

MARCH-APRIL 2025 VOLUME 3; ISSUE 2









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Nature is written in mathematical language, and the symbols are triangles, circles, and other geometrical figures.

- Galileo Galilei

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# The last digit of any integer n<sup>5</sup> is n itself





### **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 30 PhDs, the recipients of which are now working in reputed institutions or pursuing Post-Doctoral research abroad. Currently, the department has 54 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.

#### **MAR-APR 2025**



# **Academic Visits & Invited Talks**



**Ms. Debasmita Mohanty** undertook a visit to "*Inter-University Centre for Astronomy and Astrophysics (IUCAA)*" Pune in a Visiting Position to foster research and collaboration during April 11, 2025 to April 19, 2025.

**Mr. Moreswar Tayde** visited the "*Inter-University Centre for Astronomy and Astrophysics (IUCAA)*", Pune, in a visiting capacity from April 11 to April 19, 2025, with the aim of promoting research and collaborative efforts.



### **Achievements and Travel Grants**



**Mr. Kartik Vilas Tathe** received the Best Paper Award at the conference *"Indian Knowledge System with Science and Engineering Perspective – 2025 (IKS-2025)"*.

**Prof. Sumit Kumar Vishwakarma** received a JSPS project as Co-PI, titled "Construction of an interaction model of randomly distributed small scattering sources focusing on the causality of wave response", under the **PI**, **Prof. Terumi Touhei**.





**Ms. Debismita Nayak** secured AIR 80 in CSIR NET JRF-DEC 2024.



## **Conferences and Workshops**



**Mr. Kartik Vilas Tathe** presented a paper on the topic Concepts and Computations of Relative Motion in Classical Sanskrit Texts in the conference "*Indian Knowledge System with Science and Engineering Perspective (IKS-2025)*" held at Visvesvaraya National Institute of Technology, Nagpur, Maharashtra from 28th February to 1st March, 2025.

**Mr. Nitin Kumar Sharma** attended the *"Spring School on Symmetric Cryptography"* held at Roma Tre University, Rome, Italy from 10th to 14th March, 2025.

He also attended the 1st Workshop on *"Symmetric-Key Cryptanalysis Automation and Modelling (SKCAM)"* held at Roma Tre University, Rome, Italy on 15th March 2025.

He presented a paper on Significantly Improved Cryptanalysis of Salsa 20 with Two-Round Criteria in the *"31st Fast Software Encryption Conference*" held at Roma Tre University, Rome, Italy from 17th to 21st March, 2025.







**Mr. Moreshwar Tayde** participated in the conference titled *"Beyond the Horizon: Testing the Black Hole Paradigm"*, held at the International Centre for Theoretical Sciences (ICTS), Bengaluru, from March 24 to April 4, 2025. The event brought together leading researchers to explore cutting-edge developments in black hole physics.



### **Conferences and Workshops**



**Prof. Sumit Kumar Vishwakarma** delivered a research presentation on "Green Functions for Scalar Wave Equations at the Workshop on "*Mathematical Methods and Simulations in Physical Science* (*MMSPS-2025*)", held at SR University, Warangal, on April 16–17, 2025. His insightful talk contributed to the broader discussions on analytical techniques and computational approaches in physical sciences, engaging participants from diverse academic backgrounds.

**Mr. Anshid Aboobacker** attended the "*Lean for the Curious Mathematician*" workshop held at the International Centre for Theoretical Sciences (ICTS), Bengaluru, from April 24 to 26, 2025. The workshop introduced participants to the Lean proof assistant and its applications in formalizing mathematics. It brought together students and researchers from across the country, fostering a collaborative learning environment.





**Mr. Sai Swagat Mishra** participated in the international conference *"Theoretical Aspects of Astroparticle Physics, Cosmology, and Gravitation – 2025",* held at the Galileo Galilei Institute in Florence, Italy, from March 3 to 14, 2025. He received funding from CSIR, INDIA to attend the school.The event brought together experts and early-career researchers to discuss recent advances in fundamental physics, including topics such as dark matter, cosmic inflation, gravitational waves, and quantum gravity.



### **PhD Awardees**



Scholar: Ms. Nakidi Shravani PhD Thesis: A Posteriori Error Analysis of Parabolic Partial Differential Equations with Small Randomness in the Robin Boundary Condition Supervisor: Prof. G.M.M. Reddy, Prof. M. Vynnycky Final Viva-voce: 17 March, 2025

Scholar: **Ms. Sunita Kumawat** PhD Thesis: **Mathematical Modelling of Elastic Wave Propagation in Composite Structures** Supervisor: **Prof. Sumit Kumar Vishwakarma** Final Viva-voce: **22 March, 2025** 





Scholar: **Mr. Gaurav Narayanrao Gadbali** PhD Thesis: **Accelerated Expansion of the Universe in Nonmetricity-based Modified Gravity** Supervisor: **Prof. P.K. Sahoo** Final Viva-voce: **8 April, 2025** 

Scholar: **Ms. Sangeeta Dhawan** PhD Thesis: **Nonlinear Analysis of Some Fractional Difference Equations** Supervisor: **Prof. J. Jagan Mohan** Final Viva-voce: **9 April, 2025** 





Scholar: **Mr. Lokesh Kumar Duchaniya** PhD Thesis: **Cosmological and Dynamical Aspects of Teleparallel Gravity and its Extension** Supervisor: **Prof. Bivudutta Mishra** Final Viva-voce: **28 April, 2025** 



# **Publications**



- Soundararajan, A., and Barbhuiya, F. P. (2025). Transient analysis of a renewal input multiserver queueing model with infinite buffer. Operations Research Letters, 60, 107275.
- Dey, S., Maitra, S., Sarkar, S., and Sharma, N. K. (2025). Significantly Improved <u>Cryptanalysis of Salsa20 with Two-Round Criteria</u>. Cryptology ePrint Archive. \*
- <u>Mohanty, D., Tayde, M., and Sahoo, P. K. (2025). Non-commutative gravastar</u> configuration in f (R, Lm, T) gravity. <u>Nuclear Physics B, 116914.</u>\*
- <u>Majhi, D. K., Kumar, M., Rajak, B. P., and Vishwakarma, S. K. (2025). Effect of</u> initial stress and inhomogeneity on the Love wave propagation in an inhomogeneous <u>composite structure. Acta Mechanica, 1-14. \*</u>

### Know a Mathematician : <u>Terence Tao</u>

Terence Tao is an Australian-American mathematician celebrated for his brilliance and deep contributions to mathematics, including number theory, analysis, and combinatorics. Born in 1975, he earned a Ph.D. at 20 and became a full professor at UCLA by 24. He won a gold medal at the IMO at 13 and received the Fields Medal in 2006.

He is especially known for his work with Ben Green showing that primes contain arbitrarily long arithmetic progressions. Tao has authored several influential books and is a strong advocate for collaborative research. He also shares accessible insights through his popular blog: terrytao.wordpress.com.





### **AXIOM Events**

Axiom's flagship event, Integration Bee, was successfully conducted, offering an engaging and intellectually stimulating challenge for mathematics enthusiasts. The competition began with Round 1 on March 26, where participants showcased their problemsolving abilities and mathematical intuition. The top performers advanced to Round 2 on the April 14th, which featured even more thought-provoking problems. The event concluded on a high note, celebrating the mathematical excellence spirit of and friendly competition.





**Ignite** is a series of events conducted every year for several orphanage kids in the even academic semesters. As a part of **Ignite 2025**, Axiom has conducted "*Jeopardy*" for students of grades 7-9 on **14<sup>th</sup> March, 2025**. This event is similar to a gameshow where they select a category and answer the questions which have been displayed. Participants have exhibited great amount of interest in the event and have performed exceptionally well. The event imitated a trivia game show to a great extent.

For Ignite 2025, another event namely "*Vedic Maths workshop*" for students of grades 3 - 6 was conducted on **15<sup>th</sup> March, 2025**. A well renowned Vedic Math scholar, **Prof. Ramesh Rao**, was invited by Axiom and Prof. N Kishore Kumar, HoD Mathematics, to host this event. In this event, the students have bagged the opportunity to explore various methods to solve complicated expressions in just a few seconds.





# Departmental Activity

#### Talk by Dr. Ashok Kumar Vaikuntam on Level Set Method

**Dr. Ashok Kumar** Vaikuntam delivered a talk on "*Level Set Methods*" on 19<sup>th</sup> April, presenting a modular framework for tracking interfaces in free boundary problems. His approach featured accurate initialization using a direct signed distance method, refined contouring with an improved marching cubes algorithm, and efficient propagation via mean curvature flow with reduced mass loss. The method, offering enhanced precision and robustness, is implemented in industrial tools such as GeoDict, Magmasoft, and Sigmasoft.



#### **Three-Day Workshop on Mathematics for Machine Learning**

The Department hosted a comprehensive three-day workshop titled "Mathematics for Machine Learning" from April 10 to 12, 2025. The sessions provided an engaging overview of the core mathematical and statistical foundations that underpin modern machine learning techniques. From linear algebra and calculus to probability and optimization, the workshop offered participants solid а framework theoretical essential for understanding and advancing in the field of machine learning.





## **Research Scholar Weekly Talk**



**Mr. Sayantan Ghosh** delivered a talk on the "*spectrum of isoperimetric inequality*". Isoperimetric inequality states that among all shapes with the same perimeter circle has the largest area. The isoperimetric inequality is simple to state but hard to prove. This simple looking statement involves infinite possibilities, strange shapes and deep mathematical tools. He lead the audience through a gentle and intuitive journey into the world of planar closed curves.

**Ms. Unnati Gupta** talked briefly about "*gravastars*" in this session. A gravastar is a theoretical object in space that some scientists think might replace the concept of black holes. Even though gravastars are just theoretical, scientists use mathematics to create models of how these might work. She talked about the mathematical aspects of gravastars, such as boundary and stability analysis, and showed how mathematics is necessary to hypothesise the idea of gravastars.





**Mr. Jayen Raj Sharma** addressed the audience with the "*Stefan Problem*". It is a general name given to an initial boundary value problem, which involves fixed and moving phase boundaries. **Mr. Jayen** briefly explored this world that combines deep math with real physics and showed how a daily life process like a melting candle can be really complex.



## **Research Scholar Weekly Talk**

**Ms. Amrutha Ruddaraju** talked about "*Rings of fractions and some local-global properties*". A ring essentially means a set of elements, and rings of fractions are different sets of fractions, each with a different property. She shows how the behaviour of a whole ring can be determined by analysing a small portion of that ring.





Mr. Arjun Reddy Chinepalli gave a talk on "*The partition factor theory – An analogy between graph theory and abstract algebra*". It suggests a connection between graph theory and abstract algebra. This theory might not be widely established, He showed how a parallel can be drawn between these two different branches of mathematics.

Mr. Paras Balani talked about "Wormholes and their solutions in modified gravity". Although wormholes are shown as a mystical phenomenon in various fictional stories, He talked about their practicality and sustainability. He bridged the foundational concept with frontier research in this rapidly evolving field.





**Ms. Ashwini S.** delivered a talk on "*Random variables to markov chains*". A Markov chain is a mathematical model used to describe a sequence of possible events in which the probability of each event depends only on the state attained in the previous event. She introduced the foundational concepts of probability, starting with random variables and building up to stochastic processes.



# – Upcoming Events :

Workshop / Conference	Domain	Venue & Schedule	Deadline
National Workshop on Python for Scientific Computing and Applications (PSCA- 2025)	Mathematical Computation & Application	MANIT Bhopal, India Online Mode) (16 Jun - 20 Jun)	May 31, 2025
Arithmetic and Diophantine Geometry, via Ergodic Theory and o- <u>minimality</u>	Geometry & Topology	IHES - Marilyn and James Simons Conference Center (08 Sep - 12 Sep)	May 31, 2025
<u>Summer School on</u> Formulas of Siegel <u>and Weil</u>	Number Theory & Geometry	Bielefeld University, Germany (29 Sep - 02 Oct)	June 15, 2025
<u>2<sup>nd</sup> International</u> <u>Conference on</u> <u>Nonlinear Analysis</u> <u>and Computational</u> <u>Technique (ICNACT-</u> <u>2025)</u>	Numerical Analysis & Computational Mathematics	VIT Bhopal, India (06 Aug - 08 Aug)	July 01, 2025
International Conference on Class Groups of Number Fields and Related Topics (ICCGNFRT-2025)	Algebra	SRM University, India (06 Oct - 10 Oct)	July 20, 2025



# **PhD Alumni**

#### Dr. Siddheshwar Atmaram Kadam

Assistant Professor, Department of Mathematics School of Computer Science and Artificial Intelligence, SR University, Warangal



PhD Thesis: Dynamical and
Cosmological Aspects of Teleparallel and Extended Teleparallel Gravity.
Supervisor: Prof. Bivudutta Mishra
Year of Conferral : 2024

**Dr. Siddheshwar Atmaram Kadam**, is currently working as an Assistant Professor at SR University, Warangal, in the Department of Mathematics, School of Computer Science and Artificial Intelligence. He specializes in cosmology and modified theories of gravity, with a focus on teleparallel gravity, scalar-tensor theories, and dynamical system analysis. He has published 12 research papers in reputed journals such as Annals of Physics, Physics Letters B, and Physics of the Dark Universe, exploring topics like Noether symmetry, bouncing cosmology, and boundary couplings. An active peer reviewer and presenter at 18 international conferences—including BSM-2023 in Egypt—he also completed a research visit to IUCAA, Pune, and received the DST-ITS travel grant. In 2025, he convened a national workshop at SR University. Alongside research, he is committed to teaching, mentoring, and academic event organization.

**Dr. Hirendra Kumar Garai** earned his PhD in Mathematics from BITS Pilani, Hyderabad Campus, under the guidance of Dr. Sabyasachi Dey, with a research focus on symmetric-key cryptanalysis, particularly ARX-based ciphers like ChaCha and Salsa. Currently, he is a Research Fellow at the School of Physical and Mathematical Sciences, NTU Singapore, continuing his work in cryptographic design and analysis.

During his doctoral journey, he published in top-tier venues such as IEEE Transactions on Information Theory (TIT), IACR ToSC, and Cryptologia, and presented at leading conferences including EUROCRYPT and FSE. He was awarded the CSIR JRF and SRF, and served as a Teaching Assistant at BITS across multiple semesters.

Beyond academia, Dr. Garai contributed to AGANIT as part of its editorial team, collaborated with researchers at TCG-CREST, and briefly held a postdoctoral position at IIT Madras.

A cryptography enthusiast with a passion for clean code, he fondly recalls his time at BITS as a place where he learned to prove, program, and persevere.

#### Dr. Hirendra Kumar Garai

Research Fellow <u>NTU, Singapore</u>



PhD Thesis: Study on Crypatanalysis of ARX-based ciphersSupervisor: Prof. Sabyasachi DeyYear of Conferral : 2024



### PhD Alumni

#### Dr. Tapashwini Patro

Postdoctoral Fellow <u>Society for Electronic</u> <u>Transactions</u> <u>and Security (SETS), Chennai</u>



PhD Thesis: A Study on the Various Aspects of Quantum Entanglement Supervisor: Prof. Niman Ganguly Year of Conferral : 2024

**Dr. Tapaswini Patro** earned her PhD in Quantum Information Theory from BITS Pilani, Hyderabad Campus, under the supervision of Prof. Nirman Ganguly.

Her research lies at the intersection of quantum information theory and mathematical physics, with a focus on quantum entanglement and its applications as a quantum resource in Bell nonlocality, network nonlocality, quantum channels, and entropy measures such as conditional Rényi entropy. Her doctoral work made significant contributions to the study of quantum correlations in network scenarios, including a notable result on revealing hidden nonlocality through sequential measurements.

She has presented her work at leading international institutions such as Humboldt University (Berlin), Nanyang Technological University (Singapore), and the Okinawa Institute of Science and Technology (Japan). She was awarded the prestigious DST INSPIRE Fellowship and received travel support from the University of Strathclyde (Glasgow, UK), DST-SERB, CSIR, and student support award from OIST to present her research. After completing her PhD, she joined as a Visiting Scientist at IIT Hyderabad. She is currently a Postdoctoral Fellow at the Society for Electronic Transactions and Security (SETS), Chennai, contributing to the Quantum Communication project under the National Quantum Mission.

**Dr. Zinnat Hassan** earned his Ph.D. in Mathematics in 2025 under the prestigious DST-INSPIRE Fellowship, working under the guidance of Prof. P. K. Sahoo. His doctoral research centered on astrophysical compact objects, including wormholes, black holes, and compact stars, with a particular focus on the role of Casimir energy, dark matter, and dark energy models in these exotic structures.

He was awarded a gold medal during his master's degree in mathematics, recognizing his academic excellence. During his Ph.D., Dr. Hassan published 19 research papers in reputed peer-reviewed SCI journals, contributing significantly to the field of gravitational physics and cosmology.

Following the completion of his Ph.D., Dr. Hassan joined the Department of Mathematics at SASTRA Deemed University, Thanjavur, Tamil Nadu, as an Assistant Professor. He is passionate about both teaching and research and looks forward to continuing his academic journey while mentoring young minds. paragraph text

Dr. Zinnat Hassan

Assistant Professor Department of Mathematics <u>Sastra University, Tamilnadu</u>



PhD Thesis: Exploring Wormholes in Modified Theories of Gravity Supervisor: Prof. P. K. Sahoo Year of Conferral : 2024





### BITS Pilani Hyderabad Campus Department of Mathematics

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