BITS Pilani
Hyderabad Campus
Department of Mathematics

NOV-DEC 2024
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Agnit

innovate achieve lead

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> Mathematics is the science of patterns, and nature exploits just about every pattern that there is.
>
> **- Ian Stewart**

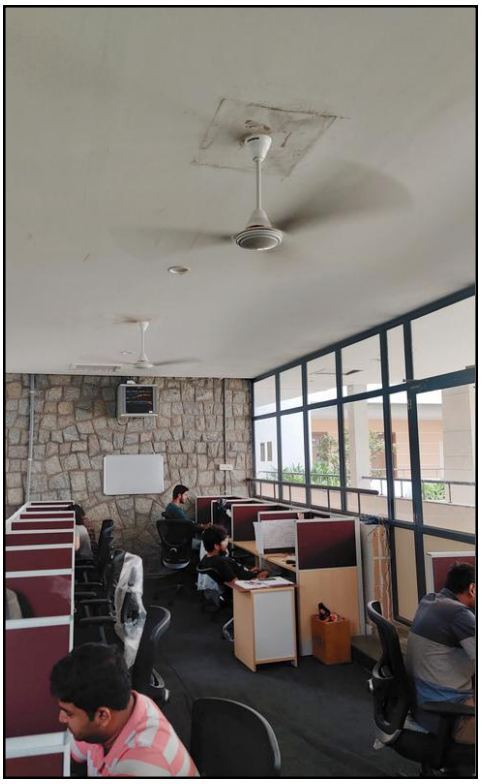
EVENTS

Persona Grata

In 1964, R. Dougherty discovered the largest known ‘factorion’, 40,585, using a computer search. Basically,

$$40585 = 4! + 0! + 5! + 8! + 5!.$$

About Us



The Department of Mathematics was established in 2008, along with the Hyderabad Campus of BITS Pilani. Presently, the department offers Integrated MSc, PhD in Mathematics, and Minor in Data Science in collaboration with the Computer Science Department. We also offer various courses and programs to industry professionals through Work Integrated Learning Programs (WILP).

The department has 28 faculty members, of which 3 are professors, 12 are associate professors, and 13 are assistant professors. Our faculty members are actively engaged in conducting research in multi-dimensional areas of Mathematics such as Algebra, Analysis, Applied Statistics, Computational Fluid Dynamics, Cosmology & Relativity, Cryptography, Differential & Integral Equations, Graph Theory, Mathematical Modeling, Number Theory, and Quantum information.

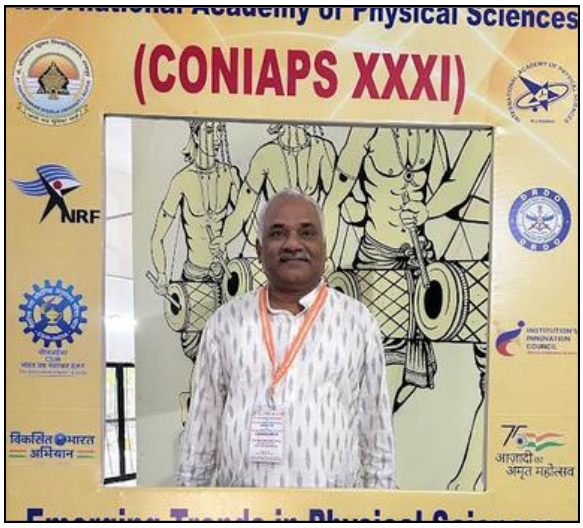
Since its establishment, the department has awarded 25 PhDs, the recipients of which are now working in reputed institutions or pursuing Post-Doctoral research abroad. Currently, the department has 64 PhD students. The department has a well-furnished computational lab with 20 computers equipped with MATLAB, Mathematica and Statgraphics. It has one main node and two computational nodes. This is supported by the FIST grant received by DST, Govt. of India.

Academic Visits & Invited Talks

Prof. P.K. Sahoo visited IUCAA, Pune as an associate. Our Vice-Chancellor Prof. Ramgopal Rao delivered the 36th IUCAA Foundation Day Lecture during the same time.

(From left, Prof. P.K. Sahoo, Poonam Mehta (JNU), Prof. Ramgopal Rao (Vice-Chancellor of BITS) & Prof. Raghunathan Srianand (IUCAA Director) after the talk in auditorium)

Prof. PK Sahoo was invited as the Chief Guest at Fergusson College, Pune on 27-12-2024 for the Mathematics Department Festival 'SANKHYA (संख्या)'



Prof. PK Sahoo delivered an invited talk at the “31st International Conference of International Academy of Physical Sciences (CONIAPS XXXI) On Emerging Trends in Physical Sciences” held at Pt. Ravishankar Shukla University, Raipur, India during 20-21 December 2024.

Prof. PK Sahoo delivered an invited talk at the “4th Symposium of the BRICS Association on Gravity, Astrophysics and Cosmology (BRICS-AGAC 2024)” held at Shree Guru Gobind Singh Tricentenary University (SGT University), Gurugram, Haryana, India during 17-19 December 2024.

Academic Visits & Invited Talks

Mr. Sai Swagat Mishra undertook a visit to IUCAA Pune in a Visiting Position to foster research and collaboration.

Prof. PK Sahoo delivered an invited talk at the "7th International Conference on Frontiers in Industrial and Applied Mathematics (FIAM-2024)" held at Central University of Punjab, Bathinda, Punjab during 13-14 November 2024.

Prof. Deepika visited IISER Bhopal and delivered an invited talk at the 71st Annual Conference of BGP organized during 16th November 2024 and 17th November 2024.

AXIOM Events

Axiom, the Mathematics Association of BITS Pilani, Hyderabad Campus, hosted three engaging events during **ATMOS-Astral Arcade**, the annual technical fest. The pre-ATMOS event, **FUNRAP**, kicked things off with fun challenges and problem-solving. **Cubing Atmosphere**, a speedcubing competition, drew participants from across India and even abroad, while the three-day **Cryptography Workshop**, led by **Mr. Nitin Kumar Sharma**, an in-house PhD student, introduced attendees to the fascinating world of cryptography. Axiom's efforts added a unique touch to the fest, making it a memorable experience for all.

Conferences and Workshops

Santosh V. Lohakare presented a paper on **Stability of f(Q, B) Gravity via Dynamical System Approach: a Comprehensive Bayesian Statistical Analysis in the Space Time Civilization (STC-2024) conference** held at **Bauman Moscow State Technical University, Moscow, Russia** in collaboration with **Birla Institute of Technology and Science, Pilani, India** during 02-07 November 2024.

Kartik Vilas Tathe presented a paper on **Non-Homogeneous Generalized Fractional Skellam Process** at the **7th International Conference on Frontiers in Industrial and Applied Mathematics** held at **Central University of Punjab, Bathinda, India**, from 13-14 November 2024.

Kailash Chand Swami presented a paper on **Performance of a parabolic overtopping wave energy converter device using RANS model** at the **International Conference on Renewable Energy and Conservation (ICREC 2024)** held in **Rome, Italy**, from 22-24 November 2024.

He also presented a paper on **Mathematical Modeling of the Viscoelastic Floating Flexible Membrane Placed Over Variable Bathymetry Regions Under Oblique Water Waves** in the **International Workshop on Mathematics of Sea Ice and Ice sheets (MOSSI-2024)** held in **Australia** on 29 November 2024.

Santanu Kumar Dash presented a paper on **Viscoelastic Membrane Dynamics: Influence of Bathymetry and Random Wave Conditions** in the **International Workshop on Mathematics of Sea Ice and Ice sheets (MOSSI-2024)** held in **Australia** on 29 November 2024.

Gaurav N. Gadbail presented a paper on **Gaussian process approach for model-independent reconstruction of f(Q) gravity with direct Hubble measurement** in the **33rd Workshop on General Relativity and Gravitation (JGRG33)** held at **Kindai University, Osaka, Japan**, from 02-06 December 2024.

Conferences and Workshops

Moreshwar Tayde presented a paper on **Exploring wormhole solutions with global monopole charge in the context of f(Q) gravity** at the **BCVSPIN Conference 2024: Particle Physics and Cosmology in the Himalayas** held in the **Tribhuvan and Kathmandu University, Kathmandu, Nepal**, from 09-13 December 2024.

Sai Swagat Mishra presented a paper on **Can teleparallel f(T) models play a bridge between early and late time Universe?** at the **International Conference on Neutrinos and Dark Matter 2024 Cairo, Egypt**, from 10-16 December 2024.

Sunita Kumawat presented a paper on **Characteristics of wave propagation in Pre-stressed Viscoelastic Timoshenko Nanobeams with Surface Stress and Magnetic Field Influences** at **The 14th AIMS Conference on Dynamical Systems, Differential Equations and Applications** held in the **New York University** at **Abu Dhabi UAE**, from 16-20 December 2024.

Debismita Nayak gave an online presentation on **Arterial blood flow simulation in COMSOL emphasizing mesh optimization** at the **International Halich Congress on Multidisciplinary Scientific Research-VIII** held in **Istanbul, Turkey**, from 03-05 December 2024.

Prof. Sumit Kumar Vishwakarma gave a talk on **A Cell-Centered Implicit Finite Difference Scheme to Study Wave Propagation in Acoustic Media** at **The 14th AIMS Conference on Dynamical Systems, Differential Equations and Applications** held in the **New York University** at **Abu Dhabi UAE**, from 16-20 December 2024.

Conferences and Workshops

Prof. Sharan Gopal gave a talk on **Dynamics of Solenoidal Automorphisms** at **The 14th AIMS Conference on Dynamical Systems, Differential Equations and Applications** held in the **New York University** at **Abu Dhabi UAE**, from 16-20 December 2024.

Ameya Kolhatkar presented a paper on **Investigating early and late-time epochs in f(Q) gravity** at the **4th BRICS-AGAC symposium on gravitation, astrophysics and cosmology** held in **CCSP, SGT University, Gurugram** from 17-19 December 2024.

Sayantan Ghosh presented a paper on **Dynamical system analysis of DBI scalar field cosmology in general symmetric teleparallel gravity** at the **4th BRICS-AGAC symposium on gravitation, astrophysics and cosmology** held in **CCSP, SGT University, Gurugram** from 17-19 December 2024.

Nitin Kumar Sharma presented a paper **On Improved Cryptanalytic Results against ChaCha for Reduced Rounds ≥ 7** at the **International Conference on Cryptology in India, 2024 INDOCRYPT 2024** held in the **Centre for University - Industry Collaboration (CUIC), Anna University, Chennai, India** from 18-21 December 2024.

He also attended the **National Symposium on Mathematics and Applications** held in the **Department of Mathematics, IIT Madras, Chennai, India** on 22 December 2024.

Lakhan Jaybhaye presented a paper on **Late time cosmic acceleration through parametrization of Hubble parameter in f(R, Lm) gravity** at the **31st International Conference of International Academy of Physical Sciences** held in **Pt. Ravishankar Shukla University, Raipur** from 20-21 December 2024.

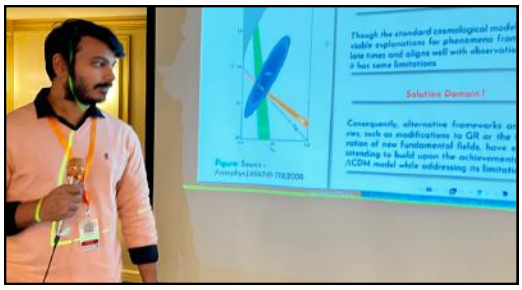
Conferences and Workshops

Prof. Sayan Ghosh presented a talk on the topic **Workshops on Omics Data Science, and Interpretable and Interactive Machine Learning** at the **Annual Conference of the International Indian Statistical Association (IISA 2024)** held at **Cochin University of Science and Technology, Kochi, India** from 27-31 December 2024.

Gaurav N. Gadbail received BITS International Travel Grand to attend the 33rd workshop on General Relativity and Gravitation at Kindai University, Osaka, Japan

Moreshwar Tayde Received BITS International Travel Grand to attend the BCVSPIN Conference 2024: Particle Physics and Cosmology in the Himalayas, Kathmandu, Nepal

Sunita Kumawat achieved BITS international travel grant to attend 14 AIMS Conference at Abu-Dhabi, UAE, Dec 16-20, 2024.



Sai Swagat Mishra got BITS International Travel Grand to attend Neutrinos and Dark Matter, Cairo, Egypt

Kailash Chand Swami received BITS international travel grant to attend the international conference on renewable energy and conservation, at Rome, Italy.

Research Scholar Weekly Talk

In the first talk of research scholar weekly talk, **Mr. Pankaj Patel** explored the fascinating concepts of the Cantor set and the Cantor function in mathematical analysis. He explained how the Cantor set is formed by iteratively removing the middle third from the interval [0, 1], resulting in a set that is uncountably infinite yet has zero measure. Pankaj also discussed the Cantor function, a continuous and monotonic mapping of the Cantor set onto [0, 1]. Often referred to as the "devil's staircase," the Cantor function defies intuitive expectations by being continuous everywhere but having no derivative at any point within the Cantor set.

During a recent session, **Mr. Komal Kumar** gave an insightful presentation on probability measures and random variables. He began by discussing the fundamental definition of probability measures and their various properties, laying a solid foundation for understanding the topic. Moving forward, he delved into the concept of random variables, explaining how they assign numerical values to each outcome in a probabilistic space. Through a series of examples, he illustrated the application of these concepts, making the abstract ideas more tangible and accessible.

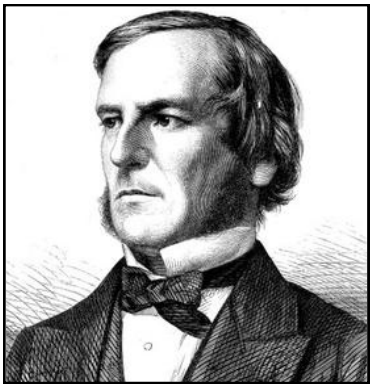
Research Scholar Weekly Talk

Mr. Rabindranath Chakrabortty explored the intriguing topic of symmetries on finite sets. The talk focused on translational symmetry in finite Cartesian products of sets and examined how symmetry and asymmetry can coexist within a finite set through counting techniques. He provided proofs for two fundamental theorems in number theory: Fermat's Little Theorem and Euler's Congruence Theorem. While these theorems have multiple proofs, he offered a unique perspective by leveraging the concepts of symmetry and asymmetry to demonstrate their validity.

In the latest talk, **Mr. Anshid Aboobacker** tackled the question, "Are we learning math the right way, and are we teaching it the right way?" Addressing both student and educator perspectives, the talk delved into the challenges of math anxiety and innumeracy. He argued that math itself isn't inherently difficult, but our approach to it often makes it seem so. By exploring the root causes of these struggles, he encouraged a rethinking of how we learn and teach math, suggesting that a shift in mindset could help alleviate common barriers and make the subject more accessible to everyone.

Know a Mathematician : George Boole

George Boole (1815–1864) was a self-taught English mathematician and logician whose development of Boolean algebra laid the foundations for modern computer science and digital logic. His work in The Laws of Thought (1854) formalized logical reasoning through algebraic techniques, shaping fields like computer science and electrical engineering.



To honor his legacy, the documentary 'The Genius of George Boole' explores his life and groundbreaking contributions to mathematics and computer science. The film, produced by University College Cork, features insights from mathematicians, computer scientists, and historians, illustrating how Boole's innovations continue to shape the digital era.

"The mathematics of logic is needed not only in pure mathematics but in every branch of knowledge".

Publications

* indicates Q1 journal

- **Loewer, N., Tayde, M.,** and **Sahoo, P.K. (2024).** A study of stable wormhole solution with non-commutative geometry in the framework of linear f(R, Lm, T) gravity. The European Physical Journal C, 84, 1196. *
- **Ghosh, S., and Davidov, O. (2024).** Modeling and analyzing stability of hybrid stars within f (Q) gravity. Statistics and Applications, 101686.
- **Lohakare, S.V., Niyogi, S., and Mishra, B. (2024).** Cosmology in modified f ($\mathcal{G}$) gravity: a late-time cosmic phenomena. Monthly Notices of the Royal Astronomical Society, 535,pp.1136-1146. *
- **Dey, S., Leander, G. & Sharma, N.K. (2024).** Improved key recovery attacks on reduced-round Salsa20. Designs, Codes and Cryptography. *
- **Lohakare, S.V.,** and **Mishra, B. (2024).** Stability of f(Q, B) Gravity via Dynamical System Approach: A Comprehensive Bayesian Statistical Analysis. The Astrophysical Journal, 978(1), 26.*
- **Sharma, N.K., Dey, S., Sarkar S.,** and **Maitra S. (2024).** On Improved Cryptanalytic Results Against ChaCha for Reduced Rounds≥ 7. Progress in Cryptology – INDOCRYPT 2024. Lecture Notes in Computer Science, 15496, pp. 29–52.
- **Swami, K.** and **Koley, S. (2024).** Oblique Wave Trapping in the Presence of Seawall Under the Influence of Ocean Current . The Fifteenth ISOPE Pacific/Asia Offshore Mechanics Symposium.
- **Mishra, S.S., Kavya, N.S., Sahoo, P.K.** and **Venkatesha, V. (2024).** Chebyshev cosmography in the framework of extended symmetric teleparallel theory. Physics of the Dark Universe, 47.*
- **Almeida, C.A.S., Lima, F.C.E., Mishra, S.S., Olmo, G.J., Sahoo,** and **P.K. (2024).** Thick brane in mimetic-like gravity. Nuclear Physics B, 1009, 116747.
- **Dash, S.K.** and **Koley, S. (2024).** Analyzing the Impact of Various Sea-Bed Configurations on the Efficiency of an Onshore OWC Device. The Fifteenth ISOPE Pacific/Asia Offshore Mechanics Symposium, pp. ISOPE-P-24-158.
- **Kumawat, S., Vishwakarma,** and **S.K. (2024).** Reflection–transmission coefficients of SH waves across thin-walled spring-membrane strain gradient interface. European Journal of Mechanics - A/Solids.*
- **Kumawat, S., Vishwakarma, S.K.,** and **Touhei, T. (2024).** Dispersive Constraints of Antiplane Shear Waves in a Strain-Gradient LoH Model under an Inflexible Boundary Plane and Initial Pressure. International Journal of Geomechanics, ASCE, 25(3).*

Our Faculty

Prof. Nirman Ganguly

Prof. Nirman Ganguly did his Bachelors and Masters in Mathematics from Jadavpur University, Kolkata. His PhD was from S.N.Bose National Centre for Basic Sciences, Kolkata (University of Calcutta). His research interest includes quantum information theory, specifically the domain areas being detection of quantum entanglement, entanglement witnesses, positive maps, and quantum entropy.

Prof. Ganguly's research focuses on quantum information theory, particularly quantum entropies, entanglement, and their applications in communication and computation. His ongoing externally funded project under SERB investigates "Completely Positive Maps and Quantum Conditional Entropy" (2023–2026), while a completed internal project at BITS-Pilani explored conditional von Neumann entropy in quantum information tasks (2019–2021).

With numerous publications in leading journals like Physical Review A and Quantum, his work addresses quantum steering, entanglement detection, and teleportation. Notable studies include "Entanglement witness operator for quantum teleportation" (Physical Review Letters, 2011).

Prof. Ganguly has delivered invited talks on quantum entanglement, conditional entropy, and quantum computing at prestigious events, including ISI Kolkata, IIIT Hyderabad, and NIT Karnataka. His lectures span foundational and advanced topics, emphasizing entanglement's role in quantum information and global unitary operations.

Prof. Gujji Murali Mohan Reddy

Prof. Gujji Murali Mohan Reddy, a Ph.D. graduate from IIT Guwahati, specializes in Adaptive Finite Element Methods, Inverse Problems, and PDEs with Randomness. He completed postdoctoral research at the University of São Paulo, Brazil, and collaborates internationally with Japan and Brazil on numerical methods for complex mathematical problems.

Currently, Prof. Reddy works on microfabrication modeling and error analysis for evolution equations, supported by SERB-DST and international grants. His previous projects include inverse Stefan problems and adaptive finite element methods.

His research, featured in journals like Mathematics of Computation, Journal of Scientific Computing, BIT Numerical Mathematics, IMA Journal of Numerical Analysis, and Studies in Applied Mathematics, addresses efficient numerical solutions for boundary and phase-change problems.

Prof. Reddy has delivered talks at institutions worldwide, including IIIT Delhi, the University of São Paulo, and Ghent University, highlighting his expertise in finite element methods and numerical analysis.

Our Faculty

Prof. Santanu Koley

Prof. Santanu Koley is an accomplished academic and researcher specializing in Boundary Element Method (Theory & Applications), Integral Equations, and Statistical Modeling. He is currently an Associate Professor at BITS-Pilani, Hyderabad Campus and has over a decade of teaching and research experience. He completed his PhD and MSc from IIT Kharagpur, with support from prestigious fellowships like CSIR/UGC-NET, NBHM, and SERB-NPDF.

Prof. Koley's research focuses on mathematical modeling in wave-structure interaction problems and wave energy converter devices. His major projects, funded by DST and SERB, include studies on hydrodynamics of oscillating water column devices and porous breakwaters. These projects have received over ₹60 lakh in funding, highlighting the impact of his work.

He has published extensively in leading journals, including Engineering Analysis with Boundary Elements, where his work has received "Most Cited Articles" and "Best Paper" awards. His research has also earned recognition at international conferences, such as ICIAM, where he has presented papers and chaired sessions.

Beyond research, Prof. Koley serves as a technical committee member for international conferences like ICACER and ICEEEP. He actively mentors PhD students and contributes as a guest editor for Q1 journals. Through his expertise and dedication, Prof. Koley continues to advance applied mathematics and computational sciences.

Prof. Deepika

Prof. Deepika is an esteemed academic and researcher in Infinite Dimensional Holomorphy and Multilinear Extensions of Operator Ideals. She is an Assistant Professor at BITS Pilani, Hyderabad Campus and completed her PhD at IIT Kanpur in 2017 under the supervision of Prof. Manjul Gupta. Before joining BITS, she was a postdoctoral fellow at NISER Bhubaneswar.

Prof. Deepika's research focuses on functional analysis and operator theory, particularly on approximation properties in weighted spaces of holomorphic functions. She has led projects funded by BITS and SERB, including a study on dynamics of operators on infinite-dimensional spaces, supported by the prestigious SERB-POWER Grant.

Her research contributions include publications in prominent journals like Bulletin of Brazilian Math Society and Collectenea Mathematica. She has collaborated on topics such as Gelfand Philps Property and generalized summability, showcasing her versatility in mathematics.

Currently,she is supervising two PhD Scholars and is supported by ANRF-Power Grant in topics such as Gelfand Philips property and mid summability.

She was invited for a talk in IISER Bhopal and gave a talk on Banach Spaces and Operator with Applications at the Faculty of Mathematics and Computer Science of Adam Mickiewicz University in Poznan,Poland.

First Degree Alumni

Srikanth Suresh

Srikanth Suresh graduated from BITS Pilani Hyderabad Campus in 2011 with a dual degree in Mathematics and Computer Science. He works at Booking Holdings India, where he applies his analytical skills to drive product development for Booking.com. By translating user needs into actionable insights, he ensures the team prioritizes the right features at the right time. His strong analytical background is complemented by research experience, including co-authoring a paper titled "Non-existence of Perfect Dark Energy Fluid in Bianchi Type-IV Space-Time," under the guidance of Dr. B. Mishra and Dr. P.K. Sahoo. This experience aids him in evaluating complex data and making informed decisions in a fast-paced environment.

Viral Tiwari

Viral Tiwari graduated from BITS Pilani in 2023 with dual degrees in Mathematics and Electronics & Communication Engineering. During his time at BITS, Viral pursued diverse research interests, including Wormhole Geometry in Modified Gravity under Prof. P.K. Sahoo and Image Processing Techniques for COVID-19 Detection with Prof. Manish. Kumar. He also served as a Teaching Assistant for courses such as Numerical Analysis, Elementary Real Analysis, and select Humanities electives. Beyond academics, Viral actively contributed to campus life as a Placement Coordinator for his batch and as Captain of the Squash Team. Currently, Viral is a Product Manager at Sprinklr, where he draws on his wide ranging experiences at BITS to build and scale Conversational AI Product and the broader Contact Center as a Service (CCaaS) suite, leveraged by most leading global brands.

Shreyas Kulkarni

Shreyas Kulkarni began his academic journey at BITS Pilani, Hyderabad Campus, where he completed a dual degree with an M.Sc. in Mathematics and a B.E. in Computer Science. He developed a strong interest in Computer Vision and Natural Language Processing, conducting research internships at the University of Sherbrooke and IIIT Bangalore. He also interned at Cisco and Amazon Bangalore as a Software Developer and Applied Scientist Intern. Currently, with over three years of experience as an Applied Scientist at Amazon, Shreyas focuses on applied research in Generative AI, particularly on multimodal generative models for enhancing catalog quality and product recommendation systems.

PhD Alumni

PhD Thesis: Mathematical modelling of wave energy converter devices in real sea conditions.
Supervisor: Prof. Santanu Koley
Year of Conferral : 2023

Dr. Kshma Trivedi

Assistant Professor
Vellore Institute of Technology, Chennai

Her research specializes in mathematical modeling, integral equations, wave energy converter devices (OWC), ANN modeling, and water waves. She has been recognized with several prestigious awards, including the Best Paper Award 2023 from Engineering Analysis with Boundary Elements for her work on “Mathematical modeling of oscillating water column wave energy converter devices over the undulated sea bed” . She also received the CSIR Foreign Travel Grant and financial support from ICIAM 2023, covering her participation in the Tokyo conference, where she presented her research. She has published 42 research articles, including 25 in high-impact factor journals, 13 in Scopus-indexed conference proceedings, and 4 book chapters. Her contributions to wave energy modeling and hydrodynamics have been widely acknowledged in the scientific community, making her a prominent researcher in her field.

Dr. Agrawal Amarkumar Shyamsunder

Assistant Professor
JSPM University, Pune, Maharashtra

Dr. Agrawal Amarkumar Shyamsunder earned his Ph.D. in February 2024 under the guidance of Professor Bivudutta Mishra. His doctoral research, titled "Bouncing Scenario and Cosmic Dynamics in Modified Theories of Gravity," focused on exploring advanced cosmology and gravitational physics concepts. He has contributed extensively to the field through publications in esteemed national and international journals. He has actively participated in various academic forums, presenting his research at numerous national and international conferences. In recognition of his work, he was awarded an international travel grant by the DST-SERB under the International Travel Scheme (ITS). This grant supported his participation in a prestigious conference at the University of New South Wales, Sydney, Australia.

Currently, Dr. Amarkumar is an Assistant Professor at JSPM University and a member of the Board of Studies (BoS). Under his mentorship, one Ph.D. student has commenced research. Dr. Amarkumar continues to advance his academic pursuits through teaching, mentoring, and contributing to the scientific community.

PhD Thesis: Bouncing Scenario and Cosmic Dynamics in Modified Theories of Gravity
Supervisor: Prof. Bivudutta Mishra
Year of Conferral : 2024

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