RAMA MISHRA

www.ramamishrasite.wordpress.com
Correspondence Address:
Department of Mathematics
Indian Institute of Science Education and Research, Pune,
Dr. Homi Bhabha Road,
Pune-411008, India
PHONE: +91-20-25908096 (O),
+91-9225631894 (Cell)
Email: r.mishra@iiserpune.ac.in

Research Interests

Knot theory, low dimensional topology, Real Algebraic Geometry

Education

Ph.D. (1994), Department of Mathematics, Indian Institute of Technology Bombay, Bombay, India
 Supervisor: Prof. Akhil Ranjan,
 Thesis: *Polynomial representation of knots*.

M.Sc. Mathematics (1986), Department of Mathematics, University of Allahabad, Allahabad, India

B.Sc. with Mathematics, Physics and Statistics (1983), University of Allahabad, Allahabad, India

Additional Research Coursework (1986-1989), School of Mathematics, TIFR (in affiliation with Bombay University), Bombay, India

Academic Achievements

- National Merit Scholarship from U.P. Board, India 1978 – 1980.
- National Merit Scholarship from Allahabad University, India 1980 – 1982.
- Gold Medal from Allahabad University, India, for achieving rank one in M.Sc. Program, 1984.
- Full Time Junior Research Fellow at Bombay University, India with CSIR/UGC Fellowships, 1986-1989.
- Full Time Research Scholar with Fellowship at IIT, Bombay, India, 1989 – 1994.

Research Experience

Positions held:

- **Visiting Researcher** at Department of Mathematical Sciences, **New Mexico State University**, Las Cruces, New Mexico, USA, May-June 2016
- **Visiting Associate Professor** on research collaboration at Department of Mathematical Sciences, **New Mexico State University**, Las Cruces, New Mexico, USA, 2014-15
- **Adjunct Graduate faculty** in the Mathematics Department, **Boise State University**, Boise, Idaho, USA, 2007-2010

- **Visiting Faculty** on research collaboration at Department of Mathematics, **Boise State University**, Idaho, USA, 2006-07
- **JSPS Research Fellow** at the Department of Mathematics, **Osaka City University**, Osaka, Japan, August 2005 - May 2006
- **Visiting Mathematician** at the **Osaka City University** sponsored by COE program of Akio Kawauchi, May-July, 2004
- **Full-Time Visiting Scientist** at **Indian Statistical Institute- Delhi** with a post-doctoral fellowship from the National Board of Higher Mathematics, New Delhi, India, 1996 -1998
- **Full-Time Visiting Fellow** at **Mehta Research Institute of Mathematics and Mathematical Physics**, Allahabad, India, 1994-1996

Student Supervision

Ph. D. Students

- Tumpa Mahato, Skein modules, IISER Pune, working at present.
- Visakh Narayanan, Quantum invariants and Volume Conjecture, IISER Pune, working at present.
- Hitesh Raundal, thesis titled, "*Polynomial knots and their spaces*," Indian Institute of Science Education and Research Pune, India, 2017, currently a **post-doctoral fellow at HRI**, Allahabad.
- M. Prabhakar, thesis titled, "*Minimal Degree Sequence for Knots,*" Indian Institute of Technology New Delhi, India, 2005, currently an **Associate Professor at IIT Ropar**.

Master's Students

- Adithyan P, working at present on ` Geometric knot theory'.
- Visakh Narayanan, thesis titled "*Functorial knot theory",* 2017.
- Soheila Egbali, thesis titled, "*Galois theory for Differential Equations,*" Boise State University, Boise Id, USA, 2008
- Gurmeet Singh Arora, thesis titled, "*Virtual Knot Theory*," I.I.T. Delhi, 2005
- Charu Puri, thesis titled, "*Role of Topology in DNA Analysis,*" I.I.T. Delhi, 2004
- Neelakshi Goswami, thesis titled, "*Polynomial Knots and Singularities*," I.I.T. Delhi, 2004
- Namrata Mallik, thesis titled, "*Introduction to Algebraic Geometry*," I.I.T. Delhi, 2002
- Sunita Mehta, thesis titled, "*Latest Problems in Computational Topology*," I.I.T. Delhi, 2002

Undergraduate Research (IISER Pune) Students

- Adithyan P, Combinatorial knot theory, working in Spring 2019.
- Adithyan P, Three manifold topology, Fall 2018.
- Nazia, Siddharth, Adithyam and Nima, Function Spaces, Spring 2018.
- Jayanth Kumar, Topological Data Analysis, Spring 2018.
- Abhishek Tilva, Introduction to Smooth manifolds, Fall 2017.
- Visakh Narayanan, Frobenius algebras and TQFT, Spring 2016
- Visakh Narayanan, Category Theory, Fall 2015
- Visakh Narayanan, Function Spaces, Summer 2015

- Ajit Nair, Calculus on Manifolds, 2014
- Suraj Chawla, Application of Topology in Physics, 2011
- Punya Prabal Satpaty, Morse Theory, 2011

Undergrad Research (non-IISER Pune) Students

- Diptaishik Chaudhary, CMI, knots and Graphs, 2014
- Omkar Devlekar, Pune University, Topology and its applications, 2013-14
- Asha Sebastian (NIT Cochin), IISER summer program, Basic knot theory, 2013
- R Mahesh Chandrakanth, University of Hyderabad, Basic Algebraic Topology, summer student sent by INSA, 2009.

Research Publications

Published/Accepted in Refereed Journals:

1. Polynomial invariants, Knot Homologies and Higher Twist numbers of Weaving Knots W (3, n), Joint with Ross Staffeldt, to appear in Journal of knot theory and its Ramifications, 2020.

2. Constructing real rational knots by gluing, joint with Shane D'Mello, Topology and its applications, Vol. 237, 2018, Pages 67-81.

3. Spaces of polynomial knots, joint with Hitesh Raundal, Topology and its applications, Vol. 218, 2017, Pages 66–92

4. Spaces of Polynomial knots in low degree, joint with Hitesh Raundal, Journal of knot theory and its Ramifications, Volume 24, Issue 14, December 2015

5. Polynomial Unknotting and Singularity index, Kyungpook Mathematical Journal 2014 Vol. 54, No. 2, 271-292

6. Nodal Parity Invariants for Knotted Rigid Vertex Graphs, Journal of Knot theory and its Ramifications, Vol. 22, Issue 4, joint with Louis H Kauffman, 2013.

7. Knot theory in understanding proteins, joint with Shantha Bhushan, Journal of Mathematical Biology, Volume 65, Issue 6-7, 2012, pp 1187-1213,

8. Minimal degree sequence of torus knots of type (p,q), Journal of Knot theory and its Ramifications, Vol. 18, No. 4 (2009), World Scientific Publishing Company, 485-491.

9. Polynomial Representation for Long Knots, joint with M. Prabhakar. Int. Journal of Math. Analysis, Vol. 3, 2009, no. 7, 325 – 337.

10. Polynomial Representations of Strongly invertible Knots and Strongly Negative Amphicheiral Knots, Osaka Journal of Mathematics, Vol. 43, no.3, 2006.

11. Minimal Degree Sequence of 2 –Bridge Knots, Fundamenta Mathematicae, Vol. 3, 190, 2006, joint with M. Prabhakar.

12. Minimal Degree Sequence of Torus Knots of type (p, 2p-1), Journal of Knot theory and its Ramifications, Vol. 15, No.9 (2006), World Scientific Publishing Company, joint with M. Prabhakar

13. Minimal Degree Sequence for Torus Knots, Journal of Knot theory and its Ramifications, vol. 9, No.6 (2000), 759 – 769, World Scientific Publishing Company.

14. Polynomial Representation of Torus Knots of type (p, q), Journal of Knot Theory and its Ramifications, World Scientific Publishing Company, Vol.8, No.5 (1999), 667-700.
15. Polynomial Representation of Torus knots, Journal of Knot Theory and its Ramifications, Vol. 5 No.2 (1996), 279 – 294, World Scientific Publishing Company, joint with A. Ranjan.
16. On Maxima -Minima, Proceedings (Mathematical Sciences) of the Indian Academy of Sciences, Vol.106, No.1, Feb 1996, 65 – 68.
17. On Polynomial Isotopy of Knots, Proceedings (Mathematical Sciences) of the Indian Academy of Sciences, Vol. 104, No.3, Aug. 1994, 543-548.

Communicated:

1. Hecke algebra trace algorithm and some conjectures on weave knots, joint work with Hitesh Raundal, 2019.

In Preparation

1. On Multi Sum formulas of Colored Jones Polynomial, Joint with Uwe Kaiser, 2019.
2. Distribution associated with ranks of Khovanov Homologies in Weave knots, joint work with Ross Staffeldt, 2019.

Published in Conferences:

1. Polynomial representation for links, Proceedings of the International Workshop on Knot theory of Scientific Objects at Osaka City University, Japan, 2006.
2. A degree sequence for a general knot-type, Proceedings on Extended Kook Seminar at Konan University, Japan, 2005.
3. Minimal Degree Sequence for Non-Compact Knots, Proceedings on Topology of Knots VI, Nihon University, Japan 2003.
4. An Estimate of Degrees of Polynomials Representing a p – Braided Knots, Abstracts, International Conference on Topology in Matsue, Japan, 2002.

Editor:

1. Knot theory and its applications, **Contemporary Mathematics, AMS, 2016.**

Research Grants

1. "Around the Volume Conjecture in knot theory", **MATRICS** grant of Rs 2 lakhs per anum for a period of three years by **SERB, DST, 2017**.
2. "*Knot Theory and its Applications*", grant of Rs. 16 lakhs from **ICTS** to organize an Advanced School and discussion Meeting at IISER Mohali, 2013.
3. "Indian Women and Mathematics", grant of Rs.20 lakhs, from **NBHM**, 2013.
4. Advanced Foundation School, a grant of Rs. 7 lakhs, from **NBHM,** 2011.

5. *"Knot Theory in the study of Proteins"* (Status-Closed), a grant of Rs 20 lakhs, from **DST**, India, 2010-11.

6. *"Application of Knot theory in analyzing DNA molecules"* (Status – closed) A grant of Rs 10 lakhs from **MHRD**, India, 2004-07.

7. "*Polynomial Representation of 2-Knots*" (Status - Closed) , a grant of Rs 5 lakhs from **Fast Track grant from DST** India, 2004-07.

8. "*Emerging Challenges in Computational Topology*", (Status - completed) A grant of Rs 2 lakhs from **Indian Institute of Technology, Delhi**, India, 2000-2002.

Invited Talks

1. Presented a paper in "Knots in Washington" meeting at GWU, USA, Jan 2019.
2. Gave a colloquium on "Introduction to Volume Conjecture" at New Mexico State University, 2 Jan 019.
3. Contributory talk in the "Workshop on Volume Conjecture and Related Topics in knot theory" at IISER Pune, Dec 2018.
4. Mini Course (3 lectures) on "Knot theory and Quantum groups", IWM meeting at Shiv Nadar University, June 2018.
5. Invited Speaker and the Chief Guest for the inaugural of National Conference on knot theory, Goa University, Feb 2018.

6. Colloquium talk at CUNY, USA, 2017.

7. Colloquium talk at Boise State University, USA, 2017.

8. Colloquium Speaker at Department of Mathematics, University of Texas at El Paso, USA, 2015.

9. Invited Speaker for a mini course on knot theory, Young Women and Mathematics Conference at IISER Pune, 2014.

10. Invited speaker at **Advanced School and Discussion Meeting** on Knot Theory and its applications, held at IISER Mohali, India, 2013.

11. Six lectures on basic knot theory in an **Advanced Training School for Researchers** at Harish Chandra Research Institute, Allahabad, 2013-14

12. Invited talk at Boise State University, Boise, Idaho, USA, 2013.

13. Invited speaker at the Topology Seminar at University of Illinois at Chicago, USA, 2013.

14. Four lectures on Knot Homology at IIT Ropar, 2013.

15. Invited speaker at EKOOK Seminar at Osaka City University, Japan, 2013

16. **Plenary speaker** at Indian Women and Mathematics meeting held at Institute of Mathematical Sciences, Chennai, India, 2012.

17. Invited speaker at a knot theory conference held at Osaka City University, Osaka Japan, 2011.

18. Invited lecture in Topology seminar at University of Illinois at Chicago, 2010

19. Invited lecture on polynomial knots, Sonoma State University, USA, 2010

20. Invited talk at **University of Rochester**, USA, 2009

21. Four lectures on knot theory, IIT Guwahati, 2008.

22. Invited talk at University of South Alabama, 2007

23. Invited talk at **National University of Singapore**, 2006

24. Visited National University of Singapore and gave a talk, August 2005.

25. First KOOK Seminar International Awaji Shima, Island, Japan, July 2004. (Presented a paper).

26. Visited Tokyo Institute of Technology, Japan and gave a talk, July 2004.

27. Gave a talk at Tokyo University, Japan, July 2004.
28. Gave a seminar in the 21st Century COE Program:" Constitution of wide-angle mathematical basis focused on knots" led by Akio Kawauchi at Osaka City University, May 2004.
29. Visited Waseda University, Japan and gave a seminar, Dec 2003.
30. Workshop on Topology of Knots, Nihon University, Tokyo, Japan, Dec. 2003. (Presented a paper).
31. Gave a talk at Tokyo Women Christian University, Japan, Dec. 2003.
32. Speaker at the Topology Seminar at **Columbia University**, USA, 2003
33. Invited speaker at **Rutgers University**, USA, 2003
34. Knots in Washington 15, Joint Japan – USA Workshop in Knot Theory , George Washington University and John Hopkins University , USA (Jan 2003) (Survey talk).
35. Knots in Poland , **an International Conference on Knot Theory , Stephen Banach Center , Warsaw and Mathematical Conference Center** , Bedlewo , Poznan, Poland , 2003 (Survey Talk).
36. International Conference on Topology in Matsue 2002 Joined with the Second Japan – Mexico Topology Symposium, Department of Mathematics, Shimane University, Japan, June 2002. (Presented a paper)
37. International Conference on Symplectic Topology at IIT Bombay, 1999 (Presented a paper).
38. Conference on Geometry and Topology, Department of Mathematics, IISC, Bangalore, 1996, India. (Presented a paper).
39. U.G.C. Instructional Conference on Algebraic and Differential Topology at the Department of Mathematics, NEHU , Shillong, India, delivered two lectures on Homological Algebra (July 1987).

Sessions Chaired

1. International conference of The Indian Mathematics Consortium in cooperation with American Mathematical Society, 2016.
2. International Conference on Topology and Groups, Goa university, 2015.
3. Asian Meeting on Knot theory at Osaka City University, 2013.
4. Indian Women and Mathematics, IISER Pune, 2013.
5. Indian Women and Mathematics, IMSc, Chennai 2012.

Conferences/Workshops/Math Events Organized

1. Organized a workshop on "Volume Conjecture and related topics in knot theory" at IISER Pune, Dec 2018.
2. Organized a visit along with institute level colloquium by Prof Louis Kauffman, Dec 2016.
3. Organized a workshop on hyperbolic knot theory inviting Abhijit Champanerkar from CUNY at IISER Pune, Dec 2015.
4. Organized a short meeting on low dimensional topology at New Mexico state university, March 2014.
5. Organized the Advanced School and Discussion Meeting on Knot Theory and its applications held at IISER Mohali as being one of the members of the Organizing Committee and Scientific Committee funded by ICTS, Dec 2013.

6. Organized a symposium "Indian Women and Mathematics", at Indian Institute of Science Education and Research, July 2013.

7. Organized an Instructional Workshop" Annual Foundation School-level 1" funded by National Board for Higher Mathematics, India, at IISER Pune, 2011.

Teaching Experience

Positions held:

In India-

- Professor, Indian Institute of Science Education and Research, Pune, India, Jan 2020 onwards.
- Associate Professor, Indian Institute of Science Education and Research, Pune, India, August 2007-Jan 2020.
- Assistant Professor, Department of Mathematics, IIT Delhi, New Delhi, India, January 2000 – Jan 2007
- Assistant Professor, Department of Mathematics, IIT Kharagpur, India, March 1998 – December 1999
- Assistant Professor at Delhi University Colleges, India, July 1997-March 1998

In USA-

- Visiting Associate Professor, Department of Mathematical Sciences, New Mexico State University, Las Cruces, New Mexico, USA, 2014-15
- Visiting Assistant Professor, Department of Mathematics, Boise State University, Boise, ID, USA, August 2006-July 2007

Courses Taught in India:

At IISER Pune-

1. Graduate Topology II, Spring 2019.
2. Point Set Topology, Fall 2018.
3. Reading Course: Quantum invariants for knots: Spring 2018
4. Topology I, PhD course: Fall 2017.
5. Topology II, PhD Course: Spring 2017.
6. Point Set Topology: Fall 2016.
7. Calculus on Manifolds: Spring 2016
8. Analysis: Fall 2015

On Sabbatical during Fall 2014-Spring 2015

9. Point Set Topology: Spring 2014
10. Topology I (PhD): Fall 2013
11. Point Set Topology: Spring 2013
12. Calculus I: Fall 2012

13. Topology 2 (PhD), Functional Analysis: Spring 2012
14. Algebraic Topology: Fall 2011
15. Multivariable Calculus: Spring 2011
16. Functional Analysis: Fall 2010
17. Introduction to Real Analysis: Spring 2010
18. Coordinated and tutored Linear Algebra with Prof R R Simha: Fall 2009
19. Measure Theory and Integration: Fall 2009
20. Topology: Spring 2009
21. Special topics in Analysis: Spring 2009
22. Analysis on R^n: Fall 2008
23. Introduction to Real analysis: Spring 2008
24. Abstract Algebra and Matrix Theory: Fall 2007

At IIT Delhi/ Kharagpur- (1998-2006)

1. Introduction to Analysis and Differential Equations, Three times to First Semester B.Tech students of Computer Science at IIT Delhi.
2. Introduction to Algebra and Matrix Analysis: Twice to Second Semester B.Tech students of Computer Science at IIT Delhi.
3. Basic Mathematics II, to Second Semester B.Tech students at IIT Delhi
4. Real and Complex Analysis to the Second Semester MCA students in the Department of Mathematics at IIT Delhi
5. Algebraic Geometry to the third year MCA students in the Department of Mathematics, IIT Delhi
6. Basic Calculus Course to B.Tech students in first and second semesters at IIT Kharagpur.
7. Real Analysis, twice to First year M.Sc students at IIT Delhi
8. Complex Analysis, twice to First Year M.Sc students at IIT Delhi.
9. Topology, twice to Second Year M.Sc. students at IIT Delhi.
10. Functional Analysis to Second Year M.Sc students at IIT Delhi
11. Algebra to First Year M.Sc Students at IIT Delhi
12. Basic Topology to Final Year M.Sc students at IIT Kharagpur
13. Measure Theory and Integration to Final Year M.Sc students at IIT Kharagpur
14. Variational Principle to Five Year Integrated students in the Department of Mathematics and Computing at IIT Kharagpur.

Courses Taught
In USA:

1. Calculus II at New Mexico State University: Fall 2014, Spring 2015
2. Introduction to Topology at New Mexico State University: Spring 2015
3. Advanced Topology for graduate students (Covering Knot Homologies): Fall 2014
4. Calculus I at Boise State University: Fall 2006, Spring 2007, and Summer 2007

Outreach Activity

1. Gave a popular talk, "Knotty mathematics in real life" at Ecole Centrale, Tex Mahindra Engineering College, Hyderabad, March 2019.
2. Refresher Course to weak students in Mathematics, IISER Pune, Aug 2017.
3. Invited Speaker in Inspire Camp, Latur, 2015.
4. *Opportunities after High School,* Vidya Valley school, Pune, 2013.
5. *Language of Mathematics*, Rishi Valley School Chitoor, 2012.
6. Gave two semester long courses on Real Analysis and Elementary Number Theory in FLAME University, Pune, 2010.
7. Lectured in KVPY camp, IISER Pune, 2009.
8. *Opportunities and career in Mathematics*. 11th and 12th Std students in Moti Lal Nehru Inter-College, Jamshedpur, 2008.

Administrative Experience

1. Chairperson for Grievance Redressal Committee at IISER Pune, since 2018.
2. KVPY representative to conduct the exam, Nov 2017.
3. UGC Nominee for the SAP-DRS-II Program, 2016-21.
4. Member of Student Welfare Committee at IISER Pune since 2011-14
5. Member of Disciplinary Committee at IISER Pune since 2011-14
6. Member of Senate, IISER Pune, 2011-14
7. Member of Interview Panel for KVPY, 2009 and 2014
8. Member of Women Cell at IISER Pune since 2011
9. Resident Warden for the girl's hostel at IISER Pune since September 2009-14
10. Chairperson of a Master's thesis committee of Soheila Egbali at Boise State University, Boise, ID, USA, 2007
11. Examiner for the evaluation of the Joint Entrance Examination, 2005.
12. Timetable in charge in the Department of Mathematics, Indian Institute of Technology, Delhi, India, Sept 2003- August 2005
13. Institute Representative to conduct the Screening Test of the Joint Entrance Examination of IIT, 2000-2005
14. Seminar in charge in the Department of Mathematics, Indian Institute of Technology, Delhi, India, 2000-2002
15. Member of the Editorial Board for the American Journal of Mathematical Analysis, Science Education Publishing, USA. 2012-17.