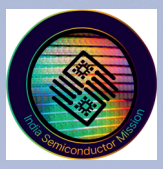

NIT DELHI RESEARCH BULLETIN

अनुसंधान

SHOWCASING INSTITUTES'S RESEARCH ACTIVITIES

VOLUME 2, ISSUES 3 & 4,

JULY - DECEMBER 2023

राष्ट्रीय प्रौद्योगिकी संस्थान दिल्ली

National Institute of Technology Delhi

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National Institute of Technology Delhi

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LAUNCH OF "अनुसंधान" (VOL. 2, ISSUE 1 AND 2)

MESSAGE FROM THE PATRON

Apart from the culmination of "*Azadi ka Amrit Mahotsav*" and G-20 activities, our beloved country has now resolved to become a developed country by 2047. This extremely ambitious campaign "*Viksit Bharat 2047*" aims to make India a developed nation with economic growth, environmental sustainability, social progress and good governance. This campaign will include the unprecedented enhancement in the research activities in the institutes of national importance such as our institute.

In 2023, India has also established the National Quantum Mission (NQM) aiming to seed, nurture and scale up scientific and industrial R&D and create a vibrant & innovative ecosystem in Quantum Technology (QT). India Semiconductor Mission is another ambitious project undertaken by our country in the year 2023. Recent establishment of National Research Foundation (NRF) is a crucial milestone with an aim to make India a leading nation in scientific and technological research. All these developments indicate towards the need for accelerating the efforts and resources in the area of research and development at the institute level.

NIT Delhi, keeping a close eye on all these developments, has already aligned its research activities in these areas in the shape of taking up new research themes, establishing new research laboratories, and signing MoUs and partnership agreements etc. While releasing this edition of our research bulletin '**अनुसंधान**', I am extremely proud to mention that NIT Delhi is astutely committed towards incessant advancement in its research activities consistent with the country's vision.

It fills me with enormous joy to share with you the next edition of '**अनुसंधान**'. I congratulate the editors for their tireless work behind '**अनुसंधान**', which is now completing its second volume.

Prof. (Dr.) Ajay Kumar Sharma
Director, Nit Delhi

FOREWORD FROM THE EDITORS

Welcome to the latest edition of our research bulletin"**अनुसंधान**". Throughout the past year, researchers across various disciplines have embarked on ambitious endeavors to tackle pressing challenges and expand the frontiers of knowledge. From advancements in technology to breakthroughs in healthcare, the diversity and depth of research outcomes in 2023 have been truly remarkable.

One notable area of progress lies in the realm of artificial intelligence and machine learning. Researchers have made significant strides in developing algorithms capable of solving complex problems with unprecedented efficiency and accuracy. These advancements have paved the way for applications ranging from autonomous vehicles to personalized medicine, revolutionizing industries and improving the quality of life for millions. Furthermore, the year 2023 saw a renewed focus on sustainability and environmental conservation. Researchers have been at the forefront of efforts to develop renewable energy sources, mitigate the impact of climate change, and protect biodiversity. Our institute has been constantly keeping pace with these areas through extensive research activities undertaken by the faculty members.

As we reflect on the achievements of the past year, it is clear that the pursuit of knowledge knows no bounds. The research outcomes of 2023 serve as a testament to the dedication, ingenuity, and collaborative spirit of the global scientific community. They inspire us to continue pushing the boundaries of what is possible and to strive for a brighter, more prosperous future for all.

As we delve into the pages that follow, let us be inspired by the tireless dedication of our researchers and the boundless potential that research holds. The whole team of editors whole-heartedly thank the Hon'ble Director, Prof. Ajay Kumar Sharma, for giving us this opportunity to work on the past and current editions of '**अनुसंधान**'. We are also thankful to all the faculty members for sharing the research information and data for this edition of the research bulletin.

Faculty Editors
"अनुसंधान"

NIT DELHI – AT A GLANCE

National Institute of Technology Delhi (NITD) is one of the thirty NIT(s) established in the year 2010 by an act of the parliament and has been declared as an Institute of National importance. NIT Delhi is an autonomous Institute, which functions under the aegis of the Ministry of Education, Government of India.It aims to provide education and research facilities in various disciplines of Engineering, Science and Technology, Management, Social Sciences, and Humanities for advanced learning and dissemination of knowledge. The Institute is imparting holistic education, along with inculcating high moral values in its students.

NIT Delhi started its academic session in 2010 and it was operating from its transit campus at Narela, Delhi until recently. The institute is now fully operational at its permanent campus situated on NH-1 (GT Karnal Road), Narela sub-city, New Delhi. The institute already offers B. Tech. programmes in five areas of technology (Computer Science and Engineering, Electronics and Communication Engineering, Electrical Engineering, Mechanical Engineering, and Civil Engineering), M. Tech. programmes in six disciplines, along with Ph.D. programmes in all branches of Science and Engineering.

The institute makes all attempts to establish strong research collaborations in evolving fields of research in science and engineering. The programmes like joint thesis work, inter-institute collaborative projects, institute assistantship to PG and doctoral students, and administrative support to faculty members for taking up research and consultancy work (sponsored by external agencies). The institute also has the Institute Post-Doctoral Fellowship (IPDF) programme to further escalate the research activities and has recruited several IPDFs in recent months.

NIT Delhi takes immense pride in conveying that the guidelines of National Education Policy (NEP)-2020 have been implemented for all batches of UG and PG students. From the academic session 2023-24, the institute has started new B. Tech. programme in 'Artificial Intelligence & Data Science' and M. Tech. programmes in 'Mathematics and Computing', and 'Power and Energy Systems' which have been designed in line with the NEP-2020 guidelines. From academic session 2024-25, the institute aspires to start new B. Tech. programme in "VLSI Design and Technology" and M. Tech. programme in "Industrial Chemistry".

BROAD AREAS OF RESEARCH AT NIT DELHI

Department/Stream	Research Areas
Physics	Nanophotonic Sensors and Devices, Plasmonics, Fiber Optics, Optical Device Modeling, Optical imaging & instrumentation, Biomedical optics, Digital Holography, Microwave imaging and instrumentation, EM Theory in different media, Antennasand wave propagation, MHD waves & Flow
Mathematics	Convection in Fluids, Heat Transfer, Nanofluids, Ferrofluids, Micropolar Fluids, Non-Newtonian Fluids, Porous Media, Computational Applied Mathematics, Climate Modeling,
Chemistry	Design and synthesis of new porous materials with metal skeleton and their application in catalysis, chemical technology, and host-guest chemistry (molecular adsorption and molecular recognition), electrical, optical and magnetic properties.
Civil Engineering	Concrete Structures, Bridges, Earthquake Engineering, Advanced materials like Composites, FGMs, CNTs etc., Environmental Science and Engineering, Environmental Biotechnology, Waste Management, Waste to Energy Conversion
Computer Science and Engineering	Wireless Sensor Networks, Network Theory, Data Analytics, Quantum Computing in Networks, Federated Learning, Machine Learning , Motion analysis, Computer Vision, Cloud Computing, Data Security, 5G, Artificial Intelligence, Databases, Big Data Analytics, Data Science, Health Informatics, Data Mining, Data Warehousing, Databases, Big Data, Software Engineering
Electrical Engineering	Power System Restructuring/Deregulation, Electricity Market, Distributed Generation, Renewable Energy, Security Analysis, Fault Detection, Operation and Control of Power Systems, Smart Energy Network, Electric Vehicle, Power Electronics, Renewable Energy Systems, Electric Drives, Smart Grids (Micro/Nano), Modeling, Design and Digital Control of DC Conversion System, Embedded Systems, Modeling& Design of Converters, FPGA Design, Control Systems, Signal Processing, Control Systems, Biomedical Signal processing, Artificial Intelligence, Renewable Energy, Image Processing, Reliability Engineering, Conventional and Hybrid Power Systems, Power Systems Analysis, and Smart Grid Analysis, RAMS.
Electronics and Communication Engineering	MOSFET and TFET Devices, Standard cell library characterization, Computer Architecture, VLSI Design, Embedded Systems andDigital Image Processing, RF And Microwave Circuits, Networking, Wireless Communication (4G and 5G), Neural Networks, Signal and Image processing, Computer vision, Robotics, Machine Learning and Pattern Recognition, Artificial Intelligence, Optical Communication and Networks, Wireless Communication, Optoelectronics, Digital VLSI, Game theory, Peer-to-Peer Networks, Blockchain, Peer-to-Peer electricity trading, Semiconductor Devices, Nanophotonics, Speech Processing, Communication and Instrumentation, Antennas and wave propagation etc.
Mechanical Engineering	Additive manufacturing, Non-Conventional machining, Metal matrix composites, Metrology, Manufacturing Science, Advanced Machining Processes, Composite Materials

MEMORANDA OF UNDERSTANDING (MOU)

1. NIT Delhi and Aryabhatta Research Institute of Observational Sciences (ARIES)

On December 19, 2023, NIT Delhi has signed an MoU with the Aryabhatta Research Institute of Observational Sciences (ARIES), Nainital. Some key highlights of this MoU are:

- Research Collaboration: The MoU establishes a framework for collaborative research initiatives between NITD and ARIES, facilitating the exchange of expertise and resources.
- Joint Projects: Joint projects will be envisaged in the areas such as space physics, astronomy, and related fields, leveraging the strengths and capabilities of both institutions.
- Knowledge Exchange: The partnership includes provisions for the exchange of researchers, knowledge, and best practices, enhancing the intellectual capital of both entities.
- Training and Development: This MoU extends to educational initiatives, offering opportunities for training and development for students, researchers, and professionals.

2. NIT Delhi and Rey Juan Carlos University (Spain)

On October 27, 2023, NIT Delhi and Rey Juan Carlos University, Madrid (Spain) signed a General Action Protocol (GAP) with an objective to enhance the quality of research, training, and services aimed to address the multifold challenges of the society. The duration of this GAP will be four years that facilitates the development of actions and activities mutually benefitting both organizations. The forms of collaboration include:

- Cooperation in projects or programs of cooperation and development by means of the subscription of the pertinent contracts for the completion of scientific, technical or artistic work.
- Involvement of researchers or technical personnel in training orexchange programmes.
- The use of specific facilities or equipment available at both institutions, under the conditions established in mutual agreement.
- Cooperation in technology and innovation dissemination programmes.
- Reciprocal support/collaboration in sessions, cycles, seminars or events organized jointly.

3. NIT Delhi and IIT Ropar

On October 20, 2023, NIT Delhi and IIT Ropar signed an MoU with an aim to explore the possibility of collaboration in following areas:

- Exchange of intellectual know-how and resources.
- Partnership in innovation and entrepreneurship driven opportunities and resources.
- Sharing of scientific-technical network and infrastructure.
- Collaborative consulting and research projects.

4. NIT Delhi and Bureau of Indian Standrards (BIS)

On August 4, 2023, NIT Delhi and BIS, Delhi signed an MoU to develop the collaborating activities in the areas of standardization and conformity assessment on the basis of equality and reciprocity. The major objectives of this MoU are:

- Ensuring participation in Standardization activity through Technical Committees of the Bureau at National & International level.
- Undertaking R&D Projects related to standardization and conformity assessment.
- Developing infrastructure support for R&D Projects of relevance to standardization.
- Providing IT based technological solutions.

- Jointly organizing seminars, conferences, workshops symposia or lectures on related topics.
- Exchange of publications and other literature of common interest related to Standardization and Conformity Assessment.
- Exchange of information on research and educational programmes and other programmes.
- NIT Delhi to consider introduction of topics on standardization in academics.
- Jointly organizing training and short-term education programmes.
- Exploring the possibility for setting up a Centre of Excellence in the field of Standardization, Testing & Conformity Assessment at NIT Delhi.
- Exploring the possibility of using laboratory facilities available at NIT Delhi.

5. NIT Delhi and NIT Hamirpur

On August 11, 2023, NIT Delhi and NIT Hamirpur signed an MoU to develop strong academic and research partnerships between two esteemed organizations. The major highlights are:

- Short and Long-term Faculty members/Students Exchange.
- Collaborative research.
- Formulation of mutually agreed educational or research or field programs (biomedical, robotics, AI and ML etc.,)
- Joint project proposals to R&D funding agencies.
- Joint guidance of Ph.D. Scholars of both institutes.
- Joint organization of International Conference/Ph.D Programme.
- Joint Publications in Q1 and Q2 rank Journals.
- Joint Patents between NIT Delhi and NIT Hamirpur Faculty/students.
- Establishment of Centre of Excellence.

6. NIT Delhi and Synopsis India

On July 25, 2023, NIT Delhi and Synopsis India signed an MoU with following major objectives:

- Joint research activities .
- Joint organization of FDPs/Workshops/Hackathons etc.
- Designing of syllabi/curriculum aimed at academia-industry relationships.
- Internship and placement.

In addition to above, some more MoUs were signed in this duration. Their details are as follows:

Date of MoU	MoU signed with	Major Objectives
November 30, 2023	Manipal University Jaipur	Research and academics
November 29, 2023	LNMIT Jaipur	Research and academics
October 11, 2023	Shiksha 'O' Anusandhan, Bhubaneswar	Research and academics
August 8, 2023	KIET, Ghaziabad	Research and academics
July 29, 2023	SLIET, Longowal	Research and academics
July 27, 2023	Khalsa College of Engineering and Technology, Amritsar	Research and academics
July 20, 2023	National Institute of Electronics & Information Technology (NIELIT), Delhi	To develop skilled manpower in the domains viz. IECT, Emerging Technologies etc.

AWARDS AND HONORS

- **Prof Manoj Kumar received the Best Paper Award**

  Research paper entitled "Design of a low-power Varactor-based DCO using NMOS switching network as a digital control technique," was awarded the best paper award in 8th International Conference on Micro-Electronics, Electromagnetics and Telecommunications (ICMEET-2023) organized by NIT Mizoram, India.

- Dr. Karan Malhotra was awarded "Secretary Appreciation Award 2023" by Indian Medical Association Delhi North Zone (IMA-DNZ).

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56. V. Jangra and Manoj Kumar, "A PVT Tolerant Low Power Wide Tuning Range Differential Voltage Controlled Oscillator Design in 90nm CMOS Technology," Integration vol. 93, 102054, 2023, https://doi.org/10.1016/j.vlsi.2023.102054. (Impact factor: 1.9).

57. Manoj Kumar, D. Dwivedi, N. Kumar, V. Singh, V. Jangra, "Voltage Controlled Oscillator with Active Inductive and Capacitive Tuning," International Journal of Information Technology, Springer, Nov. 2023.

58. S. Singh, A. S. Nandan, GeetaSikka, A. Malik, N. Kumar, "A Genetic Algorithm Based Dynamic Transmission of Data for Communicable Disease in IoMT Environment", IEEE Internet of Things Journal, vol. 55, pp. 1-1, 2023. (Impact Factor: 10.238)

59. N. Agarwal, Geeta Sikka, L. K.Awasthi, "WGSDMM+GA: A genetic algorithm-based service clustering methodology assimilating dirichlet multinomial mixture model with word embedding", Future Generation Computer Systems, vol 145, 254-266, 2023. (Impact Factor: 7.307)

60. P. Chauhan, N. Sharma, Geeta Sikka, "On the importance of pre-processing in small-scale analyses of twitter: a case study of the 2019 Indian general election", Multimedia Tools And Applications, doi 10.1007/s11042-023-16158-3, 2023. (Impact Factor: 3.6)

61. N. Agarwal, Geeta Sikka, L. K.Awasthi, "Integrating Semantic Similarity WithDirichlet Multinomial Mixture Model For Enhanced Web Service Clustering", Knowledge and Information Systems, (Impact Factor 3.3)

EXPERT TALKS/SEMINARS/FDP/CONFERENCE/OTHER EVENTS ORGANIZED

- Dr. Amit Mahajan (Associate Professor, Mathematics) of the Department of Applied Sciences organized two lectures under the Lecture series on "***Frontiers in Mathematics and Computation***" with following details:

Name of Expert	Affiliation	Title of lecture	Date of lecture
Prof. SCS Rao	Indian Institute of Technology Delhi	*Parallel Computation of Block Tridiagonal Toeplitz-Block-Toeplitz Linear System*	November 29, 2023
Dr. Sachin Kumar	Delhi University	*New Evolutionary Behaviours and Exact Invariant Solutions of the (3+1)-dimensional Nonlinear Evolution Equations*	December 27, 2023

- On 31 July 2023, Prof. Sandeep Kumar from Old Dominion University, USA gave an expert lecture.
- On 24 November 2023, Prof. Bijandra Kumar from Elizabeth State University, USA, gave an expert talk on "Use of nano-catalyst for production of hydrogen".

- **One-day joint collaborative workshop between NIT Delhi and CSIR-National Physical Laboratory (NPL), New Delhi, organized by the ECE Department of NIT Delhi on August 17, 2023, at NIT Delhi.**

About the workshop: The workshop was focused on the demonstration by scientists of various scientific divisions of NPL and interaction with the faculty and students of NIT Delhi. The Workshop provided a glimpse of various research works carried out by the various scientific divisions at NPL, so that a research collaboration between NIT Delhi and NPL may be fruitfully initiated. More than 85 faculty/ students/ staff of NIT Delhi attended the workshop.

From NPL, Dr. Dilip D. Shivagan presented his talk on "*Physico-Mechanical Metrology*", Dr. Sunil S. Kushvaha on "*Electrical & Electronics Metrology*", Dr. Sumit K. Mishra on "Environmental Science & Biomedical Metrology", Dr. Parveen Saini on "*Advanced Materials & Device Metrology*", Dr. S. P. Singh on "*Bhartiya Nirdeshak Dravyas*", Dr. Poonam Arora on "*Indian Standard Time Metrology*", and Dr. Anjali Sharma on "*Information Sciences & Digital Metrology*".





- On 20 September 2023, NIT Delhi organized a lecture on "*Power of failure*". The speaker was **Major General N K Dhir.**

- On 17 October, 2023 National Institute of Technology organized a lecture on "*Image Processing & Computer Vision*" given by **Prof Dr. Navin Rajpal.**

- On 19 October, 2023 NIT Delhi organized a lecture on "*Introduction & Applications of Remote Sensing*". The speaker was **Dr. Sugandh Chauhan.**

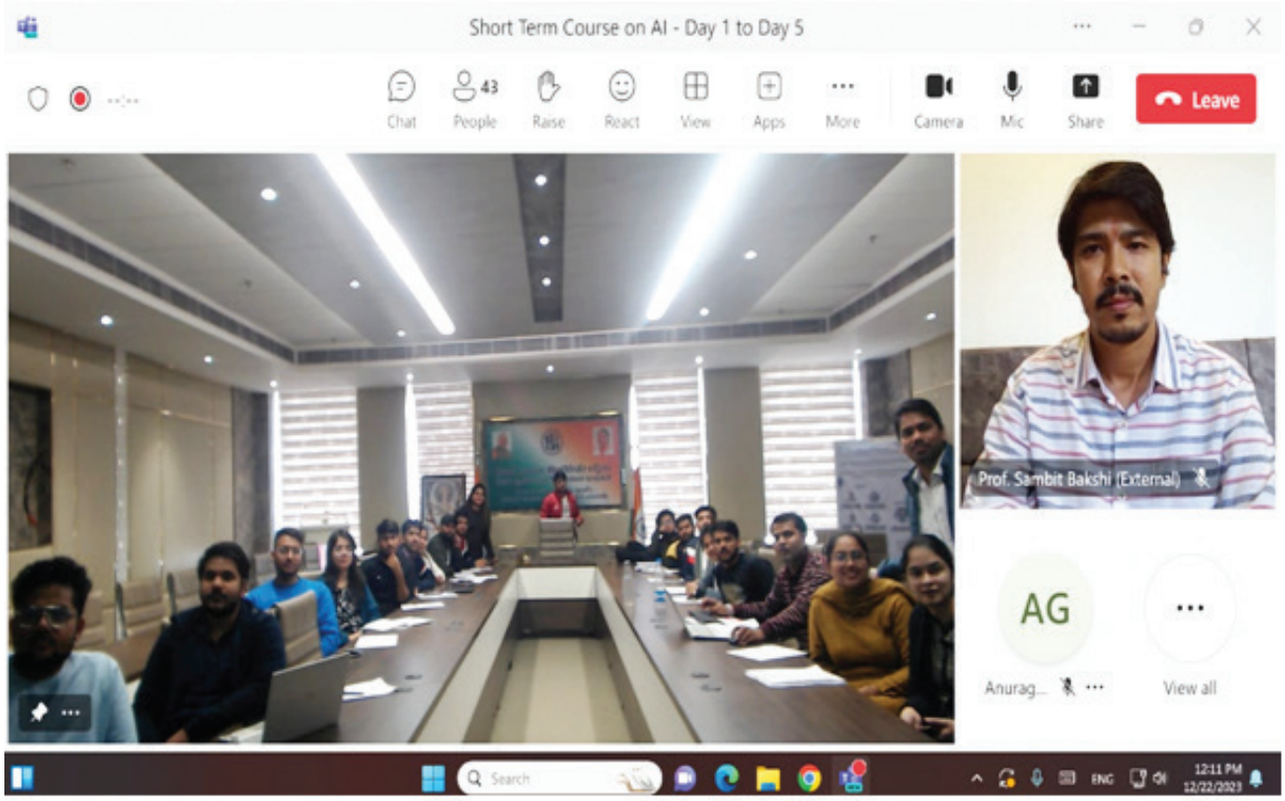
- NIT Delhi Organized a **short term course (STC)** on "*Modern VLSI Design and EDA Tools Hands-on*" during November 2-8, 2023. This STC was mainly focused on modern Very Large Scale Integration (VLSI) design and Electronic Design Automation (EDA) tools. A total of 175 participants had registered for this STC. Participants explored the principles of digital and analog circuit design, learned how to create designs, and learned the different Electronic Design Automation (EDA) tools. During this STC, twelve technical sessions were organized and ten Experts from industry and academia delivered their Talks/hands-on sessions. Four Sessions were devoted to full hand on by industry experts on Cadence and Siemens EDA Tool.



- NIT Delhi organized a 5-day **Winter School Program on Solar Physics**, during December 19-23, 2023. The prime aim of this Winter School Program on Solar Physics was to bring together students, researchers, and experts in the field to explore the latest advancements, share knowledge, and foster collaboration. Given the importance of Sun's atmosphere, Science behind Aditya-L1 mission, particularly solar physics, in today's world, this program was designed to play a crucial role in educating and inspiring the next generation of scientists and researchers. (**Convenors–Dr. V. S. Pandey and Dr. Preeti Verma**)
- Civil Engineering department organized an expert Talk on 'Sustainable Road Construction' by **Dr. Siksha Swaroopa Kar**, Principal Scientist, CSIR-Central Road Research Institute, New Delhi was conducted on 30.10.2023.
- Civil Engineering department organized anexpert Talk on '*Sustainable Waste Management: Wealth to Wealth Practices and Circular Economy*" by **Dr. Parveen Saini**, Sr. Principal Scientist and Professor AcSIR at CSIR-NPL on 01.11.2023.
- CSE Department organized an STC in Hybrid mode on "*Artificial Intelligence and its Application to Smart Systems*" during December **20-24, 2023.**

LIST OF EXPERTS

- Prof. Deepak K Jain, Associate Professor and senior Research Scientist, Dalian University of Technology, China.
- Prof. Dinesh K. Vishwakarma, Professor and Head (IT), DTU.
- Dr. Nishant Kumar, Assistant Professor, IIT Jodhpur Prof. T.V. Vijay Kumar, School of Computer & Systems Sciences, JNU.
- Prof. T. V. Vijay Kumar, Professor, JNU Delhi.
- Dr. U. P. Rao, Associate Professor, NIT Patna.
- Dr. Nonita Sharma, Associate Professor & Manager (International Affairs), IGDTUW New Delhi.
- Dr. Sambit Bakshi, Assistant Professor, NIT Rourkela.
- Mr. Abhijan Bhattacharyya, Consultant, Sr. Scientist at TCS Research.
- Dr. Munish Bhatia, Assistant Professor, NIT Kurukshetra.



- NIT Delhi organized an Expert Talk by Dr. Shikha Tyagi on August25, 2023 in Auditorium (5th Floor, Administrative Block, NIT Delhi.
- Internal Smart India Hackathon 2023 on 20th September and 22nd September 2023.

- Dr. Shelly Sachdeva (CSE department) organized "*11th International Conference on Big Data Analytics in Astronomy Science and Engineering*" during December 5-7, 2023.

NEWS COVERAGE OF THE INSTITUTE'S RESEARCH ACTIVITIES

Research paper entitled "Predicting Air Quality using Machine Learning" by Shelly Sachdeva and Team at NIT Delhi, has been highlighted in ***Current Science Reports***, Volume 125, p. 1292 (25 Dec, 2023).

(https://www.currentscience.ac.in/Volumes/125/12/1292.pdf)

PHD DEGREE AWARDED

S. No.	Name of Scholar	Supervisor(s)	Thesis title	Month of completion
1	Preeti Mehta	Dr.Mahesh K. Singh & Dr. Nitin S. Singha	Digital Image Forensic Techniques for the Detection of the Image Rebroadcast Attacks	July 2023
2	Nitish Kumar	Dr. Anshul Agarwal	Machine Learning Based Hybrid Energy System for Household and Industrial Applications	August 2023
3	Prachi Priya	Dr. Prashant Kumar	Mathematical Modelling for Linear and Non-Linear Pressure Drop over Barriers in Partially Reflecting Arbitrary Shaped Port	July 2023
4	Aijaz Ahmed	Dr. Gyanendra Sheoran	Design and Development of Indirect Near Field Holographic System for Microwave Imaging	August 2023
5	Pragya Gupta	Dr. Manisha Bharti	Design of Printed MIMO Antenna for Wireless and Biomedical Applications	September 2023
6	Appurva Jain	Dr. Abhishek Mishra	Experimental Measurements and Numerical Prediction of Rupture in Ductile Material during Mechanical Testing	October 2023
7	Divya Sardana	Dr. Prashant Kumar	CMIP6 Model Evaluation and Projection of Sea Surface Height Associated with Natural Climate Variability	October 2023
8	M Manigandan	Dr. D. Vaithiyanathan	Underwater Image Enhancement Techniques with Illumination Correction and Detail Preserving	October 2023
9	Vijayant Pawar	Dr. Shelly Sachdeva	Scalable and Secure Healthcare Framework Using Blockchain for Operational Interoperability	December 2023

RECENTLY AWARDED EXTERNALLY FUNDED RESEARCH PROJECTS

- **Research Project Title:** Surface Modified Smart Nanoprobes for Subcellular Targeted Auto-Responsive Drug Delivery

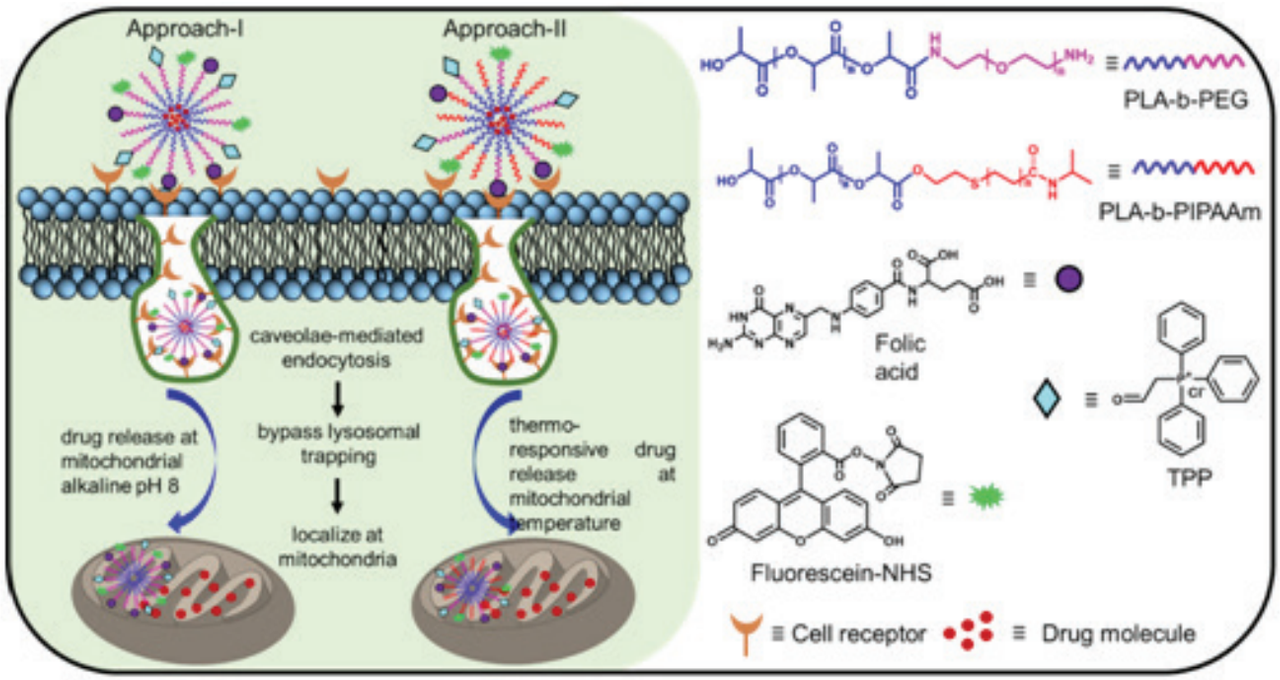
  Funding agency: Department of Science & Technology (DST)-INSPIRE

  Name of faculty member(s): Dr. Chumki Dalal (PI)

  Name of the department(s): Applied Sciences (Chemistry)

  Brief summary of the research work:

  Nanomaterial-based targeted drug delivery methods have made significant advancements in the past decades to minimize the side effect of a drug. A number of diseases are linked to specific organelles, however even after internalization by the cell, therapeutic compounds frequently fail to reach their intended subcellular target like mitochondria, nucleus, Golgi apparatus, endoplasmic reticulum etc. The most advanced method for making biomedical devices at the moment is targeted and responsive drug delivery with simultaneous monitoring of the targeted spot. Here, the strategy is to develop a surface modified smart nanoprobe specifically for mitochondria targeted drug delivery carrier which will release drug automatically after reaching targeted site, Scheme1.



- **Research Project Title:** Prototype development of a photovoltaic solar cell with a high conversion efficiency: An application of two-dimensional materials

  Funding agency: Council of Scientific and Industrial Research (CSIR) - India

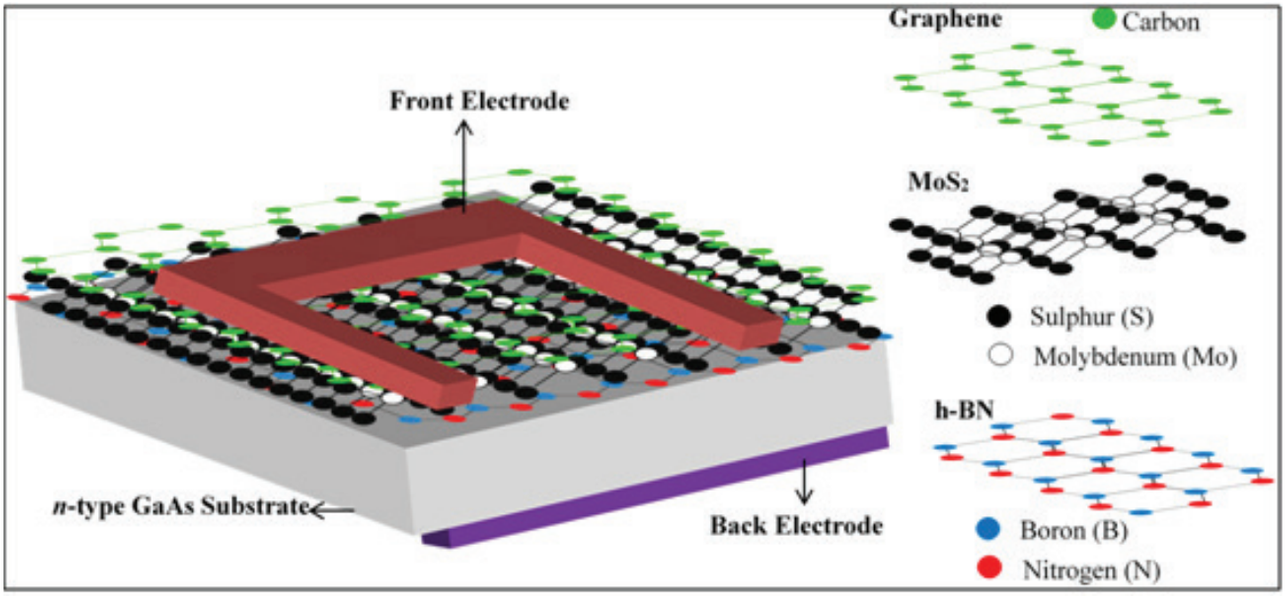
  Name of faculty member(s): Prof. Y. K. Prajapati (ECE Department, MNNIT Allahabad, PI) and Dr. Anuj K. Sharma (Co-PI)

  Name of the department(s): Department of Applied Sciences

Brief summary of the research work:

The objectives of the project work are:

- To study and apply excellent optical properties of MoS2, h-BN, the high transparency of graphene, and the tunability of its Fermi level for solar cell application.
- To perform the simulation study and optimize the performance parameter such as power conversion efficiency, open circuit voltage, short circuit current density, fill factor etc. of solar cell based on graphene/MoS2/ h-BN/GaAs/ metal electrodes (Au/Al).
- To fabricate a solar cell structure along with metal electrodes. The metal electrodes will be designed in such a way that it offers minimum contact resistance.
- Experimental validation and assessment of fabricated solar cell structure using performance measuring devices.
- Finally, a comparative validation of experimental results with the simulation study of performance parameters will be done.



Solar cell having graphene/ MoS2/ h-BN/ n-type GaAs or Si, and front & back electrodes

- **Research Project Title:** Optimizing LoRa Spreading Factor Scheduling through Incentive Mechanisms

  Funding agency: DST (MATRICS)

  Name of faculty member(s): Dr. Karan Verma

  Name of the department(s): CSE

  Amount 30,00,000/-

Brief summary of the research work:

The project aims to address interference issues in LoRa WAN networks caused by LoRa devices (LDs) using the same spreading factors (SFs). To achieve this, a game theory-based approach will be proposed, which estimates the optimal time duration for data transmission on appropriate SFs, to maximize the utilities of network devices and minimize waiting time through a scheduling algorithm. The approach utilizes concepts such as Nash equilibrium, Stackelberg equilibrium, and Scheduler to achieve its objectives

- **Research Project Title:** Development of a system for the early diagnosis of heart diseases based on deep learning models using ECG signal processing

  Funding agency: DST (EEQ)

  Name of faculty member(s): Dr. Karan Verma, Prof. Ajay K Sharma

Name of the department(s): CSE

Amount 35,77,430/-

Brief summary of the research work:

Heart diseases are a leading cause of death worldwide, and early diagnosis is crucial for effective treatment and management. Electrocardiogram (ECG) signals can provide valuable information about the heart's electrical activity and are widely used for diagnosing heart diseases. Deep learning models have shown promising results in analyzing ECG signals and detecting various heart conditions. These models can learn from large datasets and identify patterns and anomalies difficult for human experts to detect. HIPAA (Health Insurance Portability and Accountability Act) is a US federal law establishing privacy and security standards for protecting patients' medical information. Developing a system that complies with HIPAA security standards is crucial for ensuring the privacy and confidentiality of patient data. Assessing the degree of obstruction and risk of a heart attack are critical components of diagnosing and managing heart diseases. By developing a system that can accurately measure these parameters, healthcare professionals can make informed decisions about treatment options and improve patient outcomes. Combining deep learning models, ECG signal processing, HIPAA security features, and risk assessment can potentially lead to a powerful tool for the early diagnosis and management of heart diseases.

- **Research Project Title:** High Performance Computing (FIST Infrastructure Support)

  Funding agency: DST (FIST)

  Name of faculty member(s): Prof. Geeta Sikka, Prof. Ajay K Sharma, Dr. Anurag Singh,and Dr. Karan Verma

  Name of the department(s): CSE

  Amount: 118,00,000/-

Brief summary of the research work: The high-performance computing laboratory in the Institute shall facilitate advanced research and practical applications related to large-scale computational tasks, simulations, data analysis, and optimization Students and researchers shall gain hands-on experience with parallel computing, distributed systems, and other cutting-edge technologies, enhancing their skills and contributing to advancements in various fields. It will foster / strengthen ties with Industry and Academia.

CONSULTANCY WORKS UNDERTAKEN

- **Research Project Title:** Vetting of design of illumination design of football, hockey, volleyball and tennis area.

  Funding agency: Bajaj Electrical Limited

  Name of faculty member(s): Dr. Gyanendra Sheoran

  Name of the department(s): Applied Sciences (Physics)

SPONSORED RESEARCH PROJECTS COMPLETED

BOOK CHAPTERS PUBLISHED

- G. Kaur, U. Bansal, H. K. Verma, Geeta Sikka, and L. K. Awasthi, "Discernment and Perusal of Software Vulnerability. In Malware Analysis and Intrusion Detection in Cyber-Physical Systems" (pp. 115-140), IGI Global, September 2023.
- Kumari, V., Barak, N., **Sheoran,** G., "Necessity of Anatomically Real Numerical Phantoms in Optical Metrology", Handbook of Metrology and Applications. Springer, Singapore, 24 August 2023, online ISBN-978-981-99-2074-7.
- S. Goka, S. Q. Moinuddin, Ashok Kumar Dewangan, M. Cheepu, V. C. Kantumuchu, "Battery Management System for Electric Vehicles", The Future of Road Transportation: Electrification and Automation, CRC Press, Taylor & Francis group,2023, 177-195 (ISBN: 9781003354901, DOI: 10.1201/9781003354901).
- S. Goka, S. Q. Moinuddin, Ashok Kumar Dewangan, S. H. Saheb, B. Madhavi "Augmented Reality in Computer-Aided Design (CAD)", Metaverse and Immersive Technologies: An Introduction to Industrial, Business and Social Applications, John Wiley & Sons, Inc., 2023, 217-234 (ISBN:9781394174546, DOI:10.1002/9781394177165.ch8
- Kanika Soni, Shivani Batra, Shelly Sachdeva, "Role of Database in Epidemiological Situation", Bentham Science Publisher, 2023 (26 July, 2023).
- J. Kaur, RikmantraBasu, "Modelling of MQW Transistor Laser Using Group IV Materials" Lecture Notes in Electrical Engineering book series, Springer (LNEE, volume 976), 2023. Published Online, Springer.
- V. A. Popescu and Anuj K. Sharma, "Microstructured and Non-microstructured fiber-based plasmonic sensors for high-performance and wide-range detection of different parameters", Jenny Stanford Publishing, August 2023, ISBN: 9781003438304.

BOOKS PUBLISHED

- B. D. Gupta, Anuj K. Sharma, and J. Li, "Plasmonics-based optical sensors and detectors", Jenny Stanford Publishing, August 2023, ISBN: 9781003438304.

EXPERT TALKS DELIVERED AND CONFERENCE PAPERS PRESENTED

Faculty Member(s)	Name and place of Event	Duration	Topic of talk
Dr. D Vaithiyanathan	All India Council for Technical Education (AICTE) Training and Learning (ATAL) Academy Sponsored FDP on "Semiconductor device design from RTL to GDS II",organized by Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu, India, during 18.12.2023 to 23.12.2023.	22.12.2023 (18.12.2023 to 23.12.2023)	Recent Trends in VLSI Design
	SR University, Hanumakonda, Telangana, India	11.12.2023	SoC Design
Dr. Amit Kumar Singh	Recent Developments in Control, Automation and Power Engineering RDCAPE- 2023, Noida, India	12-13 October 2023	Analyzing Stability of Multiphase Induction Machine and Transmission Line
	International Conference on Power Electronics – IICPE 2023	28-30 November 2023	Li-ion Battery State of Health Assessment Using Machine Learning
Dr. Abhishek Mishra	FLUTE-2023, Amity University Noida	20th to 21st July 2023	Numerical Investigation of Rupture in Notched SS304 Tensile Test Specimen
Dr. Anmol Saxena	AICTE TRAINING AND LEARNING (ATAL) ACADEMY Faculty Development Programme (FDP) on "Microgrid with Electric Vehicles: Intelligent and Allied Areas" (23rd – 28th October 2023) Central University Haryana Mahendergarh, Haryana		Power Electronic Interfaces for Green Energy Fed Residential DC Nano-grids
	Attended and presented a paper in IEEE International Conference ETFG-2023 at University of Wollonong, New South Wales, Australia		A Three-Port DC-DC Converter for Solar PV Integration in DC Off-Grid Systems: Design and Control
Dr. Gyanendra Sheoran	Optical Measurement Systems for Industrial Inspection XIII, 126182S, Proc. SPIE 12618, Germany	15 August-18 August 2023	Shape measurement of phase objects using fringe projection technique
	3D imaging acquisition and display: Technology, perception and Applications, Boston, Massachusetts, US (Online Presentation)	14 August – 17 August 2023	Quadrature transform based surface profiling of speaker's diaphragm using fringe projection profilometry

Faculty Member(s)	Name and place of Event	Duration	Topic of talk
Dr. Manisha Bharati	**ATAL** Faculty Development Program on Recent Trends and Future Prospects in Electronics for Industry 4.0 (October 9-14, 2023) at Meerut Institute of Engineering & Technology	October 13, 2023	Wireless Communication: Advancements & Challenges
	Faculty Development Program on Next Generation Wireless Networks (December 11-15, 2023) at Delhi Technological University (DTU) Delhi	December 14, 2023	Emerging Future Technologies: Next Generation Wireless Networks
	International Conference on Electrical, Electronics, Communication and Computers (ELEXCOM), Roorkee, India, 2023, pp. 1-5, doi: 10.1109/ELEXCOM58812.2023.10370481	August 26-27, 2023	Planar Dual band SIW Antenna for K Band and mm wave Radar Applications
Dr. S Kumar	8th International Conference on Computing in Engineering and Technology (ICCET 2023), Patna, India	14-15 July 2023	Inference engines on FPGAs for AI based applications
Dr. V.S. Pandey	International Conference on Electrical, Electronics, Communication and Computers (ELEXCOM)	(2023, August)	Analytical Study of the Dual-Band Log-Periodic Antenna with MIMO Configuration for S-Band CubeSat Application.
	International Conference on Electrical, Electronics, Communication and Computers (ELEXCOM)	(2023, August)	Planar Dualband SIW Antenna for K Band and mm wave Radar Applications.
	Plasma Theory and Simulation (PTS)	(2023, August)	Slow Sausage and Kink Waves in Viscous Structured Straight Cylinder
	. Plasma Theory and Simulation (PTS)	(2023, August)	Magnetic Switchbacks in Solar Winds
Dr. Ajay Kumar	Khalsa College of Engineering & Technology, Amritsar	20-22.09.2023	Slopes and deflections of beam

Faculty Member(s)	Name and place of Event	Duration	Topic of talk
Dr. Ashok Kumar Dewangan	International Conference on Energy and Advanced Materials (ICEAM)-2023 ,Department of Physics and Materials Science & Engineering, Jaypee Institute of Information Technology, Noida, India	November 2-4, 2023	Effects of Nano Additives on Battery Thermal Management System for Electric Vehicles
Dr. Sahil	One Week Online Short-Term Course on Artificial Intelligence for Next Generation IoT Networks organized by Department of Information Technology, Dr. B R Ambedkar National Institute of Technology Jalandhar, Jalandhar, PB, India,	September 2023	Fog Computing: An Augmentation for Cloud-IoT-based Smart Environments (Through Case Studies) T
Dr. Shelly Sachdeva	Invited Talk in Special Lecture Series by UI Educon , 6 Week International Summer School on Python for Data Science and AI with Research Skills on	17 July 2023,	Deep Learning in Healthcare Applications
	IEEE Second International Conference on Informatics (ICI), JIIT, Noida, ICI 2023	23-25 Nov, 2023	Implementation And Performance Comparison of CNN-Based Semantic Segmentation Methods for Biomedical Application
	Invited Talk on Three Weeks Training Programme for 59th Batch of DANICS Probationers, organised at DTU, Delhi	11-29 September, 2023	Applications of Internet of Things
	Expert Talk for FDP on "Deep Learning and AI-Based Healthcare Systems," Coimbatore Institute of Technology, Coimbatore	18-24 Dec 2023	Deep Learning and Healthcare
	International Conference on Veda-Vijnana & Sanskriti Mahakumbha at Gurukula Kangri (Deemed to be University) Haridwar, Uttarakhand	23-25 Dec 2023	Exploring the Yagya's Effect on Air Pollutants"
	11th International Conference on Big Data Analytics in Astronomy Science and Engineering" 2023	05-07 Dec 2023	"Blockchain-based Framework for Healthcare 5.0"
	11th International Conference on Big Data Analytics in Astronomy Science and Engineering" 2023	05-07 Dec 2023	Querying in Knowledge Based Systems

Faculty Member(s)	Name and place of Event	Duration	Topic of talk
Dr. Gunjan	Keynote Speaker, ICACIS-2023, Graphic Era Hill University, Haldwani	11-12 August 2023	Multi-objective Optimization Algorithms in Wireless Sensor Networks
Dr. Karan Verma	Development of ICT skills for implementation of NEP-2020- UGC –Human Resource Development Center, BPS Women University, Khanpurkalan , Gohana(Sonepat)	16th -29th Dec., 2023	ICT skills for implementation of NEP-2020

LABORATORY NEWS

1. Dr. V. S. Pandey has developed "Space Physics and Antenna Lab" in the department of Applied Sciences. The key highlights are:

- Cutting-edge Antennas: Our lab pioneers advanced antenna designs for optimal space communication, ensuring reliability and efficiency.
- Space Weather Monitoring: We study space weather phenomena to safeguard missions against solar flares and magnetic storms.
- Collaborative Initiatives: Partnering with space agencies and industry leaders, we foster collaboration for mutual advancements.
- Educational Outreach: We're dedicated to educating the next generation, offering programs for students and educators in space science.

2. Department of ECE, NIT Delhi developed a Laboratory of "Advance VLSI design".

MORE PAPERS PRESENTED/PUBLISHED IN CONFERENCES

1. D.Vaithiyanathan, K. Mariammal, B. Pari James, "Performance Analysis of Multirate Filter Structures for Signal Processing Applications", IEEE 2023 Smart Generation Technologies in Computing, Networking & Communication (SMART GENCON), Ghousia College of Engineering, Bengaluru, Karnataka, India, 29th – 31st December, 2023.
2. K. Saiteja, D. Vaithiyanathan, P. Verma, B. Kaur, "Review of Dual-Edge Triggered Low-Powered D Flip-Flops", IEEE 2023 Smart Generation Technologies in Computing, Networking & Communication (SMART GENCON), Ghousia College of Engineering, Bengaluru, Karnataka, India, 29th – 31st December, 2023.
3. A. Singh, D. Vaithiyanathan, P. Verma, B. Kaur, "Examining and Evaluating Comparator Circuit Performance Experimentally at Various Technology Nodes", IEEE 2023 Smart Generation Technologies in Computing, Networking & Communication (SMART GENCON), Ghousia College of Engineering, Bengaluru, Karnataka, India,29th – 31st December, 2023.
4. Kaushambi, P. Verma,D. Vaithiyanathan, "Unleashing Power Efficiency: A Study Comparing Pulsed Latches and Flip-Flops for Low-Power Applications", IEEE 2023 Smart Generation Technologies in Computing, Networking & Communication (SMART GENCON), Ghousia College of Engineering, Bengaluru, Karnataka, India, 29th – 31st December, 2023.
5. B. Vadthya, D. Vaithiyanathan, B. Kaur, "A Reliability Assessment of Junctionless (JL) Nanosheet (NS) FET under Heavy Ion Irradiation Conditions", 20th IEEE India Council International Conference (INDICON2023), IEEE Hyderabad Section at the National Institute of Technology, Warangal, India, during 14th – 17th December, 2023.
6. Senthilkumar K K, Avantika E, Gayathri B, D. Vaithiyanathan, "VLSI Implementation of Reconfigurable Canny Edge Detection Algorithm", 11th International National Conference on Big-data-analytics in Astronomy, Science and Engineering, at University of Aizu, Japan, National Institute of Technology Delhi and IIT Delhi, India, during 05th – 07th December, 2023.
7. Z. Aizaz, K. Khare, M. A. Khan, M. K. Singh, D. Vaithiyanathan, "Approximate 1-row-LUT-based Low-power signed Multipliers for DSP and Machine learning applications on FPGAs", IEEE Asia Pacific Conference on Circuits and Systems (APCCAS 2023) Co-located with The Asia-Pacific Conference on Postgraduate Research in Microelectronics and Electronics (PRIMEAsia 2023), T-Hub, Hyderabad, Telangana-500081, India, during 19th – 22nd November, 2023.
8. Sharmila, R. S. Bhuvaneswaran, K. Natarajan, A. Prathiba, D. Vaithiyanathan, "Hardware Implementation of Block Ciphers – A Case Study on Encrypted Image Transfer Over Universal Asynchronous Receiver Transmitter", International Conference on Self Sustainable Artificial Intelligence Systems (ICSSAS 2023), M. P. Nachimuthu M. Jaganathan Engineering College, Erode, Tamil Nadu, India, during 18th – 20th October 2023, pp. 1120-1128, DOI: 10.1109/ICSSAS57918.2023.10331707.
9. H. Choudhary, D. Vaithiyanathan, G. Moona, H. Kumar, "An Investigation of Various Methods for Evaluating the Measurement Uncertainty", 3rd International Conference on Innovative Sustainable

Computational Technologies (CISCT-2023), Graphic Era (Deemed to be University), Dehradun, India, during 8th – 9th September 2023, pp. 1-5. DOI:10.1109/CISCT57197.2023.10351238.

10. Vaithiyanathan D, Ashish Mishra, Rajat Mishra, Alok Kumar Mishra, Preeti Verma, Baljit Kaur "A modified dynamic comparator for lowering peak kink in differential amplifier and latch", AIP Conference Proceedings, Vol 2901, issue 1, Dec 2023.

11. R. Mhaiskar, D. Vaithiyanathan, P. Verma and B. Kaur, "Performance Analysis of Human Activity", International Conference on Data Science and Advanced Computing (ICDSAC 2023) ITM Web Conf. Volume 56, August 2023.

12. R. Yadav, S. Gotra, V. S. Pandey and P. Verma, "Analytical Study of the Dual-Band Log-Periodic Antenna with MIMO Configuration for S-Band CubeSat Application," 2023 International Conference on Electrical, Electronics, Communication and Computers (ELEXCOM), Roorkee, India, pp. 1-5, 2023.

13. K. Kumar, Manoj Kumar, M. Jhamb "Performance Comparison of CMOS based voltage Reference Circuits in 180nm technology," 9th International Conference on Signal Processing and Communication (ICSC), JIIT Noida, 21-23 Dec 2023.

14. I. Kadiyan Manoj Kumar, "An Active-Inductor based Low power, Low phase noise VCO design," IEEE, International Conference on Integration of Computational Intelligent system(ICICIS-2023) November 1-4, 2023 at Ajeenkya D.Y. Patil University, Pune.

15. S. Dabas, Manoj Kumar, "Design of a low-power Varactor-based DCO using NMOS switching network as a digital control technique," 8thInternational Conference on Micro-Electronics, Electromagnetics and Telecommunications, 2023, NIT Mizoram, India.

16. M. Singh, Manoj Kumar "Comparative Analysis of Reversible Logic Gates and Reversible Decimal to Binary Encoders using Verilog," IEEE, International Conference on Integration of Computational Intelligent system (ICICIS-2023) November 1-4, 2023 at Ajeenkya D.Y. Patil University, Pune.

17. N. Kumar, V. Singh, M. Kumar and V. Kumar, "Design of a 1.726 mW, 4-Stage Differential Ring VCO with Tuning Range of 93.4% in 0.13 µm CMOS Process" IEEE International Conference on Intelligent Computing, Simulation and Optimization, December 08-10, 2023 at Goa (India).

18. S. Gupta, Geeta Sikka, A. Malik, "A Review on Deep Learning-Based Polyp Segmentation for Efficient Colorectal Cancer Screening,"in Third International Conference on Secure Cyber Computing and Communication (ICSCCC)" pp. 501-506, 2023.

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20. Chakravarti, P. K., Pandey, V. S., & Bharti, M. (2023, August). Planar Dualband SIW Antenna for K Band and mm wave Radar Applications. In 2023 International Conference on Electrical, Electronics, Communication and Computers (ELEXCOM) (pp. 1-5). IEEE

DETAILS OF ANY PRODUCT DEVELOPED

Dr. Sachin Agrawal from ECE Department and his team have designed Three super wideband antenna prototypes on FR-4 substrate using chemical etching process.

PATENT APPLICATIONS FILED

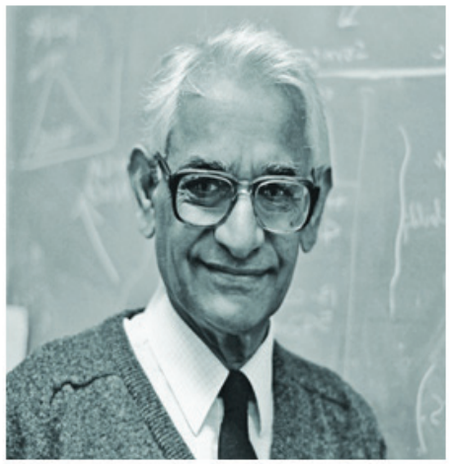
S.N.	Title	Name of Faculty member(s)	Application no.	Date of filing/publication
1	IoT Based desalination Device	Dr Varsha Sahni, Dr Jyoteesh Malhotra, et.al	349714-001	Has been published at the Indian Patent Office on 28th July 2023. The Patent Office Journal No. 30/2023, Dated 28/07/2023, pp. Published 51673
2.	Integrated System for Efficient Management of Domestic Workforce in Metropolitan/Urban Cities in India	Dr. Rikmantra Basu, Prof. Ajay K Sharma	202311087031	06.12.2023

PATENTS GRANTED

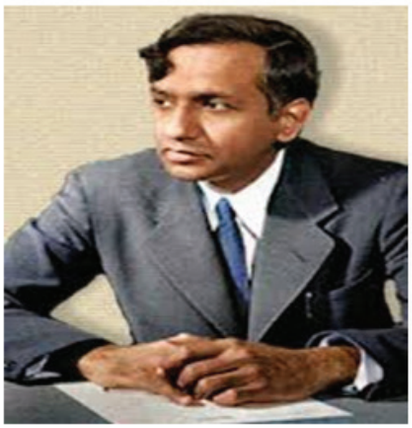
S.N.	Title	Name of Faculty member(s)	Patent no.	Certificate issue date
1	Printed Circuit Antenna with Improved Directivity and Gain using frequency selective surface (FSS) with unique split ring geometry as partially reflecting elements", Granted in	Manisha Bharti, Swati Vaid, Ashok Mittal	Patent ID: 439528	July 2023.
2	A Solar Assisted Apparatus for Cultivation	S Swain, S S Sahoo, M K Nayak, V S Pandey, A K Sharma et al.	439630	2023-07-20
3	Smart Portable Industrial Hydraulic Drum Lift Machine	Kshitij Jain, Dr. Nitesh Dutt, Dr. Ashwani Kumar, Dr. Mukesh Kumar Awasthi, Dr. Ashok Kumar Dewangan	6307054	11-09-2023
4	Heart Disease Predicting Watch	Gunjan	Design number: 6325231	20 Nov 2023

NOBEL LAUREATES OF INDIA IN SCIENCE

Sir C. V. Raman (1930, Physics)



H. G. Khorana (1968, Medicine)



S. Chandrasekhar (1983, Physics)

V. Ramakrishnan (2009, Chemistry)

राष्ट्रीय प्रौद्योगिकी संस्थान दिल्ली

(शिक्षा मंत्रालय, भारत सरकार के अधीन एक स्वायत्त संस्थान)

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