Dr B R Ambedkar University Delhi (AUD)

Activities and Events for the MPhil and PhD Programmes in Mathematics 2018-19

Talks:

1. **Dr. Krishna Balasundaram Athreya**,
   Distinguished Professor, College of Liberal Arts and Sciences, Iowa State University, Ames, Iowa, United States of America.

   Topic: Unit ball in high dimension
   Abstract: Let V^n be the volume of the unit ball in R^n for a positive integer n. That is it is the Riemann integral of the constant function 1 over the set of points in R^n that are at an Euclidean distance less than or equal to one from the origin. In this talk we show that while V^n is non decreasing for n small it is rapidly decreasing as n gets large. We extend this to L^p distance for any finite $p > 0$ and also to ellipsoids. If time permits we shall also talk about the maximum principle for harmonic functions via a math olympiad problem and its relation to Markov chains.

2. **Dr. Krishna Balasundaram Athreya**,
   Distinguished Professor, College of Liberal Arts and Sciences, Iowa State University, Ames, Iowa, United States of America.

   Topic: Motion with a constraint
   Abstract: In this talk we consider motion in R^2 , R^3 and R^n and a vector space subject to the traveller's distance from two fixed points A_1 and A_2 being in fixed ratio.If there is time we may discuss more problems.

About Prof K B Athreya:

	Professor Krishna Balasundaram Athreya is a distinguished professor at the College of Liberal Arts and Sciences of Iowa State University, Ames, Iowa. He holds a joint position in the Departments of Mathematics and Statistics. After doing his PhD from Stanford University, he has held positions in various leading institutes around the world. He holds numerous honours and awards; and is a member of various Mathematical societies. His research interests include topics in probability theory, stochastic processes, mathematical statistics and stochastic modelling and applications.

3. **Dr. Rajendra Kumar Sharma**
   Professor, Department of Mathematics, Indian Institute of Technology, Delhi

   Topic: m=M
   Abstract: We shall see how small mathematics is equal to Capital Money.

About Prof R K Sharma:

	Rajendra Kumar Sharma is professor of mathematics at the Indian Institute of Technology, Delhi. Earlier, he was in the faculty of mathematics at IIT Kharagpur. He has been teaching UG/PG classes for more than 31 years. He has guided 31 Ph.D. theses and more than 75 M. Tech. projects. He has published more than 138 research papers in international journals. He has participated in several conferences including the coveted International Congress of Mathematicians (ICM) 1994, in Zurich, Switzerland. He has travelled widely and delivered invited talks at several places. He was a postdoctoral fellow in France and Germany for 3 years. Several students are working with him on sponsored projects. His main area of research is Algebra and Cryptography.

4. **Dr. K N Raghavan**
   Professor, Department of Mathematics, The Institute of Mathematical Sciences, Chennai

   Topic: Symmetric Functions
   Abstract: Symmetric functions are interesting not just for their own sake. They occur naturally in many areas of mathematics and science, e.g., as characters in representation theory, and in the study of cohomology rings of Grassmannians and

other homogeneous spaces. There are several natural bases for the space of symmetric functions, perhaps the most interesting of which is the one formed by the Schur polynomials. The product of two given Schur polynomials is again a symmetric function, and thus can be expressed as a linear combination of Schur polynomials. The coefficients that appear in such expressions are of representation theoretic and geometric significance, and they can be calculated by the Littlewood-Richardson rule. A major portion of the talk will be devoted to an expository tour of these aspects (hopefully in a way that will make sense to a general mathematical audience). Towards the end of the talk, we will discuss a certain refinement of the Littlewood-Richardson rule (joint work with Mrigendra Singh Kushwaha and Sankaran Viswanath).

About Prof K N Raghavan:

	Prof K N Raghavan is a professor of Mathematics at The Institute of Mathematical Sciences, Chennai. He did his M. S. (Physics, 5-year integrated), from Indian Institute of Technology, Delhi, and Ph. D. (Mathematics) from Purdue University, West Lafayetter, Indiana, USA. His research interests are Representation theory of groups and algebras, Flag varieties and Schubert varieties. He has several research publications having national and international importance.

5. **Dr. Paras Kumar**
   Assistant Professor, Department of Mechanical Engineering, Delhi Technological University, Delhi
   Topic: Introduction to vehicular traffic noise

   Abstract: The development of transport infrastructure in the past two decades has resulted in increased noise levels in metropolitan, medium as well as small cities. Traffic noise is one of the important sources of the noise pollution. Communities living in the close vicinity are exposed to noise levels above prescribed limits for longer period of time. Increased exposure to transport noise has resulted in health related issues like hearing loss, sleep disturbances, stress, hypertension and other physiological problems. There is a need to understand and analyze the mechanism of ambient noise through different models and geospatial mapping techniques before proposing any remedial measures.

About Dr. Paras Kumar:

	Dr. Paras Kumar, is an Assistant Professor at the Department of Mechanical Engineering, Delhi Technological University (DTU), Delhi. He completed his M.Tech. from Indian Institute of Technology Roorkee in Machine design and obtained Ph.D. from DTU, Delhi. His research interest include Tribology, Wear modeling, Failure analysis of gearbox, Vehicular traffic noise modeling, Condition monitoring techniques (Vibration, Acoustic and Wear debris) and Soft computing techniques.

Workshops:

1. GAP workshop

GAP (Groups, Algorithms, Programming) is a system for computational discrete algebra which is used in research and teaching for the study of groups and their representations, rings, vector spaces, algebras, combinatorial structures and many more. The system, including source, is available freely.

The two resource persons conducted the GAP workshop:

1. Dr. Manoj Kumar Yadav, Professor-H, Harish Chandra Research Institute, Chhatnag Road, Jhunsi, Allahabad.
2. Dr. Vinay Wagh, Assistant Professor, Indian Institute of Technology, Guwahati.

About Prof Manoj Kumar Yadav:

	Prof Manoj Kumar Yadav is a professor-H of Mathematics at Harish Chandra Research Institute, Chhatnag Road, Jhunsi, Allahabad. He did his D. Phil from Kurukshetra University, Kurukshetra, Haryana. His research interests are theory of finite groups. He has several research publications having national and international importance. For further information

About Dr. Vinay Wagh:

	Dr. Vinay Wagh is an assistant professor in Department of Mathematics at Indian Institute of Technology Guwahati, Guwahati. He did his Ph.D. from University of Pune. His research interests are modules and derivation modules. He has good knowledge of GAP and SAGE.

2. SAGE Workshop

SAGE is a free and open source computer algebra system (CAS) having potential similar to commercial software like Mathematica, Maple, MatLab and Magma. It is built on top of many existing open-source packages such as NumPy, SciPy, MatPlotLib, Sympy, Maxima, GAP, R and many more. Sage uses Python as its primary language which is a simple and powerful language and is immensely popular among the scientific community. It is a great pedagogical tool which can also be used heavily at research level.

The following resource person to conduct the SAGE workshop is

Dr Ajit Kumar, Associate Professor and Head, Department of Mathematics, Institute of Chemical Technology, Mumbai.

About Dr. Ajit Kumar:

	Dr. Ajit Kumar is an associate professor in Department of Mathematics at Institute of Chemical Technology Mumbai. He did his Ph.D. from University of Mumbai. He has several research publications. He has good knowledge of SAGE.

Conference

Mathematics Society, Ambedkar University Delhi conducted one day conference entitled “Conference on Algebra, Analysis and Applications”.

Algebra and analysis are two key branches of mathematics that have various applications in the field of social sciences, physical sciences and engineering. This conference was devoted to explore algebra and analysis related areas and to acquaint with current trends in research in their respective areas. Also, it has given an opportunity to bring young researchers to interact with the experts in the related area. For achieving the objectives outlined above, it was proposed to have two categories of speakers (a) invited speakers and (b) research scholar. The Conference would invite speakers who would present recent research of a more specialized nature; speakers were included both faculty and researchers in other institutions as well as Ph.D. students who were in an advanced stage in their work.

The Conference was a mix of plenary sessions and some sessions of paper presentations. The plenary sessions were in the form of invited talks by experts where the speakers were asked to engage with the broader theme of the Conference as well as relating to any topic of relevance. The paper presentation were based on the theme of the conference which were presented by researcher/Ph.D. scholars.

The following were the speakers in the conference

1. **Dr. Dinesh Singh**
   Professor, Department of Mathematics, Delhi University
   Topic: Analysis in algebras

About Prof. Dinesh Singh:

Vice Chancellor (President, 2010-15) University of Delhi, Delhi, India
Director, South Campus (2005-10)
University of Delhi, Delhi, India
Other Positions

- **Chancellor, KR Mangalam University, Gurugram, Haryana, India**
- **Distinguished Academic Consultant, Middlesex University, London**
- **Distinguished Senior Fellow, Advanced Hackspace (2015-18)**
  Imperial College of Science, Technology and Medicine,

	London • **Adjunct Professor of Mathematics** University of Houston, Houston, Texas, USA • **Distinguished Professor, Shoolini University, Solan, HP, India** • **Honorary Professor** IIIT Delhi • **Professor of Mathematics** University of Delhi • **Director, Mathematical Sciences Foundation, Delhi** **Honours** • **Padma Shri** One of the highest civilian awards of the Government of India awarded by the President of India • **Honorary Doctorates** **1. University of Edinburgh** **2. National University of Ireland (UCC)** **3. University of Houston, Houston** **4. National Institute of Technology, Kurukshetra** • **Member Scientific Advisory Committee (2011-18)** **Union Cabinet, Government of India** • **President, Ramanujan Mathematical Society (2016-19)** (India's premier mathematical society) • **AMU Prize of the Indian Mathematical Society** **Honours** • **Career Award of the University Grants Commission** • **Ramasamy Aiyar Award Lecture, Indian Mathematical Society** He has served on the jury of the Jnanpith Award; one of India's most prestigious literary awards. He has pioneered several new ideas in the realm of education and on the role of technology in education. He has delivered, the world over, numerous prestigious invited public and keynote lectures on education; on policy towards economic growth; on mathematics and on Gandhi. He has published numerous mathematical research papers in international journals and his mathematical work is cited in several books, monographs and papers. He has authored/edited several books. He earned his Bachelors and Masters Degree in

	Mathematics from St. Stephens College. He obtained his Ph.D. degree from the Imperial College of Science, Technology and Medicine, London, England. He is a painter, acclaimed public speaker and a student of Gandhian Philosophy and is avidly fond of literature in English, Hindi and Urdu. He has a keen interest in sports and has been a college colour holder in volleyball. He is currently setting up a pioneering idea in education in the form of The Internet College and The College of Startups and is also working on a book dealing with India in the Twenty First Century.

2. Dr. Riddhi Shah

Professor, School of Physical Sciences, Jawaharlal Nehru University, Delhi

Topic: Distality of certain actions on real and p-adic spheres

Abstract: Distal maps were introduced by David Hilbert on compact spaces to study non-ergodic maps. A homeomorphism T on a topological space X is said to be distal if the closure of every double T-orbit of (x, y) does not intersect the diagonal in X x X unless x=y. Similarly, a semigroup S of homeomorphisms of X is said to act distally on X if the closure of every S-orbit of (x,y) does not intersect the diagonal unless x=y. Given a linear or affine action on a real and p-adic vector space, there is a corresponding natural action on the real/p-adic unit spheres. We discuss conditions under which such actions are distal or not (joint work with Alok Kumar Yadav).

About Prof. Riddhi Shah:

	Riddhi Shah is a professor of Mathematics at the School of Physical Sciences (SPS), Jawaharlal Nehru University (JNU), New Delhi. Her research interests include dynamics of group actions, probabilities on groups and the structure of groups. Riddhi Shah was born in Ahmedabad, Gujarat and studied at St Xavier's College, Gujarat University for a BSc degree in Mathematics in 1984. After receiving an MSc degree in Mathematics from IIT Bombay in 1986, she joined the Tata Institute of Fundamental Research (TIFR), Mumbai for her doctoral studies and completed a doctorate in 1991. She was a faculty member at TIFR, Mumbai from 1990 until 2007, when she joined SPS, JNU. She has visited several institutions abroad with post-doctoral fellowships. Riddhi Shah was a gold medalist during her Bachelors degree in Gujarat University. She has many publications in reputed international journals. She was awarded the Indian National Science Academy's medal for young scientists in 1995, the Alexander von Humboldt Fellowship in 1997,

	CNRS fellowship in 2003 and an Invitation Fellowship in 2004 from the Japan Society for Promotion of Science (JSPS). She has been the Chairperson of the Executive Committee of Indian Women and Mathematics (IWM) initiative from 2015 to March 2019

3. **Dr. Amitabha Tripathi**
   Professor, Department of Mathematics, Indian Institute of Technology, Delhi
   Topic: The Coin Exchange Problem: An Introduction

   Abstract: Imagine that a shopkeeper has an infinite supply of coins of two different denominations: 5 cents and 7 cents. You wish to buy something which is priced 23 cents from a vending machine. You have money, but the vending machine accepts only 5 cent and 7 cent coins. Can the shopkeeper help? This problem about giving exact change can be easily put in a more mathematical setting as follows: does the equation 5x + 7y = 23 admit a solution in nonnegative integers x and y? The answer to this question is No. What is more interesting is the role played by the number 23 in this problem; 23 is the largest number which cannot be so expressed. The mathematical generalization of this is easy to come up with. Given two positive integers a and b with gcd(a; b) = 1, what is the largest integer n such that the equation ax+by = n has no solution with x; y \in Z>=0. We use the notation g(a; b) to denote this largest integer, and use n(a; b) to denote the (_nite) number of positive integers that cannot be expressed in the form ax + by with x; y \in Z>=0. There is an obvious extension of this from coins of two denominations to one of k denominations, for any k > 2. The problem to determine the function g and n dates back to the 1880's, and is one of the most well known problems in additive Number theory, with a long and rich history. Whereas it is not di_cult to show that g(a; b) = ab -a - b and that n(a; b) = 1/2 (a - 1)(b - 1) and has been known since the 1880's, there is no analogous result for more than two variables. I will prove the two formulas stated above in several ways. I will then show how g and n can be determined in some special cases by using one or two basic tools and results. I will conclude by asking some important open questions regarding this problem. No background beyond a basic knowledge of modular arithmetic is required, and I plan to aim this at the interested and motivated undergraduate, hopefully without losing the interest of the more mature mathematician.

About Prof. Amitabha Tripathi:

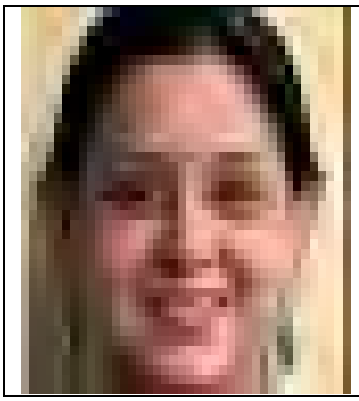
	I did my undergraduate work at St. Stephen's College, University of Delhi (1977–80) and my Masters at IIT Kanpur (1980–82). I wrote my Ph.D. dissertation in Number Theory under the supervision of Prof. T. W. Cusick at the State University of New York (1982–89). My research interests include Number Theory, Graph Theory, and Ramsey Theory. I have been with the Department of Mathematics at IIT Delhi since 1991, during which I have taught around 30 courses, guided or guiding 9 Ph.D. dissertations and over 40 Masters the- sis. I have around 60 journal publications, mostly in Number Theory and in Graph Theory, around 25 of which are with undergraduates students of IIT Delhi. I am the co-author of "Discrete Mathematics", which has been used as study material for a course for the Bache- lors programme at IGNOU since 1998, I am on the Editorial Board of Advances in Pure Mathematics. I have served as a Mem- ber of the Editorial Board of e-gurucool.com, on the Governing Body of Satyawati College and Shyama Prasad Mukherji College for Women, University of Delhi, and on the Advisory Council of Skyline Institute of Engineering & Technology, Greater NOIDA. I served as the Regional Coordinator for the Regional Mathematical Olympiads from 2000 to 2016, and a trainer at both the regional & national levels for the Olympiads. I have also been closely associated with the Kishore Vaigyanik Protsahan Yojana (KVPY) awards since 1998 and less frequently with Intel Science Talent Discovery National Fair since 2002. My non-academic interests include listening to music, playing table tennis and performing mental calculations.

4. **Dr. Shobha Bagai**
   Professor and coordinator, Cluster Innovation Centre 3rd Floor, University Stadium G C Narang Road University of Delhi, Delhi
   Topic: Natural convective flow across axisymmetric bodies immersed in porous medium saturated by a nanofluid

   Abstract: Nanofluid, the term coined by Choi, is the dispersion of nanoparticles in the fluid to enhance the characteristics of fluid involved, specifically the thermal conductivity. As nanofluids are small enough, they have an edge over micro-fluids as they can flow smoothly through micro-channels without clogging them.Therefore, the combination of porous media and nanofluid is a field which is of great interest to researchers across the globe due to its wide applications. The phenomenon of heat transfer in this case is modelled by equations that embody the conservation of mass, momentum, thermal energy and nanoparticles respectively. The governing model,

involving partial differential equations, are reduced to a system of highly coupled nonlinear ordinary differential equations by introducing similarity variables.

About Prof. Shobha Bagai:



Professor Shobha Bagai Programme Coordinator - B.Tech (Information Technology and Mathematical Innovations) Cluster Innovation Centre 3rd Floor, University Stadium G C Narang Road University of Delhi

5. **Dr. Priyanka Grover**

Assistant Professor, Department of Mathematics in Shiv Nadar University

Topic: Orthogonality and best approximation problems in Banach spaces

Abstract: Let X be a complex Banach space and let $x\in X$. Finding best approximations to x from a given subspace W of X are of importance in many subjects and have intrigued many authors. A particular case is when W is spanned by a single element y. One important question here is when is zero a best approximation to x from this subspace, that is, when do we have: $\min_\mathbb C \|x-\lambda y\| = \|x\|$? In other words, under what conditions do we have $$\|x\|\leq \|x+\lambda y\| \text{ for all } \lambda\in \mathbb C?$$ An element is said to be Birkhoff James orthogonal to y if the above condition holds. Studying characterizations for this type of orthogonality in various Banach spaces is an active area of research these days. It also provides an insight into the geometry of the Banach space in consideration. We start from the basic case of finite dimensional Hilbert space $\mathbb M(n)$, the space of $n\times n$ matrices, and then move on to $\mathbb B(H)$, the space of bounded linear operators on a Hilbert space H, and then look at the setting of a $C*$-algebra.

About Dr. Priyanka Grover:

	After completing B.Sc. and M.Sc. from University of Delhi, Priyanka Grover did her Ph.D. from Indian Statistical Institute, Delhi, in 2014 in the area of Matrix Analysis and Operator Theory. She was briefly a Postdoctoral Fellow in the Department of Mathematics at IIT Delhi, after which she joined Department of Mathematics in Shiv Nadar University in 2015. Her research interests include derivatives of matrix and operator valued functions, study of Birkhoff James orthogonality and distance problems in banch spaces, infinite divisibility and total positivity of matrices, and operator norm inequalities. She has been awarded the DST-INSPIRE Faculty award in 2015 and DST-SERB Early Career Research Award in 2019.

6. **Dr. Monika Arora**

   Assistant Professor, Assistant Professor in the department of Mathematics at IIIT Delhi.

   Topic: Multivariate Gaussian copula model using CMP distribution for doubly inflated count data

   Abstract: Several probability models exist to study bivariate inflated counts. A zero inflated bivariate Poisson model was developed by Lee et al. (2009) which was extended by Sengupta et al. (2016) to handle doubly inflated counts. Recently, Sellers et al. (2016) have studied bivariate CMP model to handle dispersed data. In this paper we introduce a general multivariate regression model using the Gaussian copula and Conway-Maxwell-Poisson marginals to handle doubly inflated counts. Our model is a generalization of Sen et al. (2018) and other related work. The proposed model has various applications in research areas like healthcare and biology.

About Dr. Monika Arora:

	Dr. Monika Arora received her Ph.D. thesis in Computational & Applied Mathematics from Old Dominion University, Virginia, USA in August 2018. She did her M.Sc. in Applied Statistics and Informatics (ASI) from Indian Institute of Technology (IIT), Bombay, India in May 2011. After her M.Sc. she worked for two years as a lead scientist in statistical modeling at a start up incubated by IIT-Bombay. She is currently an Assistant Professor in the department of Mathematics at IIIT Delhi. Her current areas of research are count data and statistical modeling. She works on univariate and bivariate count models which are applied in various fields, e.g., health science, travel, insurance and ecology. Her research involves both theoretical and computational techniques to develop the models.

7. **Dr. Pooja Yadav**
   Assistant Professor, Department of Mathematics, Kamla Nehru College, Delhi University.
   Topic: Combinatorics on Presentations of unit group of Group Rings

   Abstract: This lecture begins with an introduction of basic concepts of group rings, their unit groups and presentations. It includes discussion on word problem, conjugacy problem, isomorphism problem, Neilsen transformations. Concluding part of lecture surveys Lie regular elements, their role in presentations of general linear groups and some future research aspects in the related area.

About Dr. Pooja Yadav:

	Dr. Pooja Yadav is an assistant professor in Department of Mathematics, Kamla Nehru College, Delhi University, Delhi. She did his Ph.D. from Institute of Technology Delhi. His research interests are group rings. She has several research publications for national and international importance.