Department of Mathematics, IISER Bhopal
In-House Symposium 2019
Abstracts

Feb 8th and 9th, 2019

Plenary Speaker: Dr. Manjunath Krishnapur
Title: On nodal sets of eigenfunctions of the Laplacian, with randomness
Abstract: The study of nodal sets (zero level sets) of eigenfunctions of the Laplacian on a Riemannian manifold goes back a long way. Some questions of interest are about the length (or appropriate dimensional Hausdorff measure) of the nodal set, the number of nodal domains, the topology of nodal domains, etc. Some of these questions are difficult and open to this day. Answers are sometimes easier and more precise when one adds some randomness into the problem. In this talk, we survey some recent results in the subject. More specifically we shall talk about the length of the nodal set for Toral eigenfunctions (joint work with P. Kurlberg and I. Wigman) that has connections to arithmetic, the work on the number of nodal domains by Nazarov and Sodin that is one of the major works in the area, and the recently discovered connections/parallels to the subject of percolation. The talk is intended to be understandable to graduate students with reasonable knowledge of analysis and some basic probability.

Speaker: Dr. Soumya Dey
Title: Covers of surfaces and the liftable mapping class groups
Abstract: We will discuss basics of covering spaces of closed oriented surfaces. We will define the liftable mapping class group and formulate the problem. Then we will give a sketch of a proof.

This is an ongoing work with Dr. Kashyap Rajeevsarathy and Dr. Nikita Agarwal.

Speaker: Mr. Neeraj Kumar Dhanwani
Title: Commuting conjugates of finite-order mapping classes
Abstract: Let $\mathrm{Mod}(S_g)$ be the mapping class group of the closed orientable surface S_g of genus $g \geq 2$. In this talk, we state necessary and sufficient conditions under which two finite-order mapping classes have representatives in their respective conjugacy classes that commute in $\mathrm{Mod}(S_g)$. As an application, we show that any finite - order mapping class, whose corresponding orbifold is not a sphere, has a conjugate that is liftable under

a finite cover. Furthermore, we show that any torsion element in the centralizer of an irreducible finite order mapping class is of order at most 2. We also state equivalent conditions for the primitivity of a torsion element of $\mathrm{Mod}(S_g)$. Finally, we describe a procedure for determining the explicit hyperbolic structures that realize two-generator finite abelian groups of $\mathrm{Mod}(S_g)$ as isometry groups.

Speaker: Ms. Arusha C
Title: Stability of the projective Poincare bundle over nodal curves
Abstract: Let X be an irreducible smooth projective curve of genus $g \geq 3$ and let M_ξ denote the moduli space of stable vector bundles on X of rank r and determinant ξ where ξ is a fixed line bundle of degree d. If n and d have a common divisor, then there is no universal bundle on $X \times M_\xi$. It was proved that there exists a projective bundle on $X \times M_\xi$ with the property that its restriction to $X \times \{\mathcal{E}\}$ is isomorphic to $\mathbb{P}(\mathcal{E})$ for all $\mathcal{E} \in M_\xi$ and that this bundle, called the projective Poincare bundle is stable with respect to any polarization.

In this talk, we discuss the generalisation of the above to nodal curves. Vector bundles, moduli problems and the notion of stability will be briefly discussed before we look into the nodal case.

Speaker: Ms. Nupur Patanker
Title: On Goppa codes over Elementary Abelian p-extensions of $\mathbb{F}_q(x)$
Abstract: Linear codes are subspaces of $\mathbb{F}_q^n$. This talk aims to provide an introduction to Goppa codes, a type of linear codes, over a special extension of $\mathbb{F}_q(x)$. First, we give an overview of basics of coding theory. Second, we discuss various tools of Algebraic Geometry which are used to construct codes over the finite field $\mathbb{F}_q$. Lastly, we discuss the construction of Goppa codes over Elementary Abelian p-extensions of $\mathbb{F}_q(x)$, their basic properties and condition for self-duality of these codes.

Speaker: Dr. Shailesh Kumar Tiwari
Title: Centralizing b-generalized derivations with multilinear polynomials in prime rings.
Abstract: In ring theory, additive mappings play a vital role. Derivations are additive mappings. Many authors extended the notion of 'derivation' in various directions such as generalized derivation, Jordan derivation, $*$-derivation, generalized skew derivation etc. In prime and semiprime rings, the study of generalized polynomial identities, Utumi ring of quotient plays a crucial role. In this talk, our aim is to extend the Posner's and Bresar's result. More precisely, we prove the following. *Let R be a prime ring with characteristic different from 2, U be its Utumi quotient ring of R with extended centroid C and $f(x_1, \ldots, x_n)$ be a non central multilinear polynomial over C. Suppose that F is a b-generalized derivation and d is a non zero derivation on R such that $d([F(f(r)); f(r)]) \in C$ for all $r = (r_1, \ldots, r_n) \in R^n$, then one of the following holds:*

1. *there exist $a \in U, \lambda \in C$ such that $F(x) = ax + \lambda x + xa$ for all $x \in R$ and $f(x_1, \ldots, x_n)^2$ is central valued on R,*

2. there exists $\lambda \in C$ such that $F(x) = \lambda x$ for all $x \in R$.

Speaker: Mr. Kalachand Shuin
Title: Weighter estimates for bilinear Bochner-Riesz operators at the critical index.
Abstract: In this talk I'll talk about weighted estimates for the bilinear Bochner-Riesz operator $\mathcal{B}^\alpha$ at the critical index $\alpha = n - \frac{1}{2}$ with respect to bilinear weights.

Speaker: Dr. Partha Sarathi Patra
Title: The Hardy's Theorem and Rotation
Abstract: In this talk we will present a version of Hardy's theorem. Lakey and Hogan generalized the Hardy's theorem (a quantitative uncertainty principle) by considering the decay of f and $\hat{f}$ along arbitrary rays in the plane $\mathbb{C}$: We give an alternative proof of Lakey and Hogan's theorem by using Hermite semigroup. The proof using Hermite semigroup is relatively simpler. This idea of using Hermite semigroup helped us to do a further generalization of Lakey and Hogan's theorem by replacing the Fourier transform with Dunkl transform associated to the reflection group $G = \mathbb{Z}_2^d$ in $\mathbb{R}^d$: We give a version of Hardy's theorem for rotation by assuming the decay in the Hermite coefficient.

Speaker: Dr. Antony Selvam
Title: A uniqueness theorem for entire functions of exponential type
Abstract: In this talk, we discuss the problem of uniqueness of entire functions of exponential type. Let B_σ denote the space of all entire functions of exponential type $\leq \sigma$ which are square integrable on the real axis. We prove that if a non-zero function $f \in B_\sigma$ has infinitely many double zeros on the real axis, then there exists at least one pair of consecutive zeros whose distance apart is greater than $2\pi/\sigma$. Consequently, if $f \in B_\sigma$ satisfies $f(x_i) = f'(x_i) = 0$, for all $x_i \in \mathbb{R}, i \in \mathbb{Z}$ and $\sup_i(x_{i+1} - x_i) \leq \frac{2\pi}{\sigma}$, then $f \equiv 0$. We can also reconstruct the functions in B_σ from its sample values using Hermite interpolation.

Speaker: Dr. Bijan Kumar Patel
Title: Modular properties of the balancing sequence
Abstract: The class of linear recurrences is the mother of many important integer sequences. Balancing and Lucas-balancing sequences are examples of such sequences, that exhibit many fascinating properties. These sequences concede generalizations in numerous ways, such as gap balancing numbers, balancing-like and Lucas-balancing-like sequences, cobalancing and Lucas-cobalancing numbers etc. The modular periodicity of linear recurrences, in general, is efficiently contemplated by several researchers. The study of periodicity of the balancing sequence modulo positive integers exhibits many interesting results. One important observation is that the period is equal to the product of its rank and order. There are various intriguing properties associated with the periods of balancing numbers modulo product of consecutive and powers of balancing and related numbers. Some new approaches for finding balancing-Wieferich primes along with

improved lower bound for balancing-non-Wieferich primes are explored.

Speaker: Ms. Anshu
Title: Connected Stable Rank
Abstract: There are several notions of stable ranks associated to a C*-algebra. In this talk, we will discuss one of these notions known as connected stable rank notated as csr. We will discuss why are we concerned about the connected stable rank. We will see some examples of C*-algebras and their csr. An important class of C*-algebras is a C(X)-algebra. We will give an estimate of the csr of a C(X)-algebra. As an application, we will discuss csr of a group C*-algebra.

Speaker: Ms. Haritha C
Title: Dynamics on shift spaces with a hole
Abstract: Counting the number of strings of fixed length n not containing any of the given finitely many strings is a problem that has been extensively studied due of its applications to game theory, pattern matching and probability theory. In this talk, we discuss an application in understanding the properties of an open dynamical system (system with a hole). We consider the subshift of finite type with a hole where finitely many words of equal length are forbidden and consider the shift map defined on it. Escape rate into the hole represents the average rate with which the orbits escape into the hole. We see that escape rate can be calculated by finding the number $f(n)$ which is the enumeration of strings of length n that contain no elements from the collection of the forbidden words (coming from the hole) as subwords. We obtain the asymptotic behavior of $f(n)$ by analyzing a suitable generating function. Using this, we compare the escape rate into different holes.