Virtual Workshop on Pure Mathematics

September 21 - 25, 2020

Organized By → ***Department of Pure Mathematics, University of Calcutta***
35, Ballygunge Circular Road, Kolkata -700019.

Platform

- **Google Meet**
- **YouTube Live**

Virtual Workshop on Pure Mathematics, 2020 is an initiative to provide a platform to the young researchers to learn from the veterans and rejuvenate through academic discussions with the experts of various fields of Pure Mathematics. In this workshop, research level talks by four eminent speakers will virtually reconnect the academicians which might have been interrupted due to the outbreak of a global pandemic.

Participants : Any student/researcher/faculty interested in Mathematics may participate.
Registration : Mandatory online registration (no registration fee) by September 18, 2020. Google meet link and youtube live link will be provided to the registered participants by mail.
Link for Registration : https://forms.gle/Nf2FuapbyeY9MsA39

Eminent Speakers

Prof. Rukmini Dey
ICTS Bangalore

Prof. E.K.Narayanan
IISc Bangalore

Prof. Pratima Panigrahi
IIT Kharagpur

Dr. Surojit Ghosh
University of Haifa
International School, Israel

Chief Guest

Prof. Tanuka Chattopadhyay
Dean of Science (Acting)
University of Calcutta

Organizing Committee

1. Dr. Atasi Deb Ray, Associate Professor (HOD)
2. Prof. Ashok Kumar Das, Professor
3. Dr. Dhananjoy Mandal, Associate Professor
4. Dr. Sandip Jana, Associate Professor
5. Dr. Sunil Kumar Maity, Associate Professor
6. Dr. Pradip Majhi, Assistant Professor (Joint Convenor)
7. Dr. Suparna Sen, Assistant Professor (Joint Convenor)

Contact email id : seminar.pmath@gmail.com

Tentative Programme Schedule

Day-1 (21st Sep, 2020)	Day-2 (22nd Sep, 2020)	Day-3 (23rd Sep, 2020)	Day-4 (24th Sep, 2020)	Day-5 (25th Sep, 2020)
Welcome Address by HOD (2.15pm-2.20pm)	Lecture-1 Prof. Rukmini Dey (2.30pm-3.30pm)	Lecture-1 Dr. Surojit Ghosh (2.30pm-3.30pm)	Lecture-1 Dr. Surojit Ghosh (2.30pm-3.30pm)	Lecture-1 Dr. Surojit Ghosh (2.30pm-3.30pm)
Address by Chief Guest (2.20pm-2.30pm)	Question & Answer Session (3:30pm-3:45pm)	Question & Answer Session (3:30pm-3:45pm)	Question & Answer Session (3:30pm-3:45pm)	Question & Answer Session (3:30pm-3:45pm)
Lecture-1 Prof. Rukmini Dey (2.30pm-3.30pm)				
Question & Answer (3:30pm-3:45pm)				
Lecture-2 Prof. E.K. Narayanan (3.45pm-4.45pm)	Lecture-2 Prof. E. K. Narayanan (3.45pm-4.45pm)	Lecture-2 Prof. E. K. Narayanan (3.45pm-4.45pm)	Lecture-2 Prof. P. Panigrahi (3.45pm-4.45pm)	Lecture-2 Prof. P. Panigrahi (3.45pm-4.45pm)
Question & Answer (4:45pm-5:00pm)	Question & Answer Session (4:45pm-5:00pm)	Question & Answer Session (4:45pm-5:00pm)	Question & Answer Session (4:45pm-5:00pm)	Question & Answer Session (4:45pm-5:00pm)
				Vote of Thanks (5.00pm-5.15pm)

Prof. Rukmini Dey

Day 1:

Title: Some aspects of Maximal and Minimal surfaces and Born-Infeld solitons

Abstract: Minimal surfaces in 3-d Euclidean space and maximal surfaces in 3-d Lorentz Minkowski space are defined to be zero mean curvature surfaces. The general solutions are given by the Weierstrass-Enneper representations of these surfaces. We will first re-derive the Weierstrass-Enneper representation of a minimal and maximal surface using hodographic coordinates which was first introduced in the context of solitons by Barbishov and Chernikov. We will mention an interesting link between minimal surfaces and maximal surfaces and Born-Infeld solitons. Next we will talk about some identities we obtain from certain Euler- Ramanujan identities and their link with some of these surfaces. This link was first studied by Randall Kamien et al in the context of liquid crystals. We will also talk about some number theoretic results in this context. Some of this work is done jointly with Dr. Pradip Kumar and Dr. Rahul Kumar Singh and Mr. Rishabh Sarma.

Day 2:

Title: Geometric Quantization and Coherent states in examples

Abstract: We will start with a brief introduction of geometric quantization and Rawnsley and Perelomov coherent states. We will explain the example of the finite Toda system whose phase space can be described by a coadjoint orbit. We will touch upon the topic of geometric quantization of moduli spaces using Quillen's determinant line bundle construction. Examples include the moduli space of Higgs bundle and vortex moduli space.

Prof. E. K. Narayanan

Title: Special functions and harmonic analysis

Abstract: Special functions are ubiquitous in harmonic analysis. They appear as joint eigenfunctions of invariant differential operators, matrix coefficients of irreducible representations and so on. In three lectures, which are expository in nature, we shall explain how the special functions appear in harmonic analysis and the role they play.

Day 1: In the first lecture, we look at the Euclidean harmonic analysis, viewing R^n as a homogeneous space G/K, where G = M(n), the Euclidean motion group (rigid motions on R^n) and K = SO(n), the group of orthogonal transformations. The G-invariant differential operators on R^n are precisely polynomials in the Laplacian and so K-invariant eigenfunctions (radial eigenfunctions) of this algebra of differential operators are precisely radial eigenfunctions of the Laplacian, which are given by Bessel functions. Harmonic analysis on R^n = M(n)/ SO(n) can be interpreted as the spectral theory of Laplacian. We shall explain, how the Hankel-Fourier analysis is a natural generalization of the radial Fourier analysis on R^n.

Day 2: In the second lecture, we take up similar issues on a Riemannian symmetric space of non-compact type X = G/K. Here, G is a connected, non-compact semisimple Lie group with finite center and K a fixed maximal compact subgroup. In the real rank one case, the G-invariant differential operators on X = G/K is generated by the Laplacian on G/K (as in the R^n case) and the K-invariant eigenfunctions turn out to be Jacobi functions defined on A (the abelian part in the KAN or KAK decomposition). It is remarkable that in most of the rank one cases (where the algebra of invariant differential operators is generated by a single element (Laplacian)) the joint eigenfunctions are given by the solutions to the Gauss' hypergeometric equation (with suitable parameters). The Jacobi-Fourier analysis, thus gives a natural generalization of the K-invariant harmonic analysis on X.

Day 3: In the third lecture, we will take up a natural generalization of the K-invariant harmonic analysis on G/K (which is mainly the Harish-Chandra's spherical function theory) to arbitrary parameters developed by Heckman and Opdam in the early nineties. This theory, also provides a generalization of Gauss's hypergeometric functions to higher dimensional cases. We will try to explain some of the important results in this area and the difficulties that arise due to the absence of a group and the corresponding integral formulas.

Dr. Surojit Ghosh

Day 1:
Title: Introduction to the equivariant stable homotopy theory
Abstract: Equivariant stable homotopy theory considers spaces and spectra endowed with the action of a fixed group G. Classically, this group has been taken to be finite or compact Lie, but here we will consider only the case of a finite group acting. Our goal is to produce a broad overview of the state of equivariant stable homotopy theory.

Day 2:
Title: Wirthmüller isomorphism and transfers
Abstract: The Wirthmüller isomorphism, the equivariant analogue of the non equivariant statement that in the stable homotopy category Ho(Sp), finite sums and products are equivalent. This is a backbone of the stable category: among other things, it ensures Ho(Sp) is additive. We'll assume G is a finite group in the context of Wirthmüller isomorphism; there's a statement for compact Lie groups, but it's more complicated. Finally, we'll see that the existence of transfers is the same thing as the Wirthmüller isomorphism.

Day 3:
Title: Tom-Dieck splitting and equivariant stable stem
Abstract: The objects of equivariant stable homotopy theory--genuine G-spectra--are very rich in structure: Already the fixed point spectra of equivariant suspension spectra contain more information than just the suspension spectra of the underlying fixed point spaces. The tom-Dieck splitting gives an explicit description of all the wedge summands appearing in fixed-point spectra of equivariant suspension spectra. Using this splitting we'll recover the computation of the zeroth equivariant stable stem.

Prof. Pratima Panigrahi

Title: Some results on Self-centered Graphs
Abstract : To be announced later (Day 1, Day 2)