612 (2021), 1-29.
21. Himadri Lal Das and M. Rajesh Kannan, *On dense subsets of matrices with distinct eigenvalues and distinct singular values*, Electronic Journal of Linear Algebra, Vol. 36(2020), pp. 834-846.
22. M. Rajesh Kannan and Shivaramakrishna Pragada, *On the construction of cospectral graphs for the adjacency and the normalized Laplacian matrices*, Linear and Multilinear Algebra, 70(2022), no.15, 3009-3030.
23. Iswar Mahato, R. Gurusamy, M. Rajesh Kannan and S. Arockiaraj, *Spectra of eccentricity matrices*, Discrete Applied Mathematics, 285 (2020), 252–260.
24. Ranjit Mehatari, M. Rajesh Kannan and Aniruddha Samanta, *On the Adjacency matrix of Complex Unit Gain Graphs*, Linear and Multilinear Algebra, 70 (2022), no.9, 1798-1813.

25. Ranjit Mehatari and M. Rajesh Kannan, *Eigenvalue bounds for some classes of matrices associated with graphs*, Czechoslovak Mathematical Journal, vol. 71, no. 1 (2021), pp. 231-251.
26. Fouzul Atik, M. Rajesh Kannan and R.B. Bapat, *On distance and Laplacian matrices of trees with matrix weights*, Linear and Multilinear Algebra, 69 (2021), no. 14, 2607-2619.
27. Fouzul Atik, R.B. Bapat and M. Rajesh Kannan, *Resistance matrices of graphs with matrix weights*, Linear Algebra and its applications, 571(2019), 41-57.
28. Projesh Nath Choudhury, M. Rajesh Kannan and K.C. Sivakumar, *A note on linear preservers on semipositive and minimal semipositive matrices*, Electronic Journal of Linear Algebra, 34(2018), pp. 687-694.
29. Projesh Nath Choudhury, M. Rajesh Kannan and K.C. Sivakumar, *New contributions to semipositive and minimally semipositive matrices*, Electronic Journal of Linear Algebra, 34(2018), pp. 35-53.
30. M. Rajesh Kannan, *P-proper splittings*, Aequationes Mathematicae, 91(2017), no. 4, 619-633.
31. Hongwei Jin, M. Rajesh Kannan and Minru Bai, *Lower and upper bounds for H-eigenvalues of even order real symmetric tensors*, Linear and Multilinear Algebra, **65** (2017), no. 7, 1402-1416.
32. Naomi Shaked-Monderer, Abraham Berman, Mirjam Dür, M. Rajesh Kannan, *SPN completable graphs*, Linear algebra and its applications, **498** (2016), 58-73.
33. M. Rajesh Kannan and K. C. Sivakumar, *On Certain Positivity Classes of Operators*, Numerical Functional Analysis and Optimization, **37** (2016), no. 2, 206-224.
34. M. Rajesh Kannan, Naomi Shaked-Monderer, Abraham Berman, *On weakly irreducible non-negative tensors and interval hulls of some classes of tensors*, Linear and Multilinear Algebra, **64** (2016), no. 4, 667-679.
35. M. Rajesh Kannan, Naomi Shaked-Monderer, Abraham Berman, *Some properties of strong  $\mathcal{H}$ -tensors and general  $\mathcal{H}$ -tensors*, Linear Algebra and its Applications, **476** (2015), 42-55.
36. M. Rajesh Kannan and R. B. Bapat, *Generalized Principal Pivot transforms*, Linear Algebra and its Applications, **454** (2014), 49-56.
37. M. Rajesh Kannan and K. C. Sivakumar, *Intervals of Certain Classes of Z-matrices*, Discussiones Mathematicae - General Algebra and Applications, **34** (2014), 85-93.
38. M. Rajesh Kannan and K. C. Sivakumar,  *$P_{\dagger}$ -matrices: A generalization of P-matrices*, Linear and Multilinear algebra, **62** (2014), 1-12.
39. M. Rajesh Kannan and K. C. Sivakumar, *Moore-Penrose inverse positivity of interval matrices*, Linear Algebra and its Applications, **436** (2012), 571-578.

## Workshops and Seminars Organized

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- GIAN Course - Spectral Graph Theory - 27 October 2025 to 31 October 2025

- Short-Term Program on "Graphs, Matrices and Applications" - September 29 - October 04, 2025. (Under Malaviya Mission Teacher Training Program)
- Annual Foundational School - I, December 2-28, 2024. Funded by National Centre for Mathematics.
- Annual Foundational School - I, December 4-31, 2022. Funded by National Centre for Mathematics.
- Faculty Student Development Program on "Spectral Graph Theory and applications", IIT Hyderabad(Under PALS) November 24-25, 2022.
- Annual Instructional School on "Algebraic Combinatorics and Spectral Graph Theory", 30 May 2022 to 18 Jun 2022. Funded by National Centre for Mathematics.
- Weekly e-seminar on "Graphs, matrices and applications", from July 2020 to December 2021.
- Weekly seminar on "Graphs, matrices and applications", in the Department of Mathematics, IIT Kharagpur, from January 2018 - March 2020.
- AICTE QIP short term course on "Advanced Matrix Algebra and Applications" 18 - 22 September 2019 in the Department of Mathematics, IIT Kharagpur.
- AICTE QIP short term course on "Linear Algebra and Differential Equations" 24 - 28 August 2018 in the Department of Mathematics, IIT Kharagpur.
- Lecture series "Combinatorics commutative algebra: Introduction to edge ideals", from 02 - 06 July 2018 in the Department of Mathematics and Center for Theoretical Studies, IIT Kharagpur.

## Invited Talks

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- Invited talk in "20<sup>th</sup> Annual Conference of the Academy of Discrete Mathematics and Applications and International Conference on Discrete Mathematics (ADMA-ICDM 2024)" June 07-10, 2024, Savitribai Phule Pune University, Pune.
- Invited talk in "International Conference on Applied Analysis and Discrete Mathematics (ICAADM – 2024)", January 22-24, 2024, The Gandhigram Rural Institute, Gandhigram.
- Invited talk in "International Conference on Theoretical and Computational Graph Theory (ICTCGT 2024)", January 10-12, 2024, Vellalar College for Women, Erode.
- Invited talk in the symposium on "Algebraic Graph Theory" in 38<sup>th</sup> annual Ramanujan Mathematical Society (RMS) conference, December 22-24, 2023, IIT Guwahati.
- Invited talk in "International Conference on Linear Algebra and its Applications", December 18-21, 2023, Centre for Advanced Research in Applied Mathematics and Statistics, MAHE, Manipal, India.
- Invited talk in "International Conference on Graph Theory and its Applications", December 18-20, 2023, Amrita Vishwa Vidyapeetham, Coimbatore.
- Invited talk in "International Conference on Spectral and Approximation Theory (ICSAT-2023)", November 27-30, 2023 Cochin University of Science And Technology.

- Invited talk : Series of six lectures in the Advanced Instructional School on Algorithmic Graph Theory, 10-07-2023 to 12-07-2023, IIT Indore. (Supported by National Center for Mathematics( NCM), IIT Bombay and TIFR Mumbai)
- Invited talk in a Minisymposium in the 25<sup>th</sup> International Linear Algebra Society Conference 12-06-2023 to 16-06-2023, Madrid, Spain.
- Invited talk in pre-conference instructional workshop on Spectral Graph Theory 04-06-2023 to 07-06-2023 ( Part of annual conference of Academy of Discrete Mathematics and its applications(ADMA) and Graph theory day.)
- Invited talk in the seminar series "05C50 Online" on 10-03-2023 organized by University of Manitoba, Winnipeg, Canada.
- "GANITHA GARIMA", A workshop on core areas of Mathematics (Algebraic Graph Theory), 29-11-2021 to 03-12- 2021, Department of Mathematics, University of Kerala, Thiruvananthapuram, Kerala. (Webinar)
- "Online Refresher Course in Mathematics (Algebraic Graph Theory)", October 16-29, 2021, UGC-Human Resource Development Centre, Savitribai Phule Pune University, Pune, Maharashtra. (Webinar)
- Pre-workshop for "International Conference on Discrete Mathematics", October 8-10, 2021, Department of Mathematics, Manonmaniam Sundranar University, Tirunelveli, Tamil Nadu. (Webinar)
- "VYKHARI - International Lecture Series", 15-09-2021 to 1-10-2021, BCM College, Kottayam, Kerala. (Webinar)
- Faculty Development Training Programme on Discrete Mathematics, 28 June - 03 July 2021, Department of Mathematics, Ramco Institute of Technology, Rajapalayam, Tamil Nadu. (Webinar)
- "Online - Six-Day FDTP on Algebra and Number Theory", 24-05-2021 to 29-05-2021, Department of Mathematics, KGiSL Institute of Technology, Coimbatore, Tamil Nadu. (Webinar)
- "Online workshop on Numerical Linear Algebra", 19-25 September 2020, Department of Mathematics, Assam University, Silchar, Assam. (Webinar)
- International Faculty Development Programme on "Avant-garde trends in Mathematics," 17-23 June, 2020, Bannari Amman Institute of Technology, Sathyamangalam, Tamil Nadu. (Webinar)
- Two days Online Faculty Development Programme on "Algebra and Number Theory", 25-26 May, 2020, Department of Mathematics, Ramco Institute of Technology, Rajapalayam, Tamil Nadu. (Webinar)
- "Conference on Linear Algebra and its Applications" in honour of Prof Ravindra B Bapat, December 26-27, 2019, Indian Statistical Institute, Delhi Centre, New Delhi.
- "Workshop on Spectral Graph Theory" (Ten lectures), November 16-20, 2019, Indian Institute of Technology Ropar, Punjab.
- "International Conference on Number Theory and Graph Theory", June 27-29, 2019, Department of Studies in Mathematics, University of Mysore, Mysuru, Karnataka.

- International conference on "Emerging area of Mathematics for science and technology", 19 February 2019, organized by Rathinam College of Arts and Science, Coimbatore, Tamil Nadu.
- "Two-day National seminar on emerging trends in Topology and Geometry", February 15-16, 2019, organized by ANJA College, Sivakasi, Tamil Nadu.
- "CALDAM 2019" 5th Annual International Conference on Algorithms and Discrete Applied Mathematics IIT Kharagpur. February 14-16, 2019
- Conference on "Analysis and applications", June 18-22, 2018, Department of Mathematics. IIT Madras, Chennai, Tamil Nadu.
- One week workshop on "Analysis, Algebra and descriptive statistics" June 4 -9, 2018, Department of Mathematics, Mepco Schlenk engineering college, Sivakasi, Tamil Nadu.
- A two days symposium on "Nonlinear analysis and Fluid dynamics", March 30-31, 2018, Department of Mathematics, IIT Madras, Chennai, Tamil Nadu.
- A six day workshop on "Algebraic Graph Theory" January 25 - 30, 2018, Department of Mathematics, NITK Surathkal, Karnataka.
- Conference on "Applications of Mathematics and science in engineering" January 21, 2018, Department of Mathematics, NIT Raipur, Chhattisgarh .
- Workshop on "Nonnegative matrices and applications" December 16, 2017, Department of Mathematics, NITK Surathkal, Karnataka.
- National Conference on "Some Contemporary Research Direction in Discrete Mathematics" May 30, 2017, organized by Department of Mathematics, Mepco Schlenk engineering college, Sivakasi, Tamil Nadu.
- NBHM sponsored two days "National seminar on some recent research directions in graph theory" March 9 -10, 2017, The centre for Graph Theory, Ayya Nadar Janaki Ammal College, Sivakasi, Tamil Nadu.
- Mini workshop on "Linear complementarily problems and generalizations" September 24- 25, 2016, Indian Statistical Institute Chennai Center, Chennai, Tamil Nadu.

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