GANANAM

A Monthly Newsletter of
Department of Mathematics and Computing

$$\frac{1}{\pi} = \frac{2\sqrt{2}}{9801} \sum_{n=0}^{\infty} \frac{(4n)! \ (1103 + 26390n)}{(n!)^4 396^{4n}}$$
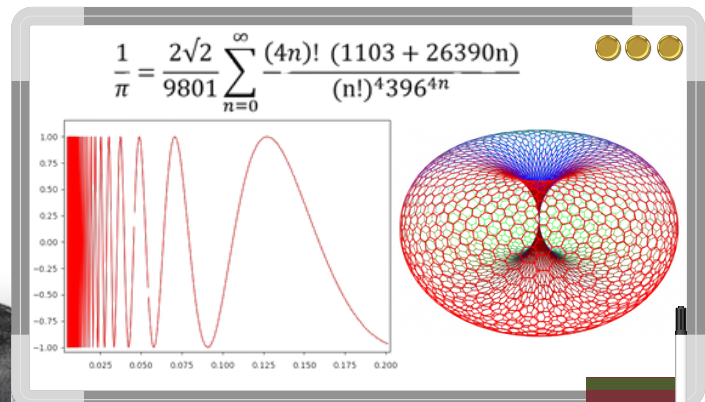
KNOWN INDIAN MATHEMATICIAN BORN IN NOVEMBER

Shakuntala Devi, born on November 4, 1929, in Bangalore, India, earned global acclaim as the "***Human Computer***" for her extraordinary ability to perform complex calculations mentally. Her talent emerged early, solving advanced arithmetic problems by age three and performing large-number calculations, such as cube roots, by six. Encouraged by her father, she showcased her skills publicly, gaining widespread recognition.

In 1977, Devi set a world record by mentally multiplying two 13-digit numbers in 28 seconds, securing her place in the Guinness Book of World Records. She authored numerous books, including In the Wonderland of Numbers (1982), aimed at making mathematics accessible and inspiring children. Her work demonstrated that anyone could master math through practice and perseverance.

In addition to her mathematical feats, Devi collaborated with the Indian Statistical Institute on population studies and explored astrology and puzzles. She passed away on April 21, 2013, leaving a lasting legacy of inspiration in mathematics.

Akshay Venkatesh, born on November 28, 1981, in New Delhi, India, is an Indian-Australian mathematician renowned for his contributions to number theory, automorphic forms, and representation theory. Moving to Australia at age 2, his mathematical talent emerged early, leading him to excel in competitions and master advanced concepts as a teenager. He completed his undergraduate studies at the University of Sydney and earned a PhD from Princeton University at 21 under Peter Sarnak. His work has significantly advanced the

Langlands Program, exploring connections between number theory, geometry, and automorphic forms.

In 2018, Venkatesh received the prestigious Fields Medal for his profound contributions to mathematics. His career spans roles at top institutions like Princeton and Stanford, where he's recognized as an exceptional researcher and mentor. Venkatesh's groundbreaking work continues to expand mathematical boundaries, inspiring future generations and influencing fields like physics and computer science.

PUBLICATIONS

- B. K. Lenka and **R. K. Upadhyay**, New order-dependent conditions to control a class of nonlinear real-order systems, European Journal of Control, 2024 (Accepted).
- **G. K. Vishwakarma**, A. Bhattacharjee, B. Rajbongshi, and A. Tripathy, Censored imputation of time to event outcome through survival proximity score method, Journal of Computational and Applied Mathematics, 451, 116103, 2024.
- **A. K. Verma**, Priyanka N C, Collective dynamics on constrained three-lane exclusion process, Physical Review E, 110 (5), 054107, 2024.
- A. Hazra, **A. Kalita**, M. Gurusamy, and D. Sah, Potential of Zero-Touch Network Management in Industry 5.0: A Future Prospect, IEEE Internet Computing, 2024 (Accepted).
- A. Hazra, P. Maurya, **A. Kalita**, I. Sarkar, Offloading Strategies and Computing Paradigms in IoT: A Survey, in book "IoT Sensors, ML, AI and XAI: Empowering A Smarter World. Smart Sensors, Measurement and Instrumentation", 50, 2024.
- S. Anand, N. Choudhury, **T. Ojha**, A. Hazarika, J. Dave, Improving Network Efficiency in Clustered Tree Topology through PSO Optimization in IEEE 802.15.4-DSME based IoT Networks, in Proceedings of IEEE ANTS, Guwahati, India, 2024

ADDITIONAL RESPONSIBILITY

- **Prof. Sanjeev Anand Sahu** appointed as Nodal officer for Jharkhand to host 'Yuva Sangam Phase-V', 2024-2025.
- **Prof. Sanjeev Anand Sahu** organized Yuva Sangam Phase-V, A flagship program of Ministry of Education, Govt. of India (Stage-I Jharkhand to Uttarakhand). This is a student exchange program under 'Ek Bharat Shrestha Bharat' scheme.
- **Prof. Gajendra K. Vishwakarma** organized Two weeks Interdisciplinary Refresher Course on "Research, Writing and Analysis" during 11-22 Nov 2024.

SPONSORED PROJECTS

- **Prof. Badam Singh Kushvah (PI)** and **Prof. S.P. Tiwari (Co-PI)** has received a Sponsored Research grant of INR 33,30,400.00 from Indian Space Research Organisation (ISRO) for the project "Precise Trajectory Propagation and Events Prediction for Highly Eccentric Orbits".
- **Prof. Sudhakar Kumawat** received a FRS grant of INR 19,25,000 for the project: "AI-based Material Detection of Objects in Indoor Spaces", from IIT (ISM) Dhanbad.
- **Prof. Tamoghna Ojha** received a Special Lab Establishment grant of INR 29,97,000 from IIT (ISM) Dhanbad for setting up "Computation for Secure and Intelligent Networks (COSINE)" Lab.

INVITED TALKS

- **Prof. Sanjeev Anand Sahu** delivered an invited talk on "Quantitative Aptitude" at the *Department of Mathematics, School of Science, O. P. Jindal University, Raigarh, Chhattisgarh* on 6 November 2024.
- **Prof. Tamoghna Ojha** delivered an invited talk on "Optimizing P2P Wireless Energy Transfer: Network and Device Dynamics" at the *ERCIM Fellows annual meet* on 8 November 2024.
- **Prof. Tamoghna Ojha** delivered an invited talk on "Recent Trends and Future Directions in Internet of Things" at the IoT Course at the *Department of EEE, BITS Pilani, Hyderabad* on 15 November 2024.
- **Prof. Subhashis Chatterjee** delivered an invited talk on "Adaptive Fuzzy Inference System-based Deep Learning Model for Early-Phase Software Dependability Analysis" at The School of Mathematics, Monash University, Australia during 19th to 22 November 2024.
- **Prof. Hemant K. Mishra** delivered an invited talk on "Equality in some symplectic eigenvalue inequalities" at Department of Mathematics, NIT Jalandhar on 29 November 2024.
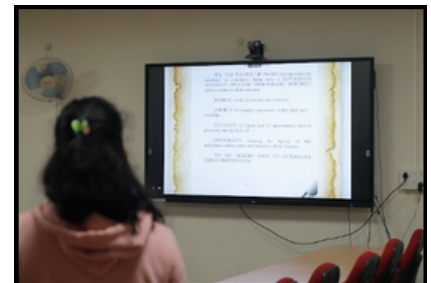
EVENTS

GUEST LECTURE

Dr. Vineet K. Srivastava, an alumnus of our department, and currently a Scientist with the Flight Dynamics Operations, Spacecraft Operations Area, ISTRAC/ISRO, Bangalore delivered a talk on "**Space Operations, Flight Dynamics Prospectives**" on
4 November 2024.

CONSTITUTION DAY CELEBRATION

Constitution Day was observed in the department on *26 November 2024* by all the employees reading out the *Preamble of the Indian Constitution*.

THESIS DEFENCE

DR. SWATI SINGH

Swati's PhD thesis investigates oblique wave scattering by rigid and flexible porous breakwaters, considering bottom undulations for wave attenuation in coastal regions. Boundary value problems are formulated under small wave steepness and solved using Havelock's expansions, Galerkin approximation, and collocation methods. Rigid breakwaters use eigenfunction expansions, while flexible ones incorporate Green's function for structural deflection. The porous boundary condition leads to a Fredholm integral equation, and solutions yield scattering coefficients and wave forces. This study highlights the combined effects of refraction and diffraction by bottom topography and breakwaters, providing insights into wave attenuation for onshore and offshore protection.

Manoj's PhD thesis analyzes the dynamic properties of perturbed restricted N-body problems, focusing on equilibrium points, zero velocity surfaces, and stability under perturbing forces like radiation pressure, oblateness, and the albedo effect. A generalized model examines primary bodies with a disc-shaped structure and a black-body secondary. Nine equilibrium points—three collinear and six non-collinear—are identified, with stability analyzed. While some collinear points are unstable, most non-collinear points exhibit linear stability. The study also explores albedo effects on equilibrium point positions and Jacobi's constant fluctuations, offering insights into the motion of infinitesimal particles in systems lacking planetary sphericity.

DR. MANOJ YADAV

DR. SANTANU DEY

Santanu's PhD thesis addresses the inference of unknown population parameters and focuses on the classification problems for directional populations and mixtures of multivariate populations. Various usual estimators and ordered estimators of the parameters considering von Mises–Fisher, Watson, and angular central Gaussian distributions were proposed. Based on these estimators, classification rules for directional and axial observations on the unit hypersphere were derived. Also, the mixture model-based classification has been derived for the mixture of multivariate t-distributions and skew-normal distributions for heavy-tailed data and skewed data, respectively.

ALUMNI SPARK

Dr. Devashish Sharma graduated with Integrated M. Tech. in Mathematics and Computing in the year 2013. Sponsored by the Comutational Science Energy Research program of Shell, he went on to finish his PhD in 2017 from the Netherlands with thesis titled "3D periodic photonic nanostructures with disrupted symmetries". From last 7 years, Devashish is working at the leading semiconductor company, ASML as Metrology Architect. He has been part of research and development of novel features for focus and overlay performances in latest EUV machines, namely NXE:3800 and EXE:5000. In fact, ASML is probably a part of the electronic device you're using right now. Our lithography technology is fundamental to mass producing semiconductor chips. With it, the world's top chipmakers are creating microchips that are more powerful, faster and energy efficient. https://www.asml.com/en

Devashish fondly remembers his time at our department in terms of building foundations of computational mathematics as well as venturing abroad multiple times for internships. He highlights that the evolving course structure of M&C keeps the students updated with latest demands in global technology sector. He expresses his gratitude for providing him opportunities for technical growth as well as personal growth.

MATHEMATICS & COMPUTING NEWS

- In August 2024, Noam Elkies and Zev Klagsbrun discovered a record-breaking elliptic curve with the most complex pattern of rational points ever found, surpassing an 18-year-old record. Elliptic curves, central to number theory and cryptography, remain enigmatic despite their historical significance. Mathematicians study their rational points to understand their structure but still debate whether limits exist to these patterns' complexity. This discovery pushes the boundaries of current knowledge, fuelling exploration into the uncharted diversity of elliptic curves. It highlights the creativity and computational efforts required to unravel fundamental questions about these ancient yet profoundly impactful mathematical objects. **Read More**

- Physical reservoir computing (PRC) utilizing synaptic devices shows significant promise for edge AI. Researchers from the Tokyo University of Science have introduced a novel self-powered dye-sensitized solar cell-based device that mimics human synaptic behaviour for efficient edge AI processing, inspired by the eye's afterimage phenomenon. The device has light intensity-controllable time constants, helping it achieve high performance during time-series data processing and motion recognition tasks. This work is a major step toward multiple time-scale PRC. **Read More**

PATENT

A. Kalita, 'An Internet of Things (IoT) enabled System and Process for real-time Monitoring of an Infant to Prevent Falling Off a Surface above Ground level'.
[Ref No: 202431081152].

STUDENT ACHIEVEMENT

Piyush Jain, a 4th year Integrated Master of Technology student was among the top 5 participants in the **Goldman Sachs India Hackathon 2024**. He worked on the following: SQL Query Engine, OMR Sheet Processing, Walk Again Problem

UPCOMING EVENTS

- National Mathematics Day, 22-23 December 2024

- National Conference on Data Predictive Analytics and Numerical Simulation, 23-25 January 2025.

- National Conference on Nonlinear Analysis, Control, and Optimization, 8-10 May 2025.

AWARDS

- **Prof. Gajendra K. Vishwakarma** received travel award of International Biometric Society, USA and International Travel Grant of ANRF Govt of India to attend IBC-2024.

- **Prof. Gajendra K. Vishwakarma** received Prof. K. Srinivasa Rao Best Researcher Award of Indian Society of Probability and Statistics 2024.

EDITORIAL TEAM

Prof. S P Tiwari (HOD), Prof. P S Rao, Prof. Atul Kumar Verma, Prof. Tamoghna Ojha, Naman Shankar Srivastava, Hima Chowdary Tanikonda.
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