

Heera Lal Janwa (DRAFT CV)

Catedratico, (Full Professor), Mathematics, UPR, Rio Piedras): (<http://ramanujan.uprrp.edu>)

MAIN RESEARCH INTERESTS:

Coding Theory (Combinatorial, Algebraic, Algebraic Geometric, LDPC codes, Expander Codes, Convolutional Codes, Network Coding); Rate Distortion and Data Compression. Combinatorics; Discrete Mathematics; Cryptography; Cryptography, Number Theory, and Algebraic Geometry (Public Key Cryptosystems based on Codes; Signature Schemes; Sequence Design; Expanders, Magnifiers and Ramanujan Graphs and Their Applications; Algebraic Geometry over Finite Fields and Its Applications; Parallel Computation; Interaction between Algebraic Topology and Graph Theory; Bioinformatics; Ecological Informatics; Network Science; Biomolecular Networks; Artificial Intelligence, Machine Learning and Deep Learning; Renewable Energy; Climate Change

Education

M.Sc. (Hons.) Integrated	1975–80	Birla Institute of Technology & Science (BITS), Pilani, India <i>Five years (B.Sc.+M.Sc.) MATH) (NSTS Fellow)</i>
B.E. (Hons.)	1978–81	Birla Institute of Technology & Science, Pilani, India <i>(Electrical and Electronics Engineering)</i>
Grad. Studies	1981–82	University of Illinois at Urbana-Champaign (in <i>Mathematics</i>)
Ph.D.	1982–1986	Syracuse University (School of Computer and Information Science)

TEACHING/RESEARCH APPOINTMENTS

- *Director (Confianza) (August 18, —) Full Professor (tenured) (July 01, 2002—), Associate Professor (August '97—June 2002)*
Department of Mathematics (and Computer Science until a few years ago), University of Puerto Rico(UPR), at the main Campus (at Rio Piedras).
- *Visiting Member*, Courant Institute of Mathematical Sciences, NYU, **Aug. 2009–Aug. 2010**, and **Aug. 2003–Aug. 2004**. During Spring Semesters **2010** and **2004**, **also as** Scholar in Residence, FRN, NYU. (on Sabbatical leave from UPR).
- *Associate Professor*, tenured (A rank somewhat similar to that of a Full Professor in the USA system. The ranking system at MRI was: *Post-Doc* → *Fellow* → *Reader* → *Professor* (A *FACULTY* member as

Assoc. Prof./ Full Professor/Senior Professor).¹, School of Mathematics, Mehta Research Institute of Mathematics and Mathematical Physics (MRI)/ Harish-Chandra Research Institute (HRI) India (**August 1997—July 1999**). (On sabbatical '97–98; on leave. '98–99')

- Reader (*confirmed (= tenured)*, **April 1996**)), Department of Mathematics, M.R.I (HRI)., **October 1992—July 1997**.
- *Full Professor*, Center for Advanced Studies in Mathematics, University of Bombay, **January 1991—October 1992** (moved to MRI);
- Visiting Fellow, School of Mathematics, Tata Institute of Fundamental Research, **July 1990- July 1991**; Joined Univ. Bombay in January **1991**.
- Visiting Assistant Professor, Department of Mathematics, Michigan State University (MSU), **1989–90**;
- Harry Bateman Research Instructor (Faculty), Department of [Pure] Mathematics, California Institute of Technology (CALTECH), **1987–1989**. (Junior Faculty Position.).
- Visiting Member, Courant Institute of Mathematical Sciences (CIMS), NYU, **1986–1987**:
(*Computational Algebraic Geometry Group*)
- Graduate Assistant, School of Computer and Information Science, Syracuse University (SU), **1982–1986**.
- Graduate Teaching Assistant, Department of Mathematics, UIUC **1981–1982**.
- MRI Faculty eligible to supervise Ph.D. students registered at Allahabad University, India, **1996–1999**;
- Faculty in the BITS/MRI M.Phil collaborative program, **1995–1999**.

Among Other Positions Offered

IISc, Bangalore (India) (Senior Lecturer, 1990); ISI (Senior Lecturer); IIT Delhi (Assistant Professor (Mathematics), 1990); Institute of Mathematical Sciences (IMSc), Madras (Fellow, 1991); Reader (1991) IIT-Kanpur (Assistant Professor–invited for interview); IIT-Kanpur (invited for Associate Professor for Electrical Engineering–invited for interview.) Visiting Membership in the Special Year in Combinatorics, Institute for Mathematics and Its Applications (IMA), University of Minnesota (1987-88)

Current Professional/ Affiliations

- Professor (Catedratico (Full Professor)) Department of Mathematics
- Professor of MATH & CS- (from Aug. 1997—until recently when we had a joint Department of Mathematics and Computer Science Dept. Currently, the affiliation with CS Dept. is not a formalized.)

¹Most prestigious positions in the TIFR system. were the most prestigious positions, responsible for all the decision-making in the Institutes. In 1997, of the around 20 faculty members in Mathematics and Theoretical Physics at MRI, there were, the only member of the FACULTY (Professors at various ranks) the Director, one Full Professor, two Associate Professors, and the rest were Readers or Fellows.

- Core Faculty Member in the Ph.D. Option in Discrete Mathematics and Ph.D. Option in Computational Mathematics, options (since 1997)
- Faculty Member in the joint Doctoral Program in Computing and Information Sciences and Engineering (CISE), since 1997
- Director, CCTCR
- Participating Core Faculty Member in the Doctoral Program in the Department of Environmental Sciences (since April 2007) **Already Supervising the Ph.D. Thesis of Dionisio Perez Montes, under the NSF-IGERT program**

SELECTED HONORS

(**Other Honors** include being members of several external Ph.D. review committees; **one of the main invited speakers** at several international conferences; (see appropriate sections below))

2016	Plenary Speaker WMC2016, Santander, Spain
2015	Invited Speaker IWSDA 2015, Bangalore
2013	Invited Speaker AGCT, Mumbai, India, Dec.2013.
2012	Invited Speaker at the Annual TIFR International Conference: 2012 Theme, “Recent Trends in Disc
2011	Invited Speaker at the AMS Annual Sectional Meeting, UNLV, Nov. 2011
2010	Invited to Organize AAEECC-18 in Puerto Rico
2010	Scholar in Residence (awarded by Faculty Resource network)(NYU), Spring Semester
2008	One hour Invited Speaker at the AMS Annual Meeting, San Diego, January 2008.
2007	Co-Chair of International Symposium on AAEECC, Bangalore, India, Dec. 16-20
2005	Invited Speaker at the AMS Annual Meeting, Atlanta, 2005
2000	UPR President Maldonado’s citation for <i>distinguished research and service to UPR</i> in the area of science and technology.
2005	Scholar in Residence (awarded by Faculty Resource network)(NYU), Spring Semester
1987–1989	Harry Bateman Research Instructor, CALTECH, 87–89.
1987–88	Visiting Membership in the Special Year in Combinatorics, Institute for Mathematics and Its Applications (IMA), The University of Minnesota (declined)
1986–1987	NSF funded visiting membership in the CIMS (NYU).
1986	Syracuse University (SU) Doctoral Prize for one of the two best Ph.D. dissertations submitted to SU (out of approximately 140) during 1985-86
1980-81	Doctoral Fellowship: Nat. Council of Educational Res. & Training, India
1975-80	National Science Talent Search Scholarship, Government of India
1974-75	Secondary School Merit Scholarship, 4th in the State of Rajasthan, India

SELECTED VISITS TO INSTITUTES/UNIVERSITIES:

1. Courant Institute of Mathematical Sciences (CIMS), NYU: **Three full-year visits and numerous periodic short term from 1986—**. From UPR visits every year **1997—2019**(From one week to six weeks to summer). **Longer-Term visits: August 2009– August 2010 (one year Sabbatical), August 2003– August 2004 (one year Sabbatical). August 1986– June 87 (Visiting Member as a Year Courant NSF-Fellow).**
2. Technical University of Denmark (DTU), August 2012 (2 weeks), January 2012 (two weeks), June 2011 (two weeks), July 23, 2010—August 08, 2010; October 10—November 15, 2009; Aug. 2—Aug 23, 2008, June 1—June 22, 2007
3. Indian Institute of Technology (IIT Bombay): September 19–22, 2015. **November 26—January 14, 2013** (three weeks); **December 23, 2012—January 08** (two weeks); **December 2007** (one week.
4. University of Zurich, November 10—December 15, 2009. University of Basel (one day visit and Colloquium in November 2010); EPFL (one day visit and Colloquium in December 2010).
5. Tata Institute of Fundamental Research (TIFR): **December 16—21, 2012.**
6. Institute for Mathematics and Its Applications (IMA) Univ. of Minnesota (Summer 1988; two weeks), (Summer 1999, One week), April 2007, One week; December 2009 (one week);
7. Indian Institute of Science (IISc), Bangalore: September 11-19, 2015, 2007 (one week), 2015 (one week); Three visits during 1990–2000.
8. Indian Statistical Institute, Bangaore, 2007 (one week), 2015 (one week), three visits during 1990—2000.
9. SU 2000 (Aug. 10–13) 1998 (Aug. 19–22); 1993, 1991, 1988, 1987, 1986 (1-3 days).
10. MIT, August 18, 1998.
11. UPR, San Juan, PR, USA, UPR-Mayaguez (1995, 1998,1999—for one day), UPR-Humacao (1995,1997-for one day)
12. Gauss Research Lab., UPR, San Juan, PR, USA
 - i) **(September 1994–March 1995);**
 - ii) May 1993 (one week);
 - iii) November–January 1992 (two months);
 - iv) October-November 1991 (one month);
 - v) May 1990 (two weeks). Funded by NSF).
13. Cornell Univ. (1993, three days), (1988, 1 day).
14. INRIA, Sophia Antipolis, France (1993) (1 day)
15. ENST, Paris, France, 1993 (1 day).
16. USC, 1991.

17. MSU, (August 1989–July 1990) **one year**); 1991 (two days).
18. OSU, 1991 (two days).
19. CALTECH (June 1987–August 1989) (**two years**); (1991, two days,), 2005 (one week).
20. CUNY (Graduate Center). Several Visits during 1986–87; August 15, 2000; January 24, 2003.
21. IAS, Princeton (2006, one week)
22. IIT-Bombay (several times), IIT-Kanpur (four times), IIT-Delhi (three times, IIT-Madras (three times), IIT-Khargarpur (once), Institute of Mathematical Sciences (now Chennai Mathematical Institute) (three times), SPIC Science Foundation (three times)
23. University of Bombay (several times), University of Delhi, Madras University, Poona University, Udaipur University

PROFESSIONAL RECOGNITIONS AND DISTINGUISHED SERVICES

1. One of the four research exchange professors from the UPR system (selected by the Vice President for Research for the UPR system) as part of a high-level delegation that visited the Microsoft Research Headquarters in Redmond, WA, on January 18, 2001, and presented one of the four research talks.
2. April 2000: Dean’s committee to recommend chair for mathematics (elected by Math Dept.)
3. Member, Conference Committee of the International Symposium on AAEECC-18, Spain, June 2009 AAEECC-17, Bangalore, India, December, 16–2007 (Co-Chair) AAEECC-16, Las Vegas, USA, February 20-24, 2005 AAEECC-15, Toulouse, France, May 12–16, 2003, AAEECC-14, Australia, November 2001, AAEECC-13, Hawaii, November 1999; AAEECC-12 Toulouse (France), July 15-18, 1997; AAEECC-11, Paris, July 1995; AAEECC-10, San Juan, PR, USA, May, 10–14, 1993.
AAEECC \equiv *Applied Algebra, Algebraic Algorithms and Error-Correcting Codes*
4. Member of the program, *The 1st Institute of Mathematical Statistics (IMS) and International Mathematical Statistics (ISBA) Joint Meeting*, July 24–26, 2003, San Juan, PR, USA.
5. Scientific Committee, COLLOQUIUM: Algorithmic, Arithmetic and Geometry in the Theory of Error-Correcting Codes, 1–5 April 1996, Universite Antilles, Guyane, Guadeloupe, (Scientific Committee: Holdt, Janwa, Lachaud, Moreno, Rolland, Tsfasman).
6. One of the main invited speakers at several International Conferences (**see the list after PUBLICATIONS below.**)
7. Long paper, at the 1995 IEEE International Symposium on Information Theory (ISIT-95), British Columbia, CANADA, Sept. 22, 1995 (with O. Moreno). (19 of the approximately 600 presentations were long); and at the ISIT-97, Ulm, Germany June 29–July 3, 1997 (with O. Moreno). (18 of the approximately 550 papers were long).

8. “The non-existence of projective planes of order 10: Recent solution to a problem of Euler,” *Annual Day Lecture in Mathematics*, at the MRI, Allahabad on July 19, 1993.
9. Served on the National Committee set up by the Chairman of the Department of Atomic Energy (DAE), India, for linking of Libraries in the 13 Institutions funded by DAE (October 1996–February 1997).

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DRAFT

PUBLICATIONS (Some publications appear both as submitted and final publications) (July 2024—SEE UPDATED AT THE END) (1000+ citations including scores of Books)

Substantial research that I carry out is in Mathematics as it is applied to Error-correcting codes, Sequences, and Cryptography, and other modern areas of applied Mathematics. Prompt publication of research in these disciplines is of utmost importance in these highly competitive research areas and publication in prestigious conference proceedings is preferred over journals that can take years (harmful for priority, patent, and competitiveness). For example, our article, H. Janwa and R.M. Wilson, “Hyperplane sections of Fermat varieties in \mathbb{P}^3 in char. 2 and some applications to cyclic codes,”

Proceedings of the 10th International Conference on AAECC,

LNCS, No. 673, 1993, pp. 180–194. (Refereed by three referees.) , is regarded as a foundational paper in APN functions, and other non-linear functions of utmost importance for cryptography and sequences. This article has received quite high citations (70; hundreds in theses, reports and so on).

The AAECC proceedings have been regarded as highly competitive with three referees and high rejection rate.

Even among these, the article, “On the parameters of algebraic-geometric codes,” *Proceedings of the 9th International Conference on Algebraic Algorithms and Error-Correcting Codes (AAECC)*, New Orleans, USA, October 7-10, 1991. *Springer-Verlag Lecture Notes in Computer Science (LNCS)*, No. 593, October 1991, pp. 19–28. (**Invited**). (Refereed by three referees.), was one of the five invited speakers. Two other articles below ISIT05 and ISIT07, were as a result of 40 minute invitations in the prestigious ISIT Symposia, and indeed from among 500—600 articles that appeared, only 15-17 were declared as such.

The AMS-Review does not review many of the articles that have appeared below. However, their quality can be judged from the citations they have received (as can be confirmed by multiple sources).

Many of the articles have already appeared as references in books. Several of these articles are also invited solicitations, in AAECC, in ISITs, in DCC, in AMS-Joint Annual Conferences,

BOOKS

1. H. Janwa, RELATIONSHIPS AMONG PARAMETERS OF CODES,
Published by the University of Michigan Dissertation Publication Services, 1986.
(Based on the award-winning Ph.D. Dissertation, School of Computer and Information Science, Syracuse University, August 1986.)
2. H. Janwa and S.S. Rangachari (TIFR), RAMANUJAN GRAPHS AND THEIR APPLICATIONS. **RESEARCH MONOGRAPH**. Preprint dated January 15, 2010. 200 pages. (Cambridge University Press has solicited this book for publication in Their Cambridge Tracts in Mathematics, and also In Their Communications Series.).
3. H. Janwa, *Algebraic Geometry over Finite Fields and Its Applications*.
(Status as of 20/06/2010: A preliminary draft version.)

Publications I (in print)

4. H. Janwa and H. F. Mattson, Jr., “The covering radii of even subcodes of t -dense codes,” *Springer-Verlag Lecture Notes in Computer Science*, vol. 229, pp. 120-130, 1986. (**Invited.**)
5. H. Janwa and H.F. Mattson, Jr., “The covering radii and normality of t -dense codes,” *Proceeding of the IEEE International Symposium on Information Theory (ISIT)*, Ann Arbor, Michigan, October 6-9, 1986.
6. H. Janwa, “Some new upper bounds on the covering radii of binary linear codes,” *IEEE Transactions on Information Theory*, vol. IT-35, no. 1, pp. 110–122, January 1989.
7. H. Janwa, “Some optimal codes from algebraic geometry and their covering radii,” *European Journal of Combinatorics*, vol. 11, pp. 249–266, 1990.
8. H. Janwa, “On the covering radii of q -ary codes.” *Proceedings of the IEEE International Symposium on Information Theory (ISIT)*, January 14–19, 1990, San Diego, California.
9. R. Dougherty and H. Janwa, “Covering radius computations for binary cyclic codes,” *MATHEMATICS OF COMPUTATION*, Vol. 57, no. 195, July 1991, pp. 415–434.
10. R. Dougherty and H. Janwa, “Appendix—Results of Covering Radius Computations,” *MATHEMATICS OF COMPUTATION*, Vol. 57, no. 195, July 1991, **s38—s218**. (As Microfiche supplements.)
11. H.T. Cao, R. Dougherty and H. Janwa, “A $[55,16,19]$ Binary Goppa Code and Related Codes Having Large Minimum Distance,” *IEEE Transactions on Information Theory*, Vol. 37, no. 5, September 1991, pp. 1432–1433.
12. H. Janwa, “On the parameters of algebraic-geometric codes,” *Proceedings of the 9th International Conference on Algebraic Algorithms and Error-Correcting Codes (AAECC)*, New Orleans, USA, October 7-10, 1991. *Springer-Verlag Lecture Notes in Computer Science (LNCS)*, No. 593, October 1991, pp. 19–28. (**Invited**). (Refereed by three referees.)
13. H. Janwa, *THE MAN WHO KNEW INFINITY: A Life of the Genius Ramanujan*, in *The Political and Economical Weekly of India*, September 26, 1992, pp. 2105–2106.
14. H. Janwa and R.M. Wilson, “Hyperplane sections of Fermat varieties in \mathbb{P}^3 in char. 2 and some applications to cyclic codes,” *Proceedings of the 10th International Conference on AAECC*, *LNCS*, No. 673, 1993, pp. 180–194. (Refereed by three referees.)
15. H. Janwa, *THE MAN WHO KNEW INFINITY: A Life of the Genius Ramanujan*, By Robert Kanigel; *Bombay Mathematical Colloquium*, March 1993;
16. H. Janwa and O. Moreno, “McEliece-Public Key Cryptosystems Using Algebraic Geometric Codes,” *Proceedings of the 1995 IEEE International Symposium on Information Theory (ISIT)*, British Columbia, Sept. 17–22, 1995, p. 484-484.
The conference had 19 long papers among 600 total.

17. H. Janwa, G. McGuire, and R.M. Wilson, "Double-error-correcting cyclic codes and absolutely irreducible polynomials over $GF(2)$," JOURNAL OF ALGEBRA, vol. 178, pp. 665–676, 1995.
18. H. Janwa and O. Moreno, "Elementary Constructions of Some Ramanujan Graphs," CONGRESSUS NUMERANTIIUM, vol. 112, pages 7-15, December 1995.
19. H. Janwa, "Public Key Cryptosystems Using Algebraic Geometric Codes," *Proceedings of the National Discussion Meeting on Cryptography and Computation*, held at JNCASR, IISc. Bangalore, India, September 1995.
20. H. Janwa and O. Moreno, "McEliece like public-key cryptosystems using algebraic-geometric codes," *Designs, Codes and Cryptography*, vol. 8, no. 3, pp. 293–307, 1996.
21. H. Janwa and A.K. Lal, "On the generalized Hamming weights of cyclic codes," *IEEE Transactions on Information Theory*, Vol. 43, No. 1, pp. 298–308, January 1997.
22. H. Janwa and O. Moreno, "Strongly Ramanujan graphs from codes, polyphase-sequences, and Combinatorics," *Proceedings of the International Symposium on Information Theory, 1997 (ISIT-97)* Ulm, Germany., 1997, pp. 408-408,
The Conference had 18 long papers among total about 600.
23. H. Janwa and O. Moreno, "Coding theoretic constructions of some number theoretic Ramanujan graphs," CONGRESSUS NUMERANTIIUM, Vol. 130, pp. 63–76, 1998.
24. H. Janwa and H.F. Mattson, Jr., "Some Upper Bounds on the Covering Radii of Linear Codes over F_q and Their Applications," *Designs, Codes and Cryptography*, Vol. 18, no. 1-3, December 1999, pp. 163–181. (invited.)
25. H. Janwa, Jr., "Relations among Expander Graphs, Codes, Sequence Design, and Their Applications," in *Proceedings of the 4th World Multi-conference on Systemics, Cybernetics and Informatics (SCI2000) and ISAS2000*, Orlando Florida, July 23-26, 2000, Vol. XI, pp. 122-124. (invited—Organized by **Jacque Wolfmann**)
26. H. Janwa and H.F. Mattson, Jr., "The Projective Hypercube and Its Properties and Applications," *Proceedings of the 2001 International Symposium on Information Theory, (ISIT-2001)* June 2001, Washington, USA., p. 312-312. (3 1/2 regular size printed pages.)
27. H. Janwa and A.K. Lal, "A Comparison of Minimum Distance Bounds on Tanner Codes," *Proceedings of the 39th Allerton Conference on Communication, Control, and Computing*, pp. 1294–1296, December 2001.
28. H. Janwa and A.K. Lal, "On Tanner Codes: Parameters and Decoding," **Applicable Algebra in Engineering, Communication and Computing**, *A Springer Journal*, Vol. 13, pp. 335–347, 2003.
29. H. Janwa, "Good Expander Graphs and Expander Codes: Parameters and Decoding," *Proceedings of the 15th International Symposium on Algebraic Algorithms and Error-Correcting Codes (AAECC-15)*, Toulouse, France, May 2003. *Springer-Verlag Lecture Notes in Computer Science (LNCS)*, No. 2643, May, 2003, pp. 119–128. (Refereed)

30. “H. Janwa, A.K. Lal. On Expander Graphs: Parameters and Applications” **arXiv:cs.IT/0406048:2004**, pp. 1—11..
31. H. Janwa, “New (Explicit) Constructions of Asymptotic Families of Constant Degree Expander Graphs from AG Codes and Their Applications to Tanner Codes,” **ABSTRACTS OF THE AMS**, Volume 26, no. 1, pp. 197. (JOINT AMS ANNUAL MEETING, Atlanta, USA, 2005; (Invitation only) Special session on Algebraic Geometry and Codes.) (Invited Talk)
32. H. Janwa, “Explicit Constructions of Asymptotic Families of Constant Degree Expander Graphs from Algebraic Geometric (AG) Codes,” *CONGRESSUS NUMERANTIUM*, vol. 179, 2006, pp. 193–207.
33. H. Janwa and A.K. Lal, “On the Generalized Hamming Weights and the Covering Radius of Linear Codes,” **Lecture Notes in Computer Science**, Vol. 4871, pp. 347—356, December 2007.
34. H. Janwa, “Ramanujan graphs and Optimal Expander Graphs from Algebraic Geometric Codes,” H. Janwa, “Expanders and Ramanujan Graphs: Construction and Applications.” **ABSTRACTS of the AMS**, Volume 29, No. 1, P. 223. (JOINT AMS ANNUAL MEETING, San Diego, CA, USA, 2008; (Invitation Only) Special session on Expander Graphs and Ramanujan Graphs.) (one hour invited talk).
35. H. Janwa, Tom Hoeholdt, “Optimal Bipartite Ramanujan Graphs from Balanced Incomplete Block Designs: Their Characterizations and Applications to Expander LDPC Codes” **Lecture Notes in Computer Science**, Vol. 5527, pp. 53—64, June 2009.
36. H. Janwa, F. Pinero, “On the Parameters of Norm Trace codes,” *CONGRESSUS NUMERANTIUM*, Vol. 206 (2010), PP. 99-113.
37. H. Janwa, F. Pinero, “On the Subfield Subcodes of Hermitian Codes,” in Proceedings of the 3rd International Castle Meeting on Coding Theory and Applications, J. Borges and M. Villanueva (eds.), pp. 223—229, 2011
38. H. Janwa, Tom Hoeholdt, “Eigenvalues and expansion of bipartite graphs” *Designs, Codes and Cryptography* (invited article in Honor of Prof. R. M. Wilson’s 65th birthday), December 2012, Volume 65, Issue 3, pp 259-273.
39. M Delgado, H. Janwa, “On the Conjecture on APN Function” **arXiv:1207.5528[cs.IT][math.AG][math.CO]** **23 July 2012**, pp. 1—15.
40. H. Janwa, “Some Applications of Groebner Bases to Combinatorics,” in *Combinatorial Topology and Algebra. Lecture Notes in Mathematics, Ramanujan Mathematical Society, Journal*. Vol. 18, pages 1994–205, 2013.
41. H. Janwa, M. Delgado, “Further Results on Exceptional APN Functions,” **www.math.iitb.ac.in/srg/AGCT-India-2013/Slides/HeeralalJanwa.pdf**.
42. H. Janwa, F. Pinero, “On the subfield subcodes of Hermitian codes,” *Designs, Codes and Cryptography*,, *Designs, Codes and Cryptography*, January 2014, Volume 70, issue 1-2m pp. 157-173.
43. H. Janwa, P. Vijay Kumar and Andrew J. Tirkel, “In Memoriam: Oscar Moreno de Ayala (1946–2015)” *IEEE Information Theory Society News Letter*, Vol. 65, no. 4, pp. 43—45, 2015,
44. H. Janwa, F. Castro, G. Mullen, and I. Rubio, “On perfect like codes,” *Bulletin of the Institute of Combinatorial Mathematics and its Applications*, Vol 76, pp. 1—7, January 2016.

45. M. Delgado, H. Janwa, “On the Conjecture on Non-linear APN Functions and Absolutely Irreducibility of Polynomials,” **Designs, Codes and Cryptography**, Springer-Verlag, 10 February 2016, pp. 1–11:DOI: 10.1007/s10623-015-0168-1
46. M. Delgado H. Janwa, “Progress Towards the Conjecture on APN Functions and Absolutely Irreducible Polynomials,” **arXiv:1602.02576 [math.NT] 30 Jan. 2016**
47. H. Janwa, F. Pinero “On Parameters of Subfield Subcodes of Extended Norm-Trace Codes,” **arXiv:1604.05777 [math.AG] , 20 Apr 2016.**
48. H. Janwa, M. Delgado, “On the absolute irreducibility of hyperplane sections of generalized Fermat varieties in \mathbb{P}^3 and the conjecture on exceptional APN functions: the Kasami-Welch degree case,” **arXiv:1612.05997 [math.AG] 18 Dec.2016**
49. H. Janwa, H.F. Mattson, Jr., “Codes and Their Groups,” **submitted**, American Mathematical Monthly, 2016.
50. H. Janwa, M. Delgado, “Some New Results on the Conjecture on Exceptional APN Functions and Absolutely Irreducible Polynomials: the Gold Case,” *Advances in Mathematics of Communications (AMC)*, Vol. 11, pp. 389–396, 2017
51. H. Janwa, F. Pinero, “On the Parameters of Subfield Subcodes of Norm Trace Codes,” *Advances in Mathematics of Communications (AMC)*, Vol. 11, 2017, pp. 2017
52. H. Janwa, M. Delgado “On the completion of the exceptional APN conjecture in the gold degree case and absolutely irreducible polynomials,” *CONGRESSUS NUMERANTIUM*, Vol. 228, pp. 135–142, 2017.
53. H. Janwa, “BCH-like codes from extended norm-trace codes,” *CONGRESSUS NUMERANTIUM*, Vol. 228, pp. 211–221, 2017,
54. H. Janwa, Steve Massey, Julian Velev, and Bud Mishra, “Origin of Biomolecular Networks”, arXiv:1811.12933:q-bio.MN, 2018.
55. H. Janwa, Steve Massey, Julian Velev, and Bud Mishra, “On the Origin of Biomolecular Networks,” *Frontiers in Genetics*, Vol. 10, 2019, 1664-8021, pp. 240:1–18; In Antoniotti M, Mishra B and Pellegrini M (2019) Editorial: **Network Bioscience**. *Front. Genet.* 10:1160. doi: 10.3389/fgene.2019.01160
56. Heeralal Janwa, Steve Massey, Julian Velev, and Bud Mishra, “Supplementary Material: Graph Theory and Its Application to Biomolecular Networks,” Suppl. to Janwa et. Al, “On the origin of Biomolecular Networks,” *Frontiers in Genetics*, Vol. 10, 2019, Pp. S1–S13.
57. H. Janwa and Moises Delgado, “Transversal Intersection for further results on the conjecture of exceptional APN functions,” *CONGRESSUS NUMERANTIUM*, Vol. 232, pp. 101–111, 2020.
58. H. Janwa, H.F. Matton, Jr., “Modular Representation of $PSL_2(q)$ and other Groups via Coding Theory”, submitted, Dec. 31, 2019 (54 pages)
59. V. Manian, J. Orozco, H. Gangapuram, H. Janwa, C. Agrinoni, “Network Analysis of Gene Transcriptions of Arabidopsis Thaliana in Spaceflight Microgravity,” *Genes*, 12(3), 337, pp. 1–17, 2021.

60. V. Manian, J. Orozco, H. Gangapuram, H. Janwa, C. Agrinoni, “Network Analysis of Local Gene Regulators in Arabidopsis Thailiana under Spaceflight Stress,” *Computers*, 10(2), 18, pp. 1–26, 2021.
61. H. Janwa and R. M. Wilson, “Rational Points on the Klein Quartic and the Binary Cyclic Codes $\langle \mathbf{m}_1 \mathbf{m}_7 \rangle$,” *IEEE Transactions on Information Theory* (Accepted for publication subject to revision). (12 printed pages.)

Publications 2022–2023

62. R. Reyes Caranza and H. Janwa, “New Differentially 4-Uniform Functions Better Than a Large List of the Current Families for Cryptographic Protocols,” *Springer Journal of Applicable Algebra in Engineering, Communication and Computing (AAECC)*, pp. 1-27 (submitted). To be revised and resubmitted.
63. V. Manian, J. Orozco, V. Diaz Martinez, H. Janwa, and C. Agrinoni, “Detection of target genes for drug repurposing to treat skeletal muscle atrophy in mice flown in spaceflight,” *Genes*, vol. 13, no. 3, 473, pp. 1–20, 2022.
64. E. Arrieta and H. Janwa, “A new construction of two-, three-and few-weight codes via our GU codes and their applications,” *Applicable Algebra in Engineering, Communication and Computing*, vol. 33, no. 6, pp. 629–647, 2022.
65. H. Janwa and R. M. Wilson, “Rational points on the Klein quartic and the binary cyclic codes $\langle m1m7 \rangle$,” *IEEE Transactions on Information Theory*, accepted subject to revision, 12 pp.
66. R. Reyes Carranza and H. Janwa, “New differentially 4-uniform functions better than a large list of the current families for cryptographic protocols,” *Applicable Algebra in Engineering, Communication and Computing*, sub-mitted, pp. 1–27.
67. H. Janwa and C. Agrinoni, “On the origin of biomolecular networks: Advanced analysis,” *Frontiers in Genetics*, submitted Jan. 2022; revised Mar. 5, 2023.
68. R. Reyes Carranza and H. Janwa, “New efficient differentially δ -uniform functions,” in *Springer Proceedings in Mathematics & Statistics*, to be sub-mitted.
69. M. Delgado, H. Janwa, and C. Agrinoni, “Some new techniques and progress towards the resolution of the conjecture of exceptional APN functions and absolute irreducibility of a class of polynomials,” *Designs, Codes and Cryptography*, pp. 1–15, Mar. 2023. doi:10.1007/s10623-023-01202-y.
70. Leigh, Metcalfe, April Edwards, Will Casey, Shirshendu Chatterjee, Chatterjee, Heeralal Janwa, Ernest Battifaran, “Getting Local and Personal: Toward Building a Predictive Model for COVID in Three United States Cities,” In *ITNG 2023, 20th International Conference on Information Technology-New Generations*. pp. 11-18, 2023. In Book: *Advances in Intelligent Systems and Computing 1445*. Springer International Publishing. ISBN: 3031283317, 9783031283314
71. H. Janwa, C. Agrinoni, “On the Origin of Biomolecular Networks: Advanced Analysis”, *Frontiers in genetics*, pp. 1—18, January 2022 (submitted); Revised, March 05, 2023.

72. R. Reyes Carranza and H. Janwa, “New Efficient Differentially $\hat{\Gamma}$ -Uniform Functions,” Springer Proceedings in Mathematics & Statistics, pp. 1-20, to be submitted.

Publications 2024–2025

73. Juan Carlos Orozco and Heeralal Janwa. Resolution of a Conjecture on the Covering Radius of Linear Codes. Springer Proceedings in Mathematics & Statistics, vol. 448, Springer, Cham, 2024, pp. 413–425. [10.1007/978-3-031-52969-6_35](https://doi.org/10.1007/978-3-031-52969-6_35)
74. Heeralal Janwa and Fernando L. Piñero-González. Quantum Error-Correcting Codes Over Small Fields From AG Codes. In: F. Hoffman, S. Holliday, Z. Rosen, F. Shahrokhi, and J. Wierman (eds), *Combinatorics, Graph Theory and Computing*, SEICCGTC 2021. Springer Proceedings in Mathematics & Statistics, vol. 448, Springer, Cham, 2024, pp. 427–442. [10.1007/978-3-031-52969-6_36](https://doi.org/10.1007/978-3-031-52969-6_36)
75. Arrieta A. Eddie and Heeralal Janwa. A Go-Up Code Construction from Linear Codes Yielding Additive Codes for Quantum Stabilizer Codes. In: F. Hoffman, S. Holliday, Z. Rosen, F. Shahrokhi, and J. Wierman (eds), *Combinatorics, Graph Theory and Computing*, SEICCGTC 2021. Springer Proceedings in Mathematics & Statistics, vol. 448, Springer, Cham, 2024, pp. 443–464. [10.1007/978-3-031-52969-6_37](https://doi.org/10.1007/978-3-031-52969-6_37)
76. Jose W. Velazquez and Heeralal Janwa. Bent and Near-Bent Function Construction and 2-Error-Correcting Codes. In: F. Hoffman, S. Holliday, Z. Rosen, F. Shahrokhi, and J. Wierman (eds), *Combinatorics, Graph Theory and Computing*, SEICCGTC 2021. Springer Proceedings in Mathematics & Statistics, vol. 448, Springer, Cham, 2024, pp. 465–492. [10.1007/978-3-031-52969-6_38](https://doi.org/10.1007/978-3-031-52969-6_38)
77. W. Casey, L. Metcalf, H. Janwa, S. Chatterjee, and E. Battifarano, “A Novel ML Method for Temporal Evolution of Geographic Clusters of Disease Spread Patterns,” in International Symposium on Intelligent Computing and Networking, Springer, 2024, pp. 149–164.
78. Carlos Agrinoni, Heeralal Janwa, and Moises Delgado (2024). A new absolute irreducibility criterion for multivariate polynomials over finite fields. Springer Proceedings in Mathematics & Statistics, vol. 462, Springer, Cham, 2024. https://doi.org/10.1007/978-3-031-62166-6_5
79. Carlos Agrinoni, Heeralal Janwa, and Moises Delgado. Resolution of the exceptional APN conjecture in the Gold degree case. *Designs, Codes and Cryptography*, 1–20, 2025.
80. Carlos Agrinoni, Heeralal Janwa, and Moises Delgado. Toward resolution of the exceptional APN conjecture in the Kasami–Welch degree case. *Journal of Algebra and Its Applications*, Article ID 2541026 (14 pages), 2025. <https://doi.org/10.1142/S0219498825410269>
81. C. Agrinoni, H. Janwa, and M. Delgado, “New Approach to Test Absolute Irreducibility of a Multivariate Polynomial with a Square Leading Form,” Springer Proceedings in Mathematics & Statistics, submitted for publication.
82. W. Casey, L. Metcalf, S. Chatterjee, H. Janwa, and E. Battifarano, and Y. Gvill, A. Edwards, “Finding Anomalies in BGP,” in Lecture Notes in Networks and Systems, Springer, 2025, pp. 1-15.
83. W. Casey, L. Metcalf, S. Chatterjee, H. Janwa, and E. Battifarano, and Y. Gvill, “An Additive Logistic Multi-Model for Interpolation, Estimation, and Prediction: Applications to Epidemics and Analogous Events,” **Nature Scientific Reports, Vol. 16, Jan. 2026, pp.2228–2240**).

84. Velev, Julian, Luis Velázquez-Sosa, Jack Leblen, Heeralal Janwa, and Abiel Roche-Lima. "Modeling Multivariate Distributions of Lipid Panel Biomarkers for Reference Interval Estimation and Comorbidity Analysis." In *Healthcare*, vol. 13, no. 19, p. 2499, 2025. MDPI

SUBMITTED

85. C. Agrinoni, A. Zabel, and M. Delgado, "Absolute ir-reducibility of generalized trinomials defined by APN functions of the form $g(x) = x^2ie + h(x)$ over F_2^s ," Springer Proceedings in Mathematics & Statistics, submitted for publication.
86. C. Agrinoni, H. Janwa, and M. Delgado, "New Approach to Test Absolute Irreducibility of a Multivariate Polynomial with a Square Leading Form," Springer Proceedings in Mathematics & Statistics, submitted for publication.

TO BE SUBMITTED SOON

87. C. Agrinoni, M. Cruz Molina, A. Montes-Mercado, and H. Janwa, "Some applications of our generalized HITS and link-prediction algorithms to gene regulatory networks of *Drosophila melanogaster* reared in microgravity," to be submitted to the American Society for Gravitational and Space Research (ASGSR).
88. C. Agrinoni, H. Janwa, and M. Delgado, "Some More Functions that are not Exceptional APN in the Kasami–Welch Case," to be submitted to *Journal of Algebra*.
89. C. Agrinoni, H. Janwa, and M. Delgado, "Some New Results on Absolute Irreducibility of Multivariate Polynomials," to be submitted to *Mathematics of Computation (AMS)*.
90. C. Agrinoni, H. Janwa, and M. Delgado, "Some New Techniques for the Resolution of the Exceptional Almost Perfect Nonlinear Conjecture," to be submitted to *Contemporary Mathematics (AMS)*.
91. C. Agrinoni, H. Janwa, and M. Delgado, "A New Criterion for the Absolute Irreducibility of Multivariate Polynomials over Finite Fields," submitted to *Finite Fields and Their Applications*, Aug. 31, 2025
92. H. Janwa, *THE MAN WHO KNEW INFINITY: A Life of the Genius Ramanujan*, book review, *Economic and Political Weekly*, Sep. 26, 1992, pp. 2105–2106.
93. H. Janwa and R. M. Wilson, "Hyperplane sections of Fermat varieties in P^3 in char. 2 and some applications to cyclic codes," in *Proc. 10th International Conference on AAECC, LNCS 673*, 1993, pp. 180–194. 8
94. H. Janwa and A. K. Lal, "A comparison of minimum distance bounds on Tanner codes," in *Proc. 39th Allerton Conference on Communication, Control, and Computing*, Dec. 2001, pp. 1294–1296.
95. H. Janwa and A. K. Lal, "On Tanner codes: parameters and decoding," *Applicable Algebra in Engineering, Communication and Computing*, vol. 13, pp. 335–347, 2003. 9

96. H. Janwa and M. Delgado, "Further results on exceptional APN functions," Slides at AGCT-India-2013, 2013.
97. H. Janwa and F. Piñero, "On the subfield subcodes of Hermitian codes," *Designs, Codes and Cryptography*, vol. 70, no. 1–2, pp. 157–173, Jan. 2014. 10
98. H. Janwa and H. F. Mattson, Jr., "Modular representation of $PSL_2(q)$ and other groups via coding theory," submitted, Dec. 31, 2019 (54 pages).
99. V. Manian, J. Orozco, H. Gangapuram, H. Janwa, and C. Agrinoni, "Network analysis of gene transcriptions of *Arabidopsis thaliana* in spaceflight micro-gravity," *Genes*, vol. 12, no. 3, 337, pp. 1–17, 2021. 11
100. R. Reyes Carranza and H. Janwa, "New efficient differentially δ -uniform functions," in *Springer Proceedings in Mathematics & Statistics*, to be submitted.
101. M. Delgado, H. Janwa, and C. Agrinoni, "Some New Techniques and Progress Towards the Proof on the Conjecture on Exceptional APN Functions and Absolutely Irreducible Polynomials," *Designs, Codes and Cryptography*, 2023, pp. 1–18. 12
102. C. Agrinoni, H. Janwa, and M. Delgado, "Progress in the Kasami–Welch of the Exceptional APN Conjecture," *Journal of Algebra and Its Applications*, 2025. 13
103. W. Casey, L. Metcalf, S. Chatterjee, H. Janwa, and E. Battifarano, and Y. Gvill, A. Edwards, "Finding Anomalies in BGP," in *Lecture Notes in Networks and Systems*, Springer, 2025, pp. 1-15. 14
104. C. Agrinoni, H. Janwa, and M. Delgado, (2025) "Classification of Generalized Quadrinomials," *Springer Proceedings in Mathematics & Statistics*, April. 2026.
105. Leigh Metcalf, Will Casey, Timur Snoke, Timur and Heeralal Janwa, Shirshendu Chatterjee, and Ernest Battifarano A Novel Graph Spectra Approach to Anomaly Detection in Border Gateway, booktitle=Proceedings of the International Symposium on Intelligent Computing and Networking 2025: ISICN 2025, pages=387, year=2025, organization=Springer Nature Publications II (Preprints)
106. H. Janwa, "Explicit constructions of asymptotic families of constant degree expander graphs: Their expander codes and decoding," preprint.
107. H. Janwa, "A graph theoretic proof of Delsarte's bound on the covering radius of linear codes." (7 pages)
108. H. Janwa, " t -MDS codes, threshold schemes and algebraic geometric codes." (12 pages)
109. H. Janwa, "On the covering radius of q -ary linear codes."
110. H. Janwa and H.F. Mattson, Jr., "On the covering radius of t -dense codes.'
111. Explicit Constructions of Good Expander Codes and Good Expander Graphs: Their Parameters and Decoding. (H.Janwa; H. Janwa and H.F. Mattson, Jr.; H. Janwa and A.K. Lal (IITK, India).

112. Algebraic geometric codes;
113. H. Janwa, O. Moreno, "Ramanujan graphs and expander graphs, codes, and sequence design.
114. H. Janwa, A.K. Lal, "Tanner codes: their parameters and applications." (IITK, India).
115. H. Janwa, H.F. Mattson, Jr., "Projective hypercubes and applications.
116. H. Janwa, P.Vijay Kumar, T. Helleseth, and O. Moreno, "Good expander graphs, codes, sequences, and exponential sums over Galois rings".
117. H. Janwa, F. Castro, "Rational point over curves over finite fields and new estimates on exponential sums and applications."
118. H. Janwa, O. Moreno, "On McEliece's and Niederreiter's public key cryptosystems and their modifications."
119. H. Janwa, A. Lal, "On the generalized Hamming weights of codes."
120. H. Janwa, "Improved bounds on the number of rational points on curves over finite fields."
121. H. Janwa, P. Rivera, "Using Genetic algorithms to construct good codes."
122. H. Janwa, P. Guan, "Optimal codes from graphs."
123. H. Janwa "New Families of Infinite Classes of Constant Degree Expander Graphs and Their Tanner Codes and Decoding," preprint.
124. H. Janwa and A.K. Lal, "Further Results on the generalized Hamming weights and the covering radius of cyclic codes" (10 pages-preprint.)
125. H. Janwa, "On the covering radii of AG codes," (12 pages preprint.)
126. H. Janwa and A.K. Lal, "Comparison of various bounds on the parameters of Tanner Codes," (15 pages, preprint.)
127. H. Janwa and H.F. Mattson, Jr. "Sparse Graph topologies for parallel computing," (10 pages, preprint.)

Mehta Research Institute (MRI)/ Harish-Chandra Research Institute (HRI) TECHNICAL REPORTS

128. "Codes from some Ramanujan graphs," MRI-MATH/M970703
129. H. Janwa, O. Moreno, "Strongly Ramanujan graphs from codes, polyphase-sequences, and combinatorics," MRI-MATH/96-06.
130. H. Janwa, O. Moreno, "Coding Theoretic constructions of some number theoretic Ramanujan graphs," MRI-MATH/96-05.
131. H. Janwa, H.F. Mattson, Jr., "Some new upper bounds on the covering radius of codes and their applications," MRI-MATH/96-02.
132. H. Janwa, "On the Generalized Hamming Weights of Codes Holding t -Designs," MRI-MATH/14/95.

133. H. Janwa, A. Lal, "On the Generalized Hamming Weights and the Covering Radius of Linear Codes," MRI-MATH/13/95.
134. H. Janwa, O. Moreno, "Elementary Constructions of Some Ramanujan Graphs," MRI-MATH/10/95.
135. H. Janwa, O. Moreno, "McEliece Public-Key Cryptosystems Using Algebraic-Geometric Codes," MRI-MATH/12/94.
136. H. Janwa, G. McGuire, R.M. Wilson, "Double-error-correcting cyclic codes and absolutely irreducible polynomials over $GF(2)$," MRI-MATH/11/94.
137. H. Janwa, "A Graph Theoretic Proof of Delsarte's Bound on the Covering Radius of Linear Codes," MRI-MATH/10/94.
138. H. Janwa, A. Lal, "On the Generalized Hamming Weights of Cyclic Codes." MRI-MATH/9/94.
139. H. Janwa, *Some Applications of Gröbner Bases to Combinatorics: A Survey*, MRI Report, MATHS/2/Mar94.
140. H. Janwa, *Super Ramanujan Graphs from Combinatorics*: MRI Report, MATHS/3/Mar94.
141. H. Janwa *l-MDS Codes, Threshold Schemes and Algebraic Geometric Codes*, MRI Report, MATHS/3/Mar94.

Drafts.

142. H. Janwa, G. Mullen, I. Rubio, F. Castro, "Characterization and Applications of Codes Related to the Perfect Codes," (in progress).
143. H. Janwa, Peter Belen, "Characterization of Graphs Associated with Some Towers of Function Fields."
144. H. Janwa, F. Bogomolov, "Distribution of the Moduli Space of Curves over Finite Fields for a Given Genus and Their Applications to cryptography."
145. H. Janwa, S. Cappell, Ed. Miller, "Laplacian of Graphs on Manifold, Their Isoperimetric Properties, and Applications."
146. H. Janwa, Joachim Rosenthal, "Network Coding and Grassmanian Varieties."
147. H. Janwa, Maria Petkovic, "Modular Interpretation of Some Towers in Odd Powers."
148. H. Janwa, M. Delgado, "On the conjecture on APN Function and Absolute Irreducibility of Polynomials," to be submitted.
149. H. Janwa, O. Moreno, "Ramanujan graphs, codes, exponential sums, and Sequences" *to be submitted*. (as a regular paper) (24 pages).
150. H. Janwa, "Post Quantum Cryptography: On our generalization of McEliece public key cryptosystems based on subfield subcodes of algebraic geometric codes," (preprint-12 pages) to be submitted. presented at GeoCrypt2009, Guadalupe, France, June 2009. Also presented at EPFL Lausanne, December 2009; University of Zurich, November 2009 and at EPFL Lausanne, Switzerland.

151. H. Janwa, "A General Framework for public key cryptosystems based on subfield subcodes of algebraic geometric codes and their security," (preprint-15 pages). To be submitted. (Presented at the University of Basel, November 2009; EPFL, December 2009, Switzerland).
152. H. Janwa, P. Guan, "New Graph-Based Code Constructions with Good Parameters and Fast Decoding Algorithm." (preprint-10 pages) (to be submitted).
153. H. Janwa, F. Pinero, "On the parameters of Hermitian codes: Theoretical and Algorithmic Results," (preprint-20 pages). (to be submitted.)
154. H. Janwa, "New Explicit Families of Constant Degree Expander from Algebraic Geometry Graphs and Their Tanner Codes," (preprint-15 pages-to be submitted.)
155. H. Janwa, and C. Beltran, "Algorithms for computing the generalized hamming of q -ary cyclic codes, and their applications to the existence of some optimal cyclic codes for wire-tap channels," in process.
156. H. Janwa, F. Pinero, "On the Parameters and Decoding of Hermitian Codes," *to be submitted*.
157. H. Janwa, P. Guan, "Amalgamated Graph-Based Codes from Cut-Sets with Fast Decoding Algorithms," *to be submitted*.
158. H. Janwa, B. Mishra, P. Franquin, "Applications of expander graphs in bioinformatics." (preliminary preprint in preparation).
159. H. Janwa, S. Cappell, S. Miller, "Constructions of some Ramanujan graphs based on insights from algebraic topology and Riemannian geometry," in preparation.
160. H. Janwa, Tom Hoeholdt, Optima Regular and Irregular Bipartite Expander and Ramanujan Graphs and Expander Graphs: Their Characterizations and Applications to Expander/ LDPC Codes. In Preparation.
161. H. Janwa, R. Dougherty, "Further results on the covering radius computation of cyclic codes'," in preparation.
162. H. Janwa, S. Cappell S. Miller, "Expander graphs from symmetries, " in preparation.
163. H. Janwa, A.K. Lal, "On Expander Graphs: Parameters and Applications" to be (12 pages-submitted).

M.Sc. (Honors) Mathematics (1975–1980), Thesis

"Parameters of codes," M.Sc. (Hons.) Mathematics Thesis, BITS, June 1980. The M.Sc. (Hons.) was a five year (1975–1980) integrated Master of Science in Mathematics program.

"Software Implementation of BCH codes," Practice School Report submitted to *Software Development Division, Department of Electronics (DOE)*, Government of India, for the work done during January–June 1981.

INVITED SPEAKER/ONE OF THE MAIN SPEAKERS

at International Conferences and Workshops not listed earlier, see for example, listings for ISIT-95, ISIT-97, AAECC-9, SCI2000/ISA2000, SIAM Mini-Syposium, AMS Annual Meetings, 2005, AMS Annual Meetings, 2008 (one hour speaker), one of main speakers in AMS Sectional Meeting, UNLV, 2011. See listed under HONORS or PUBLICATIONS; Also received invitations from several other international conferences.

Some major addresses were, **for example**:

- Invited Speaker at the International Conference On Algebraic Geometry and coding Theory (AGCT), 2013, IIT Bombay, India.
- Invited Speaker at the Prestigious Annual TIFR International Conference: 2012 Theme, "Recent Trends in Discrete Mathematics."
- Invited Speaker at the AMS Annual Sectional Meeting, UNLV, Nov. 2011
- Invited Speaker at CRYPTO-2009.
- 2010, Invited to Organize AAECC-18 in Puerto Rico
- 2010 Several talks as Scholar in Residence (awarded by Faculty Resource network)(NYU), Spring Semester
- One hour Invited Speaker at the AMS Annual Meeting, San Diego, January 2008, in *Special Session on Expander Graphs* (organized by Terras et al.)
- Invited Speaker at the AMS Annual Meeting, Atlanta, 2005, in *Special Session on Algebraic Geometry and Coding Theory* (Organized by Gao et al.).
- **AAECC-9:** (C. Traverso, H. Janwa, E. Kaltofen-Saunders, S.N. Litsyun, W.V. Vasconcelos),
- **SIAM Conf.:** (V. Pless, G. Cohen, R. Brualdi, C. Huffman, H. Janwa)
- **Conf. in Honor of Prof. Shrikhande:** (P. Cameron, L.J. Dickey, H. Janwa, J.N. Srivastava).

A list of main speakers at other conferences is available.

- "Expander Graphs, Codes, Sequence Designs: Their Relations and Applications," talk delivered (which was webcast) at the Microsoft Research Headquarters in Redmond, WA, on January 18, 2001, as one of the two research exchange professors representing the UPR, Rio Piedras campus.
- "New Constructions of Ramanujan Graphs and Good Expander Graphs from Codes, Exponential Sums and Sequences," (based on joint work with O. Moreno) at the 1999 IMA Summer Program on *Codes, Systems and Graphical Models* from August 01–08 at the Institute for Mathematics and its Applications, at Minnesota.

- *International Workshop on Discrete Mathematics* in honor of Prof. S.S. Shrikhande, at the University of Bombay, December 20, 1993– January 08, 1994. (Other invited speakers: Peter Cameron; D. Hughes; L.J. Dickey).
- “Some applications of invariant theory,” invited lecture, *Instructional Conference on Combinatorial Topology and Algebra* (ICCTA-93), IIT Bombay, December 24, 1993. (Other invited lecturers included C. Musili and N.M. Singhi).

Other Presentations at International Conferences and Workshops

[Majority of them invited participation].

(Some of the talks were presented by co-authors).

A list of over 40 such talks is available.

Presentations at National Conferences and Workshops

A list of over 36 such talks is available.

Presentations at Universities Outside India

A list of at least 35 such talks is available. These were mostly delivered at the Universities listed on page 3. Most recently on August 16, at the Institute for Mathematics, DTU Denmark, 2012.

Presentations at Universities in India

A list of over 50 such talks are available. For the universities where the lectures were delivered, see page 3.

OTHER Selected Major International Conferences/Colloquia/Workshops attended, in addition to the ones given talks

- Joint Annual AMS-MAA Meetings, Washington D.C., 2009, San Diego (2008), Atlanta 2005, Maryland 2003,
- AAECC-18 (Spain) 2009, AAECC-17 (India) 2007, AAECC-16 (Las Vegas), 2006,
- GEOCRYPT09
- IMA, Minnesota, 2007.
- ISIT-2007, Nice, France.
- IAS, Princeton, 2006 (Expander Graphs)
- IPAM, UCLA, 2004 (Expander Graphs)

- Conference on Additive Number Theory, CUNY, 2004.
- Theory Day, Columbia University, 2004.
- Theory Day, Courant Institute, 2003.
- AMS Annual Meeting, Maryland, 2003
- *AAECC-13*, Hawaii, November 1999.
- *13th International Parallel Processing Symposium & 10th Symposium on Parallel and Distributed Processing*, (IPPS/SPDP) April 12-16, 1999, San Juan, PR, USA.
- International Workshop on *Discrete Mathematics* in honor of Professor S.S. Shrikhande at the University of Bombay, from December 20, 1993–January 08, 1994;
- *International Conference on Lie Groups* in honor of Professor Harish Chandra, October 10–13, 1993 at the MRI, Allahabad.
- International Colloquium on Geometry and Analysis, TIFR, January 6–14, 1992. International Workshop on *Applications of Algebraic Geometry*, UPR (one week in January 1990);
- Indo-USSR Conference on Geometry, TIFR, January 1991.
- International Conference on Computational Algebraic Geometry, at Cornell University, July 1988.
- Workshop on *Design Theory and Coding Theory*, IMA (two weeks in July 1988);
- International Conference on Computational Algebraic Geometry, Columbia University, 1987.
- 12th American Association for Advancement of Science (AAAS) & EPSCoR Annual Meeting, 2000; Also, 11th, 10th, 7th, AAAS & EPSCoR Conferences.
- “Ten Lectures on the proof of Fermat’s Last Theorem by Wiles,” given by Prof. Ram Murty at MRI, Allahabad during September–October, 1993.
- Workshop on *Elliptic Curves*, Tata Institute of Fundamental Research (TIFR), (for one week in October 1991);
- Workshop on sl_2 , TIFR, June 1992;
- Month Long Summer School for National Science Talent Scholars conducted by NCERT (INDIA) at: IIT-Kharagpur (1976); IIT- Kanpur (1977); TIFR (1979); BITS, Pilani (1980).

TEACHING

UPR:

GRADUATE: (For recent courses, see <http://ramanujan.uprrp.edu>)

1. Spring 2022-2023: Mate8995 (Ph.D. level) Artificial Intelligence, Machine Learning, and Deep Learning
2. Fall 2022-2023 Mate6150 (Core Graduate) Linear Algebra (with emphasis on Data Analysis and Deep Learning)
3. Spring 2021-2022 Mate8990 (Ph.D. level) Information Theory
4. Fall 2021-2022
Math6150 (Core Graduate Course) Graduate Linear Algebra
5. Spring 2020–2021 Math 6202 (Second Level Graduate Course) Graduate Algebra II
6. Spring 2020–2021
MATH 8986 (Ph.D. Level) Topics in Network Science
7. Fall 2020-2021 Math6150 (Core Graduate Course) Graduate Linear Algebra
8. Fall 2019–2020 MATE 8985 (Ph.D. level) Information Theory, Inference and Machine Learning Algorithms, Network Sciences, and Harnessing the Data Revolution
9. Spring 2018-2019 (Ph.D. Level Course) Interdisciplinary Topics in the Mathematics of Emerging Big Ideas: Quantum Leap, Understanding Rules of Life and Harnessing the Data Revolution.
10. Fall 2018-2019: (Ph.D. Level course) Classical and quantum information theory, computing and error-control with a view towards post-quantum Cryptography
11. Spring 2018–2019 (Semi-graduate) Math 5207 Introduction to Coding Theory
12. Spring
Math 8990:
13. Spring 2017-2018 Mate8985 (Ph.D. Level Class) Topics in Network Sciences
14. Fall 2017 -2018 Math6201 Graduate Algebra I
15. Fall 2016-2017 Mate6201: Graduate Algebra
16. Spring 2016-2017 Mate 8021
17. Spring 2015-2016 Mate8986
18. Fall 2015-2016 Mate8985
19. Fall 2015-2016 MATH6150 Graduate Linear Algebra
20. Fall 2014-2015 Interdisciplinary Current Research Topics in Pure Mathematics

21. Fall 2013-2014 Advanced Topics in Coding Theory (Spring 2013-2014) Function Fields
22. Spring 2012-2013 Advanced Topics in Coding Theory
23. Fall 2012-2013 Advanced Topics in Cryptography
24. Fall 2012-2013
Enumerative Combinatorics
25. Fall 2011–202
Information Theory and Bioinformatics
26. Fall 2009—2019
27. August 2009–July 2010: Visiting Member, Curren Institute of Mathematical Sciences (NYU) (Sabbatical Year)
28. Spring 2008-2009
 - (a) Computational Algebraic Geometry, MATH 8995;
 - (b) Recent Advances in Coding Theory, MATH8990;
29. Fall 2008-2009
 - (a) Enumerative Combinatorics I, MATH 8005;
 - (b) Graduate Algebra I, MATH6201;
30. Spring 2007-2008
 - (a) Algebraic Combinatorics, MATH 8021;
 - (b) Information Theory 8995;
31. Fall 2007-2008
 - (a) Linear Algebra Mate 6150;
 - (b) Advanced Cryptography 8995;
32. Spring 2006-2007:
 - (a) Algebra, MATH 6202;
 - (b) Coding Theory, MATH 8995.
33. Fall 2006– 2007:
 - (a) Linear Algebra (Graduate), Mate 6150.
 - (b) Modern Algebra I (Graduate), Mate 6201
34. Spring 2005– 2006:
 - (a) MATE 8021 Algebraic Combinatorics I.
 - (b) MATH 8995 Information Theory.
35. Fall 2005–2006:

(a) Linear Algebra (Graduate Course), MATH 6150

(b) Advanced Cryptography, MATH 8995

36. Spring 2004– 2005:

(a) MATE 8021 Algebraic Combinatorics I.

(b) MATH 8995 Information Theory and BioInformatics.

37. Fall 2004–2005:

(a) Linear Algebra (Graduate Course), MATH 6150

Sabbatical 2003—2004 The Courant Institute of Mathematical Sciences

Expander Graphs and Expander Codes (Fall 2003)

Topics on Expander Graphs and Expander Codes (Summer 2003)

Information Theory and Bioinformatics, Spring 2003–2003

Finite Dimensional Vector Spaces, Fall 2002-2003

Some Current Topics in Coding Theory and Cryptography, Spring 2001-2002

Higher Dimensional Vector Spaces, Fall 2000-2001

Topics in Coding Theory and Cryptography, Fall 2000

Introduction to Coding Theory, Summer 1999-2000 (ad honorarium)

Topics in Coding Theory, (Independent Study, Fall 1999)

Data Structures I (Fall Semester, 1998-99).

Modern Algebra I (Fall Semester, 1997–98).

UNDERGRADUATE: (For recent Courses, see <http://ramanujan.uprrp.edu>)

Artificial Intelligence,

Cryptography and Computer Security, Spring 2002-2003

Parallel and Distributed Computing, Fall 2002-2003

Compiler Construction (Grad. and Undergrad. Students, Fall '97, Spring '99, Fall '2000, Spring 2003)

Theory of Computation (Spring 1997-1998, 1998–1999, 1999–200, 2000-2001)

Cryptography and Data Security, (*Fall 1999-20000*)

Parallel Computation, Spring 1999-2000

Higher Level Programming Languages: Java (Fall, 1998–99, Fall 1999-2000)

Statistics with Computers, (Summer, 1998).

Precalculus (Second Semester 1997-98)

Topics in Complexity Theory, (John Ramirez, Fall 1994.)

Artificial Intelligence, (James Irrizary, 1999)

Topics in Design and Analysis of Algorithms (Jaime Rosa, Fall 2000)

MRI:

GRADUATE:

Topics in Coding Theory, Second Semester, 1995–96.

Algebra (Fall 1993–94);
Function Fields and Codes (Reading Course, Fall 1994) and
Algebraic Geometry and Coding Theory, (Second Semester, 1994),
(Brajesh Kumar, Ph.D. Student)

BOMBAY UNIVERSITY
(Center for Advanced Studies in Mathematics):

M.Phil.

Commutative Algebra (One year M.Phil course, Univ. of Bombay, 1991–92);
Commutative Algebra (Reading Course, two Semesters 1992)

GRADUATE

Numerical Analysis (Univ. of Bombay, one year, 1991–92);

TIFR:

Organized regular research seminars in algebraic geometry and coding theory and presented 6 seminars

MSU:

GRADUATE

Numerical Analysis (MSU, one Term 1990)

UNDERGRADUATE

Three Semesters of Numerical Analysis and 2 Semesters of Calculus.

CALTECH:

GRADUATE:

Combinatorial Analysis, (full year course during 1987–88) (Text: Marshall Hall)

Algebraic Geometry (full year course, during 1988–89), *Text: Algebraic Geometry, by Hartshorne*, finished about 75 percent of the text, plus topics from Algebraic Geometric Codes.

UNDERGRADUATE:

- Huy T. Cao: *Implementation of Coding Theoretic Algorithms on Hypercubes*, Spring and Summer, 1988.
- Elizabeth Wilmer (from Harvard); *Elliptic Curve Cryptosystems*, Summer 1987.

COURANT INSTITUTE:

6 LECTURES IN THE SEMINAR SERIES ON COMPUTATIONAL ALGEBRAIC GEOMETRY

SYRACUSE UNIVERSITY:

Teaching assistant in several graduate and undergraduate courses during 1982–86.

Professional Experience I:

LECTURE SERIES

The highlights are:

- One of the main invited lecturers for *UGC*, India, sponsored, refresher courses for college teachers at: I) The Delhi University; II) Bombay University; III) Poona University.
- Organized weekly seminars on coding theory, cryptography and algebraic geometry at TIFR; Bombay University; and MRI. Furthermore, I presented series of lectures in these seminars such as Algebraic geometric codes; algebraic geometry over finite fields and Applications (bounds of Weil, Serre, Oesterle and Deligne; Drienfeld modular curves; class field towers; Ramanujan Graphs from quaternion algebras, character sums, and codes; codes, curves and lattices;
- Gave a total of ten seminars at MSU in the seminar groups in *Combinatorics*; *Commutative Algebra*; and *Group Theory*.
- Gave several seminars at CALTECH in the seminar groups in *Combinatorics*, *Algebraic Number Theory and Algebraic Geometry*, and *Information Theory*.
- At CIMS (NYU, 1986-87) Participated in Computational Algebraic Geometry seminars/Computational Number Theory Seminar (Jointly between CISM and CUNY).

Professional Experience II:

A. COMMITTEE WORK

(I have been on a dozen Ph.D. Qualifying exam Committees, and perhaps two dozen M.S. Qualifying Exam Committees), several placement exam committees, etc.)

UPR-Rio Piedras (1997—)

- Member UPR Academic Senate 2012— (Also Member of Senate Faculty Affairs Committee (2012—; Member of Revision of Rules of UPR Committee Representing Faculty Affairs Committee;
- Dean Search Committee for the College of Natural Sciences, 2014.
- Committee to recommend a new Chair for the Department [May 2000—May 2001 (completed)]. My election to that committee was extra-ordinary in that I had been in the department for less than three years.
- Graduate Committee, May 2001 (?)—2006

- Curriculum Committee [Elected in August 2000—] The task has been a major overhaul of the Undergraduate Program with several degree options. Another major task is to recommend a re-conceptualization of the undergraduate curriculum. The main task is to recommend a re-conceptualization of the undergraduate curriculum.
- Ph.D. Committee for Discrete Mathematics Option (1997—)
- Ph.D. Committee for Computational Mathematics Option (1997—)
- Committee “para enlace SIDIM” (Elected February 1999; Served until February 2000).⁵
- Faculty committee participating in the Undergraduate CS program (1997—)
- Dean’s Committee for Computational Science Research in UPR-Rio Piedras Committee (1998—1999).
- Possible collaboration between UPR Mayaguez and UPR Rio Piedras campuses for an inter-campus Ph.D. program involving several departments and several campuses.(1997—)
- Committee for Ph.D. program in CS at UPR-Rio Piedras (Fall 2000—).

MRI ((1992—1999); (On sabbatical ’97–98; on leave. ’98–99’)

- Member of the core faculty for the NBHM Nurture Program for 1996–2000 (for the 1996 batch) (on leave 1997–99).
- National level committee to link libraries in the DAE system (see page 2).
- Main Coordinator for national level Joint Written Screening Test (JWST) coordinated by MRI (for MRI/IMSC/SINP) 1995-96);
- Computer Committee, MRI, January 1993— August 1996 (Convener for one year).

University of Bombay (January 1991–October 1992):

- Member of the Computer committee at the University of Bombay, February 1991–1992.
- Several other committees.

SU (1982–6):

Graduate Student Representative on School of CIS, Tenure Committee, SU, 1983-84.

B. EXTERNAL EXAMINER

(Also, was nominated Ph.D. Examiner for Ph.D. students at IIT Kanpur, IIT Madras, and Poona University.)

1. Oral Defense of the Ph.D. of Mr. (Dr.) M. S. Garg at IIT Kanpur.

2. Ph.D. Examiner for Mr. (Dr.) N. Madhusudan, Dept. of Elect. Engg., IIT Kanpur.
3. Preliminary Examination of Ph.D. of Mr. Tony Lee at CALTECH, 1989.

DRAFT

C. STUDENTS

CURRENT Ph.D. STUDENTS:

Dioniso Perez Montes, 2011—

Julian Rodriguez, 2013—

PAST Ph.D. STUDENTS AT UPR:

1. Roberto Gorbea, B.S. 2022 (2019-2022; Supported by NSF-PRLSAMP); M.S. (2022— current)
2. Roberto Gorbea, B.S. (Supported by NSF-PRLSAMP); M.S. (2020— current)
3. Jaziel Torres, B.S. (2016—) (was awarded PennState MASS Semester long program); Supported by NSF-PRLSAMP; Alan Turing Fellowship)
4. Luis Quinones, B.S (2016–2018) ((was awarded Penn. State MASS Semester long program); Supprted by NSF-supported Alan Turing Fellowship.
5. Andres Arroyo, M.S. (2018—) (Supported by PRLAMP Bridge to Doctorate Student Fellowship Grant)
6. Carlos Agrisoni, M.S., 2021 (2017– 2021) (2018—2021, Supported by NASA Space Consortium Student Grant); currently Ph.D. student in the Department of Mathematics at Purdue Universtiy.
7. Jose Velasquez, M.S, 2022; 2019–2022 Supported by NASA Space Consortium Student Grant)
8. Eddie Ariqueta, Ph.D. May 2021
9. Anthony Gomez Fonseca, M.S. 2019 (May 2019) (Supported by NASA Space Consortium Student Grant); Currently Ph.D. Student in the Department of Mathematics, Notredame University.
10. Juan Carlos Orosco, Ph.D. 2017 (finished). (Supervised 2013—2017)
11. Hu Qin (Ph.D. May 2016) (finished) (Jointly Supervised with Dr. Puhua Guan)
12. Moises Delgado (Ph.D. 2012) (finished): Funded:2008—, 2009–2010 (supported by DEGI-FIPI grant) (Graduated with Ph.S., May 2012)
13. Carlos Beltran(Ph.D., 2006—>2009)(supported by DEGI+NSF-STEM Publications)
14. Dionisio Perez Montes, NSF-IGERT Program in the Environmental Sciences, 2009—
15. Fernando Pinero (M.S. —>Ph.D., 2006—) (supported by NSF Fellowship 2006–2008), NASA Fellowship 2008–2009 and 2009-2010.
16. Wanda Vasquez (M.S.->Ph.D., 2009—). Supported by DEGI+NSF-STEM grants; 2009-2010 by a NASA Fellowship.
17. Haydee Guzman (M.S.—>Ph.D.) Supported by NSF Fellowships.
18. Rafael Del Valle (M.S.) (2006—) Supported by DEGI-FIPI and NSF-STEM)
19. Ms. Guo Qi, January 2002— (Graduate Student.); M.S., April, 2004 (expected). Trained under NSF grant
20. Dachun Huang, M.S. Student (M.S., May 2003). Trained under NSF grant

21. Humberto Ortiz (working on genomics), now registered under the inter-campus Ph.D. program between UPR-Rio Piedras and UPR-Mayaguez. (2000-2001; co-supervision 2001-2002).
22. B. K. Sharma (Ph.D. student at MRI, since April 1996—)
23. I contributed, in varying extent, to the supervisions during the completion of Ph.D. Dissertations of M.S. Garg at IIT Kanpur, Dan Ashlok at CALTECH, Gary McGuire at CALTECH, and Nivedita Jain at Poona University.

POST-DOCS:

1. M.K. Garg (Ph.D. IIT Kanpur), 2003–2004 at MRI.
2. Arbind Kumar Lal (Ph.D. from ISI Delhi) 2003–2006 at MRI.

CURRENT AND PAST FUNDED RESEARCH STUDENTS:

1. Carlos Beltran, Ph.D., 2006— (Supported by UPR-FIPI grant, 2006–2007, NSF-STEM+RA, 2007–2008, NSF-STEM+UPR- DEGI Grant, 2008–2009)
2. Fernando, M.S. (Ph.D.—>) 2006—(2006–2008, NSF-PRLSAMP Fellow, 2008-2009, NASA Fellow)
3. Rafael Del Valle, M.S. (—>Ph.D.), 2006— (Supported by UPR-FIPI grant, 2006–2007, NSF-STEM+RA, 2007–2008, NSF-STEM+UPR- DEGI Grant, 2008–2009)
4. Wanda Vasquez, M.S. (—>Ph.D.) 2008— (Supported by UPRRP-DEGI Grant).
5. Haydee Guzman, M.S. (—>Ph.D.), 2008— (Supported by NSF-PRLSAMP Fellowship).

OTHER STUDENTS:

Supervised several other undergraduate and graduate students on various research projects. Current Undergraduate Research students: Daniel Ayalla and Jose Lugo.

D. OTHER PROFESSIONAL ACTIVITIES AND SERVICES

REFEREEING

- IEEE Transactions on Information Theory;
- IEEE Transactions on Computer;
- European Journal of Combinatorics;
- Journal of Combinatorial Theory;
- Designs, Codes and Cryptography;
- Discrete Applied Mathematics;
- SIAM Journal on Discrete Mathematics;
- AAECC (Springer);

- Finite Fields and Their Applications;
- Proceedings of the Indian Academy of Sciences (Mathematical Sciences), Bangalore,
- Proceedings of the Indian Academy of Sciences, Allahabad;
- Calcutta Mathematical Society; Refereed Proposals for NBHM;
- Proceedings of AAECC-8, AAECC-9, AAECC-10, AAECC-11;
- IEEE Information Theory Symposium;
- Bombay Mathematical Colloquium;

REVIEWER FOR FUNDING AGENCIES

- NSF
- Department of Science and Technology (DST), India, (*A large proposal to establish an Institute*)
- National Board for Higher Mathematics (India)
- Council of Science and Industrial Research (India): One of the proposal was to establish a *RESEARCH INSTITUTE FOR DISCRETE MATHEMATICS* in India.

Books Referee:

Refereed a book in the Mathematics Series, Hindustan Publishers, editor Prof. Bhatia,

Chaired sessions at several conferences

Membership in Professional Societies:

- (a) AMS [(1983–91), 1998—]
IEEE (Information Theory (1982–90, 1999–));
- (b) IEEE (Computers 1999–).
- (c) ACM, 20000—
- (d) SIAM, 20000-
- (e) MAA (1987–90).

Professional Experience III

:

PRACTICAL EXPERIENCE IN THE AREA OF COMPUTATIONAL SCIENCES

- 1) Have taught graduate and undergraduate courses in Computer Sciences and Related Subjects and have been assistant in such courses for over twenty years at prestigious universities, as listed above.

- 2) Six months training in the *Software Development Division of Department of Electronics (DOE)*, New Delhi, January–June, 1981 as a Practice School Program of BITS, Pilani.
- 3) Systems Administrator for the MRI computer systems (November 1992–);
- 4) In-charge of MRI email system (February 1993–);
- 5) Computer Committee, MRI (November 1992–; Convener for one year);
- 6) Computer Committee (Department of Mathematics, University of Bombay) 1990–1992;
- 7) I have done extensive programming in **APL**, **C**, **Java**, **MATHEMATICA** and **FORTRAN** in research; Some experience with **C++** and **PROLOG**. extensively used **UNIX** operating system; Also quite familiar with **VMS**, **DOS**, and **Mac** operating systems;
- 8) Used extensively in research: **Connection Machines** and **Hypercubes** (at CALTECH, UCLA and Argonne National Lab); worked with **PARAGON** at UPR; Working with Silicon Graphics Parallel Machine at UPR. Can program in **MPI**. Familiar with **PVM** and **CILK**. some experience with **AXIOM**, **Macaulay**, **GAP**, **GUAVA**, **PARI**;
- 9) Extensively used **MATHEMATICA**, **MATLAB** and **MINITAB** in teaching; Currently developing Genetic Algorithms for Coding Theoretic applications and implementing data structures and algorithms in **C** and **C++**;
- 10) extensive experience with **TeX**, **LaTeX** and **AMSTeX** during the past five to seven years; Some experience with **CHIWriter** and **WP**.

Professional experience IV

Multi-Disciplinary Graduate Course Work

In addition to the many courses in pertinent disciplines, e.g., for B.E. (Honors) in EEE at BITS ('78–81), for the five year M.Sc. (honors) in Mathematics, for graduate studies in Mathematics at UIUC, and Ph.D. course work at SU ('82–86).

In all the programs, I took over **40** graduate courses at all these universities in my research interest listed on page 4.

Some of these courses were quite interdisciplinary, such as:

Methods of Mathematical Physics I, II

Optimization Techniques

Control Theory and Modeling

I also taught many graduate and undergraduate courses listed earlier.

LANGUAGES

ENGLISH: The language of instruction and communication for twenty years

SPANISH: Continuing education courses at UPR [Fall 1994, Fall 1997, Summer 1999, Fall 2000]
[Residence in PR, 1997—.]

Visits [1990, 1991, 1992, 1993, 1994-95].

FRENCH: Introductory course at NYU;

GERMAN: Can read mathematical and CS papers in German.

HINDI: Mother tongue (11 years in school)

SANSKRIT: Five years in High School

DRAFT

SOME CITATIONS BY OTHER AUTHORS

Total Citations by other researchers: Quick google count gives over thousand— (and scores in Books and Ph.D. dissertations.)

DRAFT

CURRENT AND PENDING (OTHER) SUPPORT INFORMATION

Senior/Key Person Information

Name: Janwa, Heeralal

Persistent Identifier (PID): <https://orcid.org/0000-0001-8907-015X>

Position Title: Professor

Organization and Location: University of Puerto Rico, R̃o Piedras, San Juan, Puerto Rico, United States

Proposals / Active Projects

1. STEM-ONR Mentoring Workforce: Aiming to Prepare the Next Generation of Vibrant STEM Workforce Ready to Solve Tomorrow's Grand Challenges and Address Current and Future Critical Issues

Status of Support: Current

Proposal/Award Number: 13001614-027

Source of Support: ONR

Primary Place of Performance: University of Puerto Rico, R̃o Piedras

Start Date: 05/2025

End Date: 04/2030

Total Anticipated Amount: \$88,500

Person Months per Budget Period:

- 2025: 0.5
- 2026: 0.5

Overall Objectives: Design a comprehensive "Navy Fellow Program" focused on climate change and coastal resiliency, preparing the next generation of STEM workforce to address multifaceted problems of coastal resiliency, energy security, and resiliency.

Statement of Potential Overlap: None

2. Advancing High-Energy, Cycle-Stable Sulfur-Based Batteries for NASA Space Missions: An Integrated Framework of Density Functional Theory, Machine Learning, and Materials Innovation

Status of Support: Current

Source of Support: NASA

Primary Place of Performance: University of Puerto Rico, R̃o Piedras

Start Date: 08/2024

End Date: 07/2027

Total Anticipated Amount: \$750,000

Person Months per Budget Period:

- 2025: 1.13
- 2026: 2.26
- 2027: 1.2

Overall Objectives: Develop an integrated framework using DFT, machine learning, and materials innovation to advance sulfur-based batteries for NASA missions.

Statement of Potential Overlap: None

3. E-CORE RII: Research Infrastructure for AI-Based Sustainable STEM Technologies in Puerto Rico (RAIS-PR)

Status of Support: Pending

Proposal/Award Number: 13001614-027

Source of Support: NSF

Primary Place of Performance: University of Puerto Rico, R o Piedras

Start Date: 01/2026

End Date: 12/2029

Total Anticipated Amount: \$600,000

Person Months per Budget Period:

- 2026: 2
- 2027: 2
- 2028: 2
- 2029: 2

Overall Objectives: Optimize the fragmented research ecosystem in Puerto Rico to achieve global competitiveness in AI-based energy-resilient systems. Engage multiple institutions and community colleges to uplift research and workforce skills, fostering job creation and economic growth.

Statement of Potential Overlap: None

4. RampUP

Status of Support: Pending

Source of Support: [Insert agency name]

Primary Place of Performance: University of Puerto Rico, R o Piedras

Start Date: [MM/YYYY]

End Date: [MM/YYYY]

Total Anticipated Amount: [Insert amount]

Person Months per Budget Period:

and months

Overall Objectives: [Insert description of RampUP project here]

Statement of Potential Overlap: None

DRAFT

GRANTS (Until April 2024—UPDATED AT THE END)

SELECTED GRANTS:

CURRENT AND PENDING GRANTS:

- AGENCY: NSF DIVISION: Division of Biological Infrastructure (DBI)
Program: RaMP-Res & Mentoring Postbac
Award: # 2216584
Project Title: RaMP: Research and Mentoring for Postbaccalaureates in Biological Sciences at the University of Puerto Rico (RaMP-UP)
PIs: Jose Garcia-Arraras (PI); Juan Ramirez-Lugo (Co-PI)
Role: H. Janwa (Co-Mentor of selected Postbaccalaureate)
Amount: \$2,516,239.00
Dates: 15/08/2023—31/05/2023
Status: Awarded.
- H. Janwa (Co-I) Agency: NASA-EPSCoR (CITCO) Proposal Title:
- *H. Janwa (Co-I) Agency: NASA-EPSCoR Award Number: 80NSSC22M0248 Proposal Title: Artificial Intelligence / Machine Learning Application for Identification and Categorization of TLEs Amount: \$100k DATE: 10 / 01 / 2022— 09 / 30 / 2023. Status: Awarded*
- H. Janwa (Co-I) Agency: NASA-EPSCoR (CITCO) Proposal Title:
- *H. Janwa (Co-I) Agency: NASA-EPSCoR (GLOBE Observer) Proposal Title: BDNN Hackathon: Uncertainty Aware Few Shot Learning from Citizen Science Data and Bayesian Deep Neural Network for Land Cover Image Classification*
Award Number: # 80NSSC21M0156 Amount: \$100k DATE: 06/01/2021- 05/31/2022; 06/01/2022- 05/31/2023..
Status: Awarded
- H. Janwa (PI) Agency: NSF: Collaborative Research: MFB: Integrated Research in ML/AI/Network and Data Sciences and Education to Build the Molecular Foundation to Bring back Biotechnology Industries to PR Proposal Title: *Collaborative Research: MFB: Integrated Research in ML/AI/Network and Data Sciences and Education to Build the Molecular Foundation to Bring back Biotechnology Industries to PR* Amount: \$1.5million DATE:09/2022—08/2023. Status:Submitted.
- H. Janwa (Co-I) Agency: NASA-EPSCoR (Space Biology) Proposal Title: *Causal Multivariate Network Analysis of Multi-Omics Datasets for Treatment of Muscle Atrophy in Mice, and Homo sapiens in Microgravity*
Award Number: Amount: \$100k DATE: 06/01/2020- 05/31/2021; 06/01/2021-05/31/2022 Status: Awarded

- H. Janwa (Co-I) Agency: NASA-EPSCoR (GLOBE Observer) Proposal Title: *BDNN Hackathon: Uncertainty Aware Few Shot Learning from Citizen Science*
Award Number: 80NSSC21M0156
Data and Bayesian Deep Neural Network for Land Cover Image Classification
Amount: \$100k DATE: 06/01/2021- 05/31/2022; 06/01/2022- 05/31/2023. Status: Awarded
- H. Janwa (Co-I) Agency: NASA-EPSCoR (Space Biology)
Proposal Title: *Causal Multivariate Network Analysis of Multi-Omics Datasets for Therapeutic Treatment of Muscle Atrophy in Mice, and Homo sapiens in Microgravity*
Award Number: NASA EPSCoR, grant 80NSSC20M0132
Amount: \$100k DATE: 06/01/2020- 05/31/2021; 06/01/2021-05/31/2022 Status: Awarded
- H. Janwa (Co-I)
Agency: NASA-EPSCoR (Space Biology)
Award Number: # 80NSSC19M0167 Proposal Title: *Graph-based network analysis of microgravity regulated gene expression Arabidopsis Thaliana*
Award Number: NASA, grant number 80NSSC19M0167
Amount: \$100k 07/16/2019-06/30/2021 DATE: 07/16/2020- 06/30/2020; 06/01/2020-05/31/2021 Status: Awarded
- H. Janwa (Consultant)
AGENCY: Cayey-Fed Dir Gov Grants and Coop Agreeemt.Institutos y Centros de Investigacion
CONSULTATION AGENCY: FOR NSF CAREER Proposal
Amount:\$1500 DATE: 02/21/2019 Status: Awarded.
- H. Janwa (PI)
Agency: NSF Proposal ID 1920815
Submitted: 01/25/2019
Status: Pending
Proposal Title: Network Theory Approach to Harnessing Data Revolution involving BIGDATA in Biology and Medicine Using a Transdisciplinary Approach
Amount: \$4 million
Period: 48 Months
Dates: 08/01/2019—07/31/2023
- H. Janwa (PI)
Agency: NSF Proposal ID 1922685
Submitted: 02/06/2018
Status: Pending
NSF-NRT-HDR: Center for BigData Analysis in Information Theory, Genomics, and Network Sciences and Diverse HDR Workforce Development, Amount: \$3 million

Period: 60 months Months
Dates: 08/01/2019—07/31/2023

- H. Janwa (Co-PI)
Agency: NASA
Award Number: NASA, grant number 80NSSC19M0167 Submitted: 02/20/2019
Status: Awarded
Proposal Title: Graph Based Network Analysis of Microgravity Regulated Gene Expression in Arabidopsis Thailana
Amount: \$100k
Period: 12 Months
Dates: 08/01/2019—07/31/2020
- H. Janwa (PI) (CO-PIs and Senior Collaborators: Dr. Clifford Louime, Steven E Massey, Filipa Godoy Vitorino, Vidya manian, Pan, Chongle, Thulasiraman, Krishnaiya, Gruenwld, Le , Bud Mishra, Julian Velev, Fernando Pinero
AGENCY: DOE DE-FOA-0002023: 12/21/2018 PREPROPOSAL Proposal Title: The application of network science, image processing and learning algorithms to obtain a fundamental understanding of biologically mediated controls on nutrient cycling in environmental systems and biofuels
Amount: Full Proposal (if asked to submit) in millions. Status: Not selected.

PAST GRANTS:

- H. Janwa (PI)
NSF Proposal ID 1826750
Submitted: 03/28/2018
Status: Pending
Proposal Title: RII Track-2 FEC. Network Theory Approach to Genome-Phenome Mapping
Analysis Amount: \$4 million
Period: 48 Months
Dates: 08/01/2018—07/31/2022
- H. Janwa (PI)
NSF Proposal ID 1818877 Submitted: 11/30/2017 Staus: Pending Title: Collaborative Research: Some Fundamental Problems in Coding Theory, Cryptography and Information Theory: An Interdisciplinary and Collaborative Research Division: Computer, Information Science and Engineering (CISE) Amount: \$489.933k Period: 36 months Dates: 04/01/2018—03/31/2021
- H. Janwa (PI)
NSF-EPSCoR Track I (submitted for Puerto Rico Competition) Status: (only one grant selected) (not ours)

Source of Support: NSF Total Amount: \$20 million

Period: 01/06/2018—05/31/2022

- H. Janwa (PI)
Support: Letter of Intent Submitted; Final Proposal to be Submitted, February 2016
Project/Proposal Title: Graphs, Codes, Cryptosystems, Number Theory, and Algebraic Geometry: :
Source of Support: NSF
Total Award Amount: \$6 million
Location of Project: University of Puerto Rico-Rio Piedras Campus
Status: Letter of Intent Submitted 10, January, 2017: Proposal to be submitted February 10,2017
Period:08/01/2017—07/31/2022
- H. Janwa (PI)
Support: Submitted
Project/Proposal Title: Graphs, Codes, Cryptosystems, Number Theory, and Algebraic Geometry: :
Source of Support: NSF
Total Award Amount: \$496,383 K
Location of Project: University of Puerto Rico-Rio Piedras Campus
Status:Pending
Period:04/01/2017—05/31/2020
- H. Janwa (PI)
Support: Submitted
Project/Proposal Title:Exceptional Almost Non-Linear (APN) Polynomials and Absolute Irreducibility of Multivariate Polynomials
Source of Support: NSF
Total Award Amount: \$157,787 K
Location of Project: University of Puerto Rico-Rio Piedras Campus
Status:Pending
Period:08/01/2017—05/31/2020
- H. Janwa (Co-PI)
Support: Submitted
Project/Proposal Title: Codes from New Expander Graphs with Reed-Solomon Component Codes
Source of Support: NSF
Total Award Amount: \$218, 613 K
Location of Project: University of Puerto Rico-Rio Piedras Campus
Status:Pending
Period:08/01/2017—05/31/2020
- H. Janwa (PI)

Support: Submitted

Project/Proposal Title: Building a STEM-Ready Talent Pipeline at the University of Puerto Rico

Source of Support: DOE

Total Award Amount: \$1million 199k 987K

Location of Project: University of Puerto Rico-Rio Piedras Campus

Status: Declined (90 % Score in Qualify, Services, and Significance)

Period:09/01/2016—08/31/2019

- H. Janwa (Senior Personnel; Director of Project:**BioInformatic Modeling** in the Knowledge Systems Group) Support: Submitted
Project/Proposal Title: NOAA Center
Source of Support: NSF
Total Award Amount: \$15 million
Location of Project: University of Puerto Rico-Rio Piedras Campus
Status: Declined
Period:2016—2021
- Agency: NSF Division: DUE Award Number:# 0630927 Title: Accelerating Puerto Rican Students into the National Research Effort in Mathematics and Computer Science PIS: Heeralal Janwa (PI and Co-Director), Raul Pericchi (PI), Carlos Corrada (Co-PI), Maria E. Perez (Co-PI)
Period: 15/09/2006—31/08/2013 Award Number:#9814981
- Agency:NSF Agency: NSF-DUE (SMET (S-STEM-Schlr Sci Tech Eng&Math)) Award Number: #9986985
Title: Computer Science Scholarships Program
Role: Heeralal Janwa (Co-PI; Co-Director); Herman Acuna (PI-Director)
Amount: \$360,250.00
Dates: 14/02/2000–12/14/2004
Status: Awarded
- NSF-IGERT (Division of Graduate Education (DGE)) DGE: Award # 0801577
Title:IGERT: Natural-Human Systems in the Urbanizing Tropics
Amount:\$2.96 million
Role: Key Senior Personnel
Dates: 09/07/2008–30/06/2015
Status: Awarded
NSF-IGERT Grant, 2008—2013, for **\$3 million** one of the core faculty members in establishing an interdisciplinary Ph.D. program in the Environmental Sciences. Role: One of the dozen core faculty members whose CV was included in the NSF-IGERT main proposal and NSF-IGERT pre-proposal, And the only one from Mathematics in the proposal. From NSF data and discussions with some colleagues from NYU, odds for

approval of pre-proposal for selection of NSF-IGERT pre-proposal is approximately 1 in 20. And extremely difficult to get through the final proposal. **Already Supervising the Ph.D. Thesis of Dionisio Perez Montes, under the NSF-IGERT program**

- H. Janwa (PI) Support: Submitted
Project/Proposal Title: LDPC Codes for Deep Space Applications:
Source of Support: NASA IDEAS Grant (via RSCE)
Total Award Amount: \$ 30K
Location of Project: University of Puerto Rico-Rio Piedras Campus
Status: Declined
Person-Months Per Year Committed to the Project. Cal:0 Acad: 0 Sumr:
(Travel, Visitors and Student Support) June], 2010–June, 2011

OTHER GRANTS SUBMITTED/APPROVED

- (H. Janwa (PI), F. Castro (Co-PI), C. Corrada (Research Collaborator), I. Rubio (Research Collaborator), F. Castro (Research Collaborator), R. Pericchi (Research Collaborator), P. Rivera (Research Collaborator)).
Support: Submitted:

Project/Proposal Title:

Explicit Constructions and Decoding of LDPC/Expander Codes for Rapid, Reliable, and Secure Communication: Algebraic, Algebraic Geometric, Combinatorial and Probabilistic Approaches

Source of Support: DoD

Total Award Amount: \$ 714, 641

Dates: August 1, 2009—July 31, 2012

Location of Project: University of Puerto Rico-Rio Piedras Campus

Person-Months Per Year Committed to the Project. Cal: 0 Acad: 2/9 Sumr: 2/9

Status: submitted. **(Selected one of the top three proposals from UPRRP, and one of the top five from PR Institutions, under DESPSCoR solicitation.)**. Our proposal was declined. We none of the other five proposals from PR got approved.

- (H. Janwa (PI), F. Castro (Co-PI), C. Corrada (Research Collaborator), I. Rubio (Research Collaborator), F. Castro (Research Collaborator), R. Pericchi (Research Collaborator), P. Rivera (Research Collaborator)).
Support: Submitted:

Project/Proposal Title:

Explicit Constructions and Decoding of LDPC/Expander Codes for Rapid, Reliable, and Secure Communication: Algebraic, Algebraic Geometric, Combinatorial and Probabilistic Approaches

Source of Support: NASA-EPSCoR

Total Award Amount: \$ 714, 641

Dates: August 1, 2009—July 31, 2012

Location of Project: University of Puerto Rico-Rio Piedras Campus

Person-Months Per Year Committed to the Project. Cal: 0 Acad: 2/9 Sumr: 2/9

Status: submitted. PROPOSAL.

EARLIER GRANTS/PROPOSALS

- (H. Janwa (PI), F. Castro (Co-PI), C. Corrada (Research Collaborator), I. Rubio (Research Collaborator), F. Castro (Research Collaborator), R. Pericchi (Research Collaborator), P. Rivera (Research Collaborator)).
Satus:
Support: Submitted:

Project/Proposal Title:

Explicit Constructions and Decoding of LDPC/Expander Codes for Rapid, Reliable, and Secure Communication: Algebraic, Algebraic Geometric, Combinatorial and Probabilistic Approaches

Source of Support: DoD

Total Award Amount: \$ 714, 641

Dates: August 1, 2009—July 31, 2012

Location of Project: University of Puerto Rico-Rio Piedras Campus

Person-Months Per Year Committed to the Project. Cal: 0 Acad: 2/9 Sumr: 2/9

Status: **(Selected one of the top three proposals from UPRRP and one of the top five proposals from PR, under DESPSCoR solicitation and submitted to DOD. None of the five proposals submitted from PR was funded.**

- (H. Janwa (PI),
Support: Submitted:

Project/Proposal Title:

Explicit Constructions and Decoding of LDPC/Expander Codes for Rapid, Reliable, and Secure Communication: Algebraic, Algebraic Geometric, Combinatorial and Probabilistic Approaches

Source of Support: NASA-EPSCOR

Total Award Amount: \$ 750K

Dates: August 1, 2010—July 31, 2013

Location of Project: University of Puerto Rico-Rio Piedras Campus

Person-Months Per Year Committed to the Project. Cal: 0 Acad: 2/9 Sumr: 2/9

Satus: Declined.

- H. Janwa (PI) Support: (Not considered: Proposal Was not uploaded correctly under GRANTS.GOV under the Sponsored Research Office at UPRR-RP)

Project/Proposal Title: Cybersecurity IN THE CLASSICAL AND POST-QUANTUM CRYPTOGRAPHY AGE:

Code Based Cryptosystems And Their Applications Source of Support: DHS

Total Award Amount: \$ 188K

Location of Project: University of Puerto Rico-Rio Piedras Campus

Status: Not considered, as the UPR office did not submit under GRANTS.GOV in time

Person-Months Per Year Committed to the Project. Cal:0 Acad: 0 Sumr: 2/9

December 31, 009—December 31, 2012

- H. Janwa (PI)

Project/Proposal Title: POST-QUANTUM PKCs: On Our Public Key Cryptosystem

Based on Subfield Subcodes of Algebraic-Geometric (AG) Codes

Source of Support: NSF

Total Award Amount: \$ 188K

Location of Project: University of Puerto Rico-Rio Piedras Campus

Status: Declined (**wrongly classified in the CISE as TCS rather than Communications Research.**)

Person-Months Per Year Committed to the Project. Cal:0 Acad: 0 Sumr: 2/9

Aug. 1, 009—July 31, 2012

- H. Janwa (PI)

Project/Proposal Title: On Our Public Key Cryptosystems Based on Subfield Subcodes of Algebraic Geometric Codes

Based on Subfield Subcodes of Algebraic-Geometric (AG) Codes

Source of Support: NSF

Total Award Amount: \$ 188K

Location of Project: University of Puerto Rico-Rio Piedras Campus

Status: Declined **NSA does not support directly cryptography related research—conflict of interest.**

Person-Months Per Year Committed to the Project. Cal:0 Acad: 0 Sumr: 2/9

Aug. 1, 009—July 31, 2012

- H. Janwa (PI)

Project/Proposal Title: Error-Correcting Codes Based on LDPC codes for Secure and Reliable Communication.

Source of Support: DoD (ARO)

Total Award Amount: \$ 250K

Location of Project: University of Puerto Rico-Rio Piedras Campus

Status: **ARO Recommended (Accept); ARO an AFSOR-Collective Decision (Decline)**

Person-Months Per Year Committed to the Project. Cal:0 Acad: 0 Sumr: 2/9

Aug. 1, 009—July 31, 2012

- PI, UPR-DEGI grant for "Expander codes and LDPC" , **2008–2010**, for **\$ 57K**.
- Agency: NSF Division: # 9814981
Title: Ramanujan Graphs, Codes, Exponential Sums, and Sequences
Award Amount: **\$ 206,650**
Period: 15/07/1999—30/06/2003
(Heeralal Janwa, *Principal Investigator (PI)*, and Oscar Moreno (Co-PI)
https://www.nsf.gov/awardsearch/showAward?AWD_ID=9814981&HistoricalAwards=false
- NSF-CSME grant Number: #9986985 for **\$154,000** (2001-2005).
(Heeralal Janwa (Co-PI) and Herman Acuna, PI)
- NSF-CISE RESEARCH INFRASTRUCTURE, DIVISION: CNS (Computer and Network Systems) Award:
0080926 Title:CISE MII: Infrastructure for a New Program in Computer Science at the University of
Puerto Rico - RÑo Piedras Campus
ROLE: Key Senior Personnel (PI: Oscar Moreno)
Period: 22/09/2000—12/07/2004
Amount: \$ 1,499,998.00
Status: Awarded https://www.nsf.gov/awardsearch/showAward?AWD_ID=0080926
- DEPCOR Proposal for 2005–2008 for \$500,000 (H. Janwa (PI); Co-PIs R. Pericchi, I. Rubio, H.F. Mattson,
Jr. (**selected by EPSCoR as one of the five best proposals from PR for DEPCOR and was
then submitted as a part of the package to the Department of Defense**). **None of the ten
proposals from PR was funded.**
- DEPCOR Proposal for 2004–2007 for \$500,000 (H. Janwa (PI); Co-PIs R. Pericchi, I. Rubio, H.F. Mattson,
Jr. (**selected by EPSCoR as one of the ten best proposals from PR for DEPCOR and was
then submitted as a part of the package to the Department of Defense**).
- “New Families of Infinite Classes of Constant Degree Expander Graphs and Their Tanner Codes ad Decod-
ing,” UPR FIPI - Institutional Funds for Research for 2004–2006, (**\$ 26,000**)

OTHER GRANTS:

- *The MRI faculty won a 5-year grant of Rupees 150 million from the DAE. I was a senior member of the
faculty at that time. This amount was equivalent to the average salary for approximately 1500 faculty
members for one year in 1995.*
- “Ramanujan Graphs, Codes, Exponential Sums, and Sequences”
UPR FIPI - Fondo Institucional para la Investigacion Grant for 2001–2002 (**\$10,000**)
- “Genetic Algorithms to Design Good Codes,” UPR FIPI - Fondo Institucional para la Investigacion Grant
for 1998–2000 (**\$10,000**)

- Equipment Grant from the Dean of Faculty of Natural Sciences **\$ 9,000**, in 1999.
- **International Travel grant from MRI**, India to visit Universities and participate in International Conferences in 1997. [**Remark.** Very high currency exchange rates make these grants highly competitive.]
- National Board of Higher Mathematics (NBHM) (INDIA) **International Travel Grant** to participate in the *10th International Conference on Applied Algebra, Algebraic Algorithms and Error-Correcting Codes*, UPR, PR, USA, May 1993.
[**Remark.** Because of very high currency exchange rates, these grants are highly selective with all India level competition.]
- Travel and Lodging paid by the Organizing Committee of AAEECC-9 to participate as an invited speaker at the Conference held in New Orleans, USA, October 07–11, 1991 and for honorarium. \approx **\$ 2,500**.
- International Travel Grant (from India): Visited the Gauss Research Lab. (UPR), funded by EPSCoR of PR and CISE-NSF, October-November 1992 (one month), November-December 1992 (six weeks), May 1993 (one week) and September 1994-December 1994, January-March 1995.
- Travel Support from Gauss Research Lab. to participate in the International Conference on Algebraic Geometry over Finite Fields and Applications, 1990.
- Travel support and honoraria to visit Institute for Mathematics and Its Applications, University of Minnesota (two weeks: summer 1988); USC, SU, MSU, OSU, UPR (1991), SU (1993,1998,2000), INRIA (1993), IMSC Madras (1990, 1992, 1993), IISc. Bangalore, (1991, 1992), IIT Kanpur (1991), ISI Bangalore (twice), University of Bombay (1994), Poona University (1990, 1991, 1994), ISI-Delhi (twice), BHU (once), Delhi University (1995), SU (1998), MIT 1998.
- Visited many other institutes such as IIT Delhi, ISI Delhi, IIT Bombay with support.
- \$500.00 by UPR, RP, PR, USA, to participate in the *Workshop on Applications of Algebraic Geometry*, January 7-13, 1990.
- \$700.00 by IMA, Minnesota to participate in the *IMA Workshops on Coding Theory and Design Theory*, June 13-24, 1988.
- \$500.00 by the American Mathematical Society to participate in the *AMS Centennial Conference*, Providence, RI, August 1988.
- Summer Research support at SU, 1982–1985 and Summer teaching support at SU, 1983–85. (Only few of the Graduate Students received such additional support besides regular academic year support.)
- Several other trips to attend conferences and invitations were partially supported by various agencies and universities
- “CDMA Sequence Designs and Designs for Department of Defense-Office of Naval Research, (for **\$500,002**, 04/01/00–03/31/03) (H. Janwa (Co-PI), O. Moreno (PI), D. Bollman (Co-PI), F. Castro (Co-P I)) (**selected by EPSCoR as one of the ten best proposals from PR for DEPSCOR and was then submitted as a part of the package to the Department of Defense**).

- “A Multidisciplinary Graduate Program Option in Communication Science,” (Co-PI), a pre-proposal submitted to NSF, 06/28/2001

DRAFT