Advanced Functional Analysis and its Applications 2024

Sponsored By: Anusandhan National Research Foundation (ANRF) and National Board for Higher Mathematics (NBHM)

About the Speakers

A. Adimurthi is a Professor in the Dept. of Mathematics, TIFR CAM. His research interest includes non linear PDE, Hamilton Jacobi equations, conservation laws and Hardy Sobolev spaces. He has been awarded the J.C. Bose fellowship. Professor A. Adimurthi is a Fellow of the Indian Academy of Sciences, Bangalore and the National Academy of Sciences, Allahabad.

S.Thangavelu is an Indian Mathematician who specialised in harmonic analysis. He is a professor in the Department of Mathematics of Indian Institute of science, Bangalore. He was awarded the Shanti Swarup Bhatnagar Prize for Science and Technology in 2002, the Highest science award in India.

Kallol Paul is a Professor of Mathematics at Jadavpur University University. His area of research is Operator Theory in Functional Analysis. Currently, he is actively involved in research in areas involving numerical radius inequalities, Birkhoff-James orthogonality, and its applications.He started his professional career at Jadavpur University since 2005.

Sameer Chavan is a Professor in the Dept. of Mathematics and Statistics, IIT Kanpur. Prof. Sameer Chavan received his Ph.D from University of Pune in 2007. His research interest includes function-theoretic and graph-theoretic operator theory. He has written several papers all in premier journals. He has co-authored a book with Prof. Gadadhar Misra titled 'Notes on the Brown, Douglas and Fillmore theorem'

Ved Prakash Gupta is an Assistant Professor of School of Physical science at Jawaharlal Nehru University. He has received his PhD from IMSc, Chennai, 2008. His research interests includes operator algebra and certain algebraic aspects of Banach algebras coming from various tensor Products of Banach/C*-algebras.

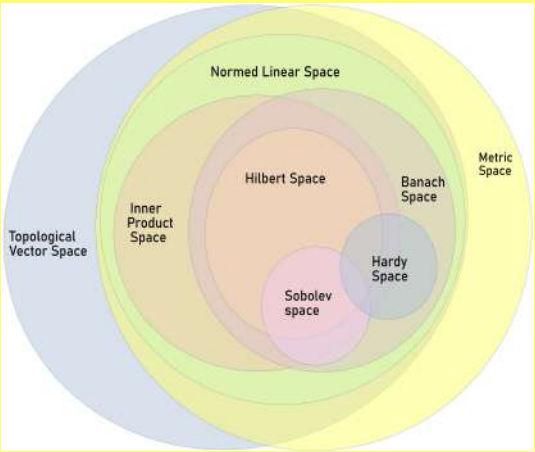
A.K. Vijayrajan is a Professor of Mathematics at KSCSTE-Kerala School of Mathematics. He obtained his Ph.D from ISI Bangalore in 1995. Dr. A. K. Vijayrajan works on the broad area of of functional analysis and in particular operator algebras. His current research interest includes Quantum approximation and extremal theory in the context of C*-algebras and von-Neumann algebras.

Aneesh Mundayadan is an Assistant Professor in the discipline of Mathematics at IIT Bhubaneswar. Dr. Aneesh M received his PhD from IIT Kanpur (2016) and MSc from IIT Kharagpur (2008). His research interests primarily in the complex analytic operator theory, operator dynamics, and Banach space theory. Specifically, it is about multiplication operators, weighted shifts, and Cesàro operators on Banach spaces of analytic functions from the dynamical point of view.

Nijjwal Karak is an Assistant Professor of Mathematics at BITS Pilani, Hyderabad. He received his Ph.D. from University of Jyvaskyla, Finland, 2014. He works on Geometric Analysis, Theory of function spaces and Geometric function Theory.

About the Department of Mathematics, IIT Hyderabad.

The Department of Mathematics, IIT Hyderabad, currently has 22 faculty members, with interests ranging among pure, applied and computational mathematics. Various research groups with the same or complementary interests exist at a very local level. Faculty members maintain active collaborations with both eminent academics and groups in their particular areas of research on a national and international level. Algebraic geometry, commutative algebra, computational intelligence, fluid dynamics, functional analysis, number theory, and theoretical non-linear PDEs are among the department's current research areas. The department provides curriculums on B.Tech in Mathematics and Computing, Masters in Mathematics and Mathematics and Computing and a Ph.D. in Mathematics.



Time & Venue

Department of Mathematics
December 9-13, 2024
IIT Hyderabad

For details please contact:

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Overview & Objectives

One of the fundamental subfields of analysis is functional analysis. This subject is offered at both the Master's and research levels by a number of universities and institutions. Depending on the needs of the teacher, this subject can be taught from a variety of perspectives. However, its core is the study of normed spaces, along with the study of function spaces over various domains, and the behaviour of the operators on normed spaces from both the linear and non-linear point of view. Functional analysis, in its broad sense, includes the study of various aspects of topologies on vector spaces, stochastic theory, non-commutative harmonic analysis and many more. This topic is also used by students of mathematical economics, financial mathematics, actuarial science, electrical mechanical engineering. Our main goal is to provide some cutting-edge subjects in this area that will be beneficial to both lecturers and research scholars. An extensive knowledge of the relevant subject and its related domains is essential for a lecturer. We think that by attending this seminar, people will get a deeper understanding and exposure to the subject.

Number of Participants

The maximum number of participants for the course shall be limited to 40.

Benefit

On successful completion of the course participation certificate will be awarded.

Course contents

The course is aimed for the Lecturers, students, analysts and researchers who have already undergone a first course in Functional Analysis, Complex Analysis and Analysis of single and Multivariable functions. We propose the following topics which are supposed to be covered in this seminar.

1. In many cases, it is difficult to get solutions for PDE. Even proving the existence of a solution is extremely difficult. Although proving the existence of weak solutions to such PDE's in Sobolev spaces is incredibly simple: once all the relevant theoretical machinery has been worked out, the existence, uniqueness, and other useful things about the solutions to the PDE can be proved in only a couple of lines. The reason Sobolev spaces are so effective for PDEs is that Sobolev spaces are Banach spaces, and thus the powerful tools of Functional Analysis can be brought to bear. In particular, the existence of weak solutions to many elliptic PDE follows directly from the Lax-Milgram Lemma. A set of four lectures will be given by Prof. A. Adimurthi on Lax-Milgram Lemma and their applications. Here some properties of the L^2 Sobolev spaces will be proved. Then the concept of weak solutions of the Second Order Elliptic PDE will be established. The Lax-Miligram Lemma and the existence of weak solutions will then be proved. The regularity results upto boundary will then be proved.

2. An important relationship between a function f and its Fourier transform $\hat{f}$ is the uncertainty principle, which roughly asserts that if a function f is highly localised in space, then its Fourier transform $\hat{f}$ must be widely dispersed in space, or to put it another way, f and $\hat{f}$ cannot both decay too strongly at infinity (except of course in the degenerate case f=0). There are many ways to make this intuition precise. One of them is the Heisenberg Uncertainty principle.

Prof. S. Thangavelu will discuss on 'An Algebra on entire functions'. In this series of lectures it will be discussed that, inside the Fock space $\mathcal{F}(\mathbb{C}^n)$ there is a subspace $A(\mathbb{C}^n)$ which becomes a Banach algebra under a suitably defined convolution product. It will be discussed that this algebra satisfies a very interesting uncertainty principle.

3. Various aspects of von-Neumann algebras will be given by Prof. Ved P. Gupta. In addition to different von-Neumann algebra definitions and their equivalence, the lectures will cover about the uniqueness of the pre-dual of any von-Neumann algebra.

4. A series of three lectures will be given by Prof. Kallol Paul on Extreme Contractions on Banach Spaces. A classical result of Kadison states that extreme contractions on Hilbert spaces are isometries or co-isometries. However, the study of the same on Banach spaces is an intriguing area of research, and the characterizations of the extreme contractions in the setting of Banach spaces still remain elusive. In this series of lectures, we plan to discuss the same, starting with operators defined between two-dimensional Banach spaces.

5. A set of three lectures will be given by Dr. Sameer Chavan on the Hausdorff moment problem. The moment problem is to ask for which sequences $\{c_n\}_{n\geq 0}$ of positive real numbers, c_n's are the moments of a measure, that is, $c_n = \int t^n \, d\mu(t), n \geq 0$, and if they are, is the measure unique. If the measure is unique, the problem is called determinate and if not, indeterminate. Depending on whether one restricts μ to have support on a particular set set Ω, we have Hamburger moment problem (Ω= $\mathbb{R}$), Stieltjes moment problem (Ω = [0, ∞)) and Hausdorff moment problem (Ω = [0, 1]). In these lectures, the solution of the Hausdorff moment problem will be discussed.

6. A set of three lectures will be given by Dr. A. K. Vijayrajan on On operator systems and spaces in C*-algebras.The non-commutative counterpart of the classical extremal theory concerning Choquet boundary of subspaces of uniform algebras, which proved to be a very important tool in classical analysis with applications in classical approximation theory, initiated by Arveson in the context of operator systems in C*algebras led to the notion of boundary representations for operator systems in C∗-algebras and developed into the theory non-commutative Choquet boundary and Silov boundary with far-reaching Applications in non-commutative functional analysis..

7. A series of three lectures will be given by Prof. Aneesh M on Hypercyclicity mixing, and chaos in the context of linear operators and provide some criteria to ensure these dynamical properties in a very general separable completely metrizable locally convex spaces (Banach spaces, in particular).

8. In 3 lectures Dr. Nijjawl Karak will discuss on Variable Exponent Lebesgue and Sobolev Spaces. We will be discussing the Variable exponent Lebesgue spaces and some basic properties of these spaces. It will also be discussed about the variable exponent Sobolev spaces and their application to the PDE and some engineering problems.

Link to the Website:

https://sites.google.com/iith.ac.in/afaa-2024

Important dates

- Last date For receiving Application 31st Oct
- Intimation to Participants 2nd Nov
- Course Dates 9-13 December

Registration fee details

There is no fee for the participants. One can register through this link given in the website.

Accommodation

All the participants will be given accommodation inside the IITH campus.

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