GURU NANAK INSTITUTE OF TECHNOLOGY · KOLKATA

DEPARTMENT OF ELECTRICAL ENGINEERING

ElekTOR

The Annual Technical Magazine

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INNOVATION · ENERGY · EXCELLENCE

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ElekTOR

The Annual Technical Magazine of the Department of Electrical Engineering

ISSUE 01 NOVEMBER 2024 · KOLKATA

LEAD STORY · SMART INDIA HACKATHON 2024

Bio Hydro Pioneers Bring Home the SIH 2024 Runner-Up Trophy

EE students out-innovate teams from across the country in the Hardware Edition at Galgotias University, Uttar Pradesh.



Team Bio Hydro Pioneers at the Smart India Hackathon 2024, Hardware Edition

UTTAR PRADESH, 2024 — Students of the Department of Electrical Engineering delivered an outstanding performance at the Smart India Hackathon (SIH) 2024, Hardware Edition, securing the Runner-Up position in one of the country's most prestigious innovation contests. The team, named Bio Hydro Pioneers, competed at Galgotias University.

IN THIS ISSUE

- Messages from the Principal & HOD
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- Sports, Gallery & Fun Facts

TOP HEADLINES

- ₹2 lakh prize: 1st Runner-up at MADE IN JIS CELEB 2024
- KMRCL honours EE alumni for underwater East–West Metro
- Four faculty & students win JIS Samman / Puraskar 2024
- SAMATVA-2K24 national tech fest held on 19–20 Sept
- Four industrial visits: solar plant to thermal power station

"Confidence and hard work is the best medicine to kill the disease called failure."

— A.P.J. Abdul Kalam

FROM THE EDITOR'S DESK

Editorial

Why ElekTOR, and what you will find in its pages

It is an occasion of immense pleasure for the Department of Electrical Engineering to publish the magazine "ELEKTOR" from the year 2024.

The Editorial Board of the Department of EE thanks all the faculty members and students who have made this issue a success by contributing articles to this magazine.

This magazine focuses on the recent trends evolving in the field of electrical engineering and aims to provide advanced knowledge and awareness among the students about the same.

The Editorial Board also thanks the Management of the Institute and the Head of the Department for inspiring us to go forward in publishing this magazine. We hope that this kind of support will continue for the next issue in 2025. – Faculty Editorial Board Message– **Faculty Editorial Board**

HOW TO READ THIS ISSUE

- Each story opens with a short headline and a dateline — read the first lines for the essentials.
- Look for gold-edged "Key Points" boxes for quick facts.
- Stories in Bengali and Hindi are in the সাহিত্য কোণ / साहित्य कोना section.

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Students Editorial Board

It is our great pleasure to present this edition of **"ELEKTOR"**, the departmental magazine of Electrical Engineering. For us, ELEKTOR is a platform to express creativity, exchange ideas, share knowledge, and showcase the talents of our student community. This edition brings together technical insights, innovative ideas, creative writings, and interesting perspectives on emerging technologies. We sincerely thank all the students and faculty members for their valuable contributions and enthusiasm. We are equally grateful to the Institute Management and our Head of the Department for their constant encouragement and support. We hope this edition inspires young minds to explore, innovate, and learn beyond the classroom.

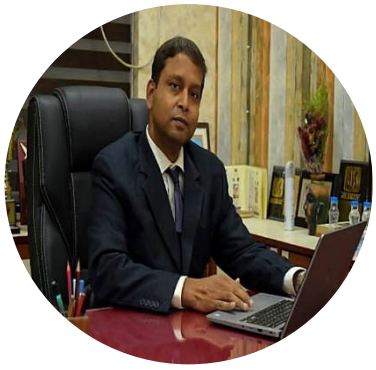
Together, let's energize ideas and illuminate the future!

Editorial

Priya Biswas (2nd year, EE)
Rima Dutta (3rd year, EE)
Nivedita Saha (2nd year, EE)
Arpan das (3rd year, EE)

FROM THE LEADERSHIP

Messages



MESSAGE FROM THE PRINCIPAL

It gives me immense pleasure to pen a few words as prologue to the E-Magazine "ELEKTOR" 2024. This is a productive technical material and a subsidiary skill-developing tool for the students. I am sure that this current issue will lighten up your spirits not only on the technical frontiers but also provide an insight into co-curricular and extracurricular activities.

Our students and faculty have performed exceedingly well in all fields. Beyond academics, research activities are being conducted. The Institute also motivates and encourages staff and students to undertake research and enterprising skills. The faculty members play a major role in the overall development of the department and the institute.

I congratulate the department, the contributors and the editorial board for bringing out such a technical publication. I extend my greetings and best wishes to the faculty and students of the department.

Prof. (Dr.) Swarup Kumar Mitra
Principal, GNIT



MESSAGE FROM THE HOD

I am delighted to announce that our Department of EE is bringing out the technical magazine "ELEKTOR", which I am sure will be a huge success. I would like to extend my warmest congratulations to all those involved in its planning and execution.

A technical E-magazine is a great way to showcase our talents and skills, and I am confident that it will provide an excellent opportunity for our EE students to display their creative abilities, leadership skills and teamwork. I encourage all student members to participate actively and make the most of this wonderful opportunity.

I am sure the magazine will be informative and resourceful. I applaud the coordinators and the team behind this issue. I wish them all success!

Dr. Barnali Kundu
Head of the Department, Electrical Engineering

OUR DIRECTION

Department at a Glance

VISION

To produce new generation technologists and entrepreneurs with creative minds, innovation and advanced research by inculcating world class education to meet industry expectations and impart sustainable growth of the society in global perspective.

MISSION

DM1 To impart quality education and innovative teaching learning methodologies.

DM2 To develop skilled professionals with the ability of critical thinking and innovativeness to face the real-life challenges in their respective domain.

DM3 To inculcate an urge of entrepreneurship, research and pursue higher studies.

DM4 To imbibe the spirit of moral values and ethics for becoming a responsible citizen for the sustainable growth of the society.

ABOUT THE DEPARTMENT

The Department has consistently demonstrated excellence in technical education, securing National Board of Accreditation (NBA) accreditation in 2009, 2014, and 2023. As an integral part of the Institute, it offers undergraduate and diploma programmes and has progressively expanded its student and faculty strength, along with continuous improvements in laboratory infrastructure to support quality teaching and research. The Department comprises experienced and highly qualified faculty members, including Ph.D. holders, supported by dedicated technical staff.

The laboratories are equipped with advanced hardware facilities, sophisticated experimental set-ups, and industry-oriented software packages. To enhance students' professional competencies and ensure industry readiness, the Department regularly organizes industrial visits, soft-skills development programmes, aptitude training sessions, and dedicated coaching classes for GATE and PSU examinations.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1 To implant strong foundation in Science, Mathematics and Electrical Engineering to become successful professionals.

PEO2 To impart knowledge on emerging technologies and entrepreneurship skills to produce future leaders.

PEO3 To train students in developing ethical attitudes, strong communication skills and capacity to relate engineering issues in social and environmental context.

PEO4 To facilitate opportunity to work in a team in interdisciplinary projects for building leadership qualities.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1 To explore the ideas, methodologies and cutting-edge technologies in Renewable Energy and Electric Vehicles for gaining competence to solve energy related problems.

PSO2 To analyze, design and provide an engineering solution applying knowledge of Embedded Systems, Smart Grid, Power Electronics and Electric Drives.

PSO3 To use modern software tools for simulation, analysis and designing of electrical and electronic systems.

KEY POINTS

- NBA accredited in 2009, 2014 and 2023
- UG and Diploma programmes in Electrical Engineering
- PhD-qualified faculty and dedicated technical staff
- Industry visits, soft-skill, aptitude and GATE/PSU classes

ON CAMPUS

Campus News

Seminars, visits, fests and meets from across the year — in brief

KEY POINTS

- 1 international FDP, 3 seminars and a national tech fest (SAMATVA-2K24)
- 4 industrial visits: solar plant, substation, railway workshop, thermal power station
- 2 alumni meets and a new MoU with JM Power Tech Pvt. Ltd.

INTERNATIONAL FDP

Five-Day International FDP on AI for Sustainable Energy



Participants at the five-day international FDP

EE, GNIT, 15–19 April 2024 — The department hosted a Five-Day International Faculty Development Programme on "AI for Sustainable Energy in Society 5.0", bringing together academics to explore how artificial intelligence can support a cleaner energy future.

NATIONAL TECH FEST

SAMATVA-2K24 Lights Up the Campus



SAMATVA-2K24, the National Level Annual Technical Fest

EE, GNIT, 19–20 September 2024 — The Department of Electrical Engineering organised SAMATVA-2K24, the National Level Annual Technical Fest, over two days of competitions, exhibitions and technical events.

SEMINAR

Digital Transformation: IoT, Cloud, Big Data, AI and Analytics



Seminar on digital transformation

EE, GNIT, 8 November 2024 — A seminar on "Digital Transformation: Confluence of IoT, Cloud Computing, Big Data, AI and Analytics" introduced students to how connected technologies are reshaping industry.

SEMINAR

Internship Pathways in Solar Energy



Seminar on internships in solar energy

EE, GNIT, 23 August 2024 — A seminar on "Internship in the Field of Solar Energy" was organised in collaboration with the Entrepreneurship Development Cell (EDC) of GNIT, guiding students towards hands-on opportunities in the solar sector.

SEMINAR

Employability Skills for the Renewable Energy Sector



Seminar on employability skills

EE, GNIT,, 8 February 2024 — Students learnt about the skill sets employers look for in renewable-energy roles at a seminar on “Employability Skills Set for Roles in the Renewable Energy Sector”.

INDUSTRIAL VISIT

On Top of a Canal: 1 MWp Solar Plant Visit



Visit to the 1 MWp canal-top solar power plant

EE, GNIT, 9 February 2024 — A one-day industrial visit took students to a 1 MWp canal-top solar power plant, organised in association with Agni Green Power Ltd., Newtown, Kolkata.

INDUSTRIAL VISIT

Inside a 33/11 kV Substation



Students at the WBSEDCL substation

EE, GNIT, 30 April 2024 — 2nd and 3rd year students visited the Belgharia 33/11 kV substation operated by the West Bengal State Electricity Distribution Company Limited (WBSEDCL).

INDUSTRIAL VISIT

Railway Engineering at the Liluah Workshop



Carriage & Wagon Workshop, Eastern Railway

EE, GNIT, 21 August 2024 — B.Tech 3rd-semester students visited the Carriage & Wagon Workshop of Eastern Railway at Liluah, Howrah.

INDUSTRIAL VISIT

Learning From a Thermal Power Station

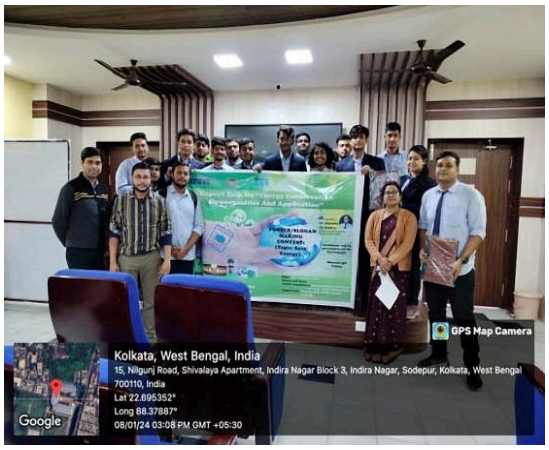


Visit to Bandel Thermal Power Station

EE, GNIT, 6 September 2024 — The department organised a one-day industrial visit for B.Tech 3rd-semester students to Bandel Thermal Power Station.

AWARENESS

Posters Urge: Save Electricity, Save Water



Poster Making Competition, Energy Conservation Day

EE, GNIT, 8 January 2024 — A Poster Making Competition celebrated Energy Conservation Day and spread awareness about the crucial need to "Save Electricity and Save Water".

ALUMNI

Alumni Come Home



Departmental Alumni Meet

EE, GNIT, 11 March 2024 — The Departmental Alumni Meet brought former and current students together to share experiences and career guidance.

ALUMNI

Engineers in the Finance Sector



Alumni Meet on engineers in finance

EE, GNIT, 23 August 2024 — An alumni meet on "The Role of Engineers in the Finance Sector" showed students how engineering skills open doors beyond core industries.

INDUSTRY COLLABORATION

MoU Signed with JM Power Tech



MoU with JM Power Tech Pvt. Ltd.

EE, GNIT, 10 September 2024 — The department signed a Memorandum of Understanding with JM Power Tech Pvt. Ltd., a prominent firm specialising in renewable energy solutions.

SPORTS

EE Boys Rule the Ground in Football



The GNIT football team

EE, GNIT, August 2024 — Five EE footballers helped the GNIT team reach the final of the inter-college tournament "Soccer Strike 2024", winning the finalist trophy. Full story in Sports.

RECOGNITION

Honours Board

Awards and recognitions won by our students and faculty in 2024

INNOVATION · ₹2 LAKH PRIZE

1st Runner-Up at MADE IN JIS CELEB 2024



EE, GNIT, 5 August 2024 — Arpan Das, Aritra Chowdhury, Saurav Das and Payel Chakraborty (3rd Year, EE) achieved 1st Runner-up at MADE IN JIS CELEB 2024 and received a reward of ₹2 lakh.

METRO RAILWAY

KMRCL Honours Work on India's First Underwater Metro



EE, GNIT, 2024 — Mr. Krishnendu Jana and Mr. Parnab Goswami received a special award from Kolkata Metro Railway Corporation Limited (KMRCL) for their contribution to the Phase 2A section of the underwater East–West Metro.

ACADEMIC MEET

1st Runner-Up at the 14th FOSET Academic Meet



EE, GNIT, 12 May 2024 — 2nd year and final year students received the 1st Runner-Up award at the 14th Academic Meet of the Forum of Scientists, Engineers & Technologists (FOSET), held at JIS College of Engineering, under the guidance of Dr. Barnali Kundu.

NPTEL

Silver Topper in Fundamentals of AI



EE, GNIT, 2024 — Mainak Chanda secured the Silver Certificate Topper Award in the NPTEL course "Fundamentals of Artificial Intelligence".

BEST PAPER

Best Paper at IEEE International Conference



EE, GNIT,, 23 November 2024 — A paper from the department was awarded Best Paper at the IEEE International Conference 2024 held at JIS Kalyani.

ENGINEERS' DAY

Felicitated as an Eminent Engineer by IE (I)



EE, GNIT, 15 September 2024 — On the occasion of the 57th Engineers' Day celebration at Sir R. N. Mukherjee Hall, The Institution of Engineers (India) felicitated a member of our department as an eminent engineer.

PHOTOGRAPHY

Student Work at the Academy of Fine Arts



EE, GNIT, 2024 — Sannidhya Mondal, 2nd Year EE, received a Certificate of Participation at the 4th Beyond Vision Grand Photography Exhibition "Spectacle – 2024", Academy of Fine Arts, Kolkata.

DOCTORATE

Mr. Suman Ghosh Awarded Ph.D.

SHIBPUR, February 2024 — Mr. Suman Ghosh has been awarded the Ph.D. degree from IIEST, Shibpur. Congratulations from the entire department!

JIS SAMMAN / PURASKAR 2024

Four Honours at JIS Samman & Puraskar 2024



Mr. Susovan Dutta — JIS Samman 2024, "Faculty with maximum no. of Patents"



Dr. Debasree Saha — JIS Puraskar 2024, "Faculty with highest Students' Publication"



Dr. Aveek Chattopadhyay — JIS Puraskar 2024, "Faculty with highest number of publications"



Mr. Ramanuj Bhowmick — JIS Puraskar 2024, "Students with highest no. of publications"

OUR TOPPERS · YGPA 2024

Toppers of the Year

Rank	Name of Student	Semester	YGPA (2024)	Photo
1	RAMANUJ BHOWMICK	8th	9.40	
2	KAUSHIK MAJI	6th	9.125	

3	ARPAN DAS	4th	8.67	

RESEARCH DESK

Faculty Publications & Patents

Selected research output of the department in 2024

Journal Publications (Scopus Indexed)

- **Aveek Chattopadhyaya, Suparna Biswas, Sayan Roy Chaudhuri, Sumedha Bhattacharya, Gautam Kr Das, Sumangal Bhaumik, Titas Bhaumik** — "Machine Learning Based ECG Signal Classification", *Journal For Basic Sciences, Volume 24, Issue 1, pp. 367-2377, 22.01.2024, ISSN No.: 1006-8341. (Scopus indexed journal)*
- **Aveek Chattopadhyaya, Suman Ghosh, Amit Debnath** — "Design of Three Phase Inverter Fed AC Drive", *Technische Sicherheit (Technical Security), Volume 24, Issue 03, pp. 201-211, 20/03/2024, ISSN No.: 1434-9728. (Scopus indexed journal)*
- **Arpan Das** — "Development of a Photovoltaic-Powered Electrolyzer for Sustainable Green Hydrogen Production", *Technical Security Journal, Volume 24, Issue 4, April 2024, ISSN No.: 2191-0073.*
- **Mainak Das, Vishal Roy, Arpan Kumar, Akash Das** — "Cost Effective Solar Powered Wireless Mobile Charger", *Journal of Basic Science, Volume 24, Issue 5, June 2024, ISSN No.: 1006-8341.*
- **Arpan Das** — "A Review of Fault Diagnosis in AC Micro-Grids by Machine Learning", *YMER (Publisher: University of Stockholm), Volume 23, Issue 6, June 2024, pp. 1215-1230, UGC Care-II, ISSN No.: 0044-0477. (Scopus indexed journal)*
- **Barnali Kundu, Debasree Saha, Suman Ghosh, Arpan Das** — "Development of a Photovoltaic-Powered Electrolyzer for Sustainable Green Hydrogen Production", *Technical Security Journal, Volume 24, Issue 4, April 2024, ISSN No.: 2191-0073.*
- **Tista Banerjee, Sumangal Bhaumik, Aveek Chattopadhyaya, Titas Bhaumik, Shubham Kar, Surajit Paul** — "Parameter Estimation of Three Phase Induction Motor using Gravitational Search Algorithm for DTC", *Journal For Basic Sciences, Volume 24, Issue 06, pp. 566-576, 27.06.2024, ISSN No.: 1006-8341.*
- **Soumya Kanti Bandyopadhyay, Sumangal Bhaumik, Aveek Chattopadhyaya, Titas Bhaumik, Amit Debnath, Suman Ghosh, Tista Banerjee** — "Negative Sequence Component and Root Mean Square Based Single Phasing Detection of Induction Motor", *Journal For Basic Sciences, Volume 24, Issue 06, pp. 594-603, 29.06.2024, ISSN No.: 1006-8341.*

Conference

- **Rikta Majumder, Susovan Dutta, Aritra Chowdhury, Aritra Kundu** — "Solar based Automatic EV Charging System", *International Conference on Science, Technology & Communication Skills (TCSCON-2024), Narula Institute of Technology, Kolkata, 22-24 February, 2024.*
- **Arpan Das, Ankur Vaibhav, Nivedita Saha** — "Design and Development of an IoT Governed Smart Battery Management System", *14th Academic Meet, Forum of Scientists, Engineers & Technologists (FOSET), JIS College of Engineering (JISCE), West Bengal, 12th May, 2024.*
- **Arpan Das, Eshita Das, Payel Chakraborty, Aritra Chowdhury** — "A Data-Driven Approach for Accurate Solar Power Forecasting", *SERB Sponsored National Conference on Machine Learning in Healthcare Applications (MLHA-2024), GNIT, Kolkata, April, 2024.*
- **Ramanuj Bhowmick, Soumyajit Pradhan, Ratnadwip Dhali** — "Smart Energy Meter Utilizing Internet of Things (IoT) Technology", *SERB Sponsored National Conference on Machine Learning in Healthcare Applications (MLHA-2024), GNIT, Kolkata, April, 2024.*
- **Debarghya Roy, Akash Bhowmick, Arghyadeep Ghosh, Kumari Guria Rani** — "Third Eye for Blind Person", *IEI Conclave of Student's Chapter 2024, JIS College of Engineering, 05.04.2024. (Selected as Session Best Paper)*
- **Chandrima Ghosh, Soumyajit Dasgupta, Souptik Chakraborty** — "Smart Weight Monitoring System", *SERB Sponsored National Conference on Machine Learning in Healthcare Applications (MLHA-2024), GNIT, Kolkata, pp. 114-121, 19.04.2024.*
- **Sahil Mondal, Tushar Ghosh, Prasun Das** — "Three Phase Transmission Line Fault Detection System", *Third Regional Conclave of Students' Chapter (Eastern Region), IEI, JISCE, 5th April, 2024.*

Patent Granted

- **Dr. Barnali Kundu, Dr. Aveek Chattopadhyaya, Mr. Susovon Dutta, Mr. Subharshi Roy, Mr. Debanjan Chatterjee** — "Cloud Based Real-Time Vibration and Temperature Monitoring System for Wind Turbine", *Patent No.: 542772, Application No: 202131054354,*

Date of Filing: 24/11/2021, Patentee: Guru Nanak Institute of Technology, Patent Grant Date: 25/06/2024. (Granted)

Patent

- **Dr. Suman Ghosh, Dr. Aveek Chattopadhyaya, Mr. Amit Debnath** — "Automated Traffic Management System", *Application No. 202431071422 A, Date of Filing: 20/09/2024, Publication Date: 04/10/2024.*
- **Arpan Das, Dr. Rajdeep Samaddar, Dr. Barnali Kundu, Aritra Chowdhury, Dr. Debasree Saha** — "A Non-Invasive Glucose Monitoring System Integrative Toothbrush", *Application No. 202431091136 A, Date of Filing: 22/11/2024, Publication Date: 29/11/2024, The Patent Office Journal No. 48/2024.*

Student Publication

- **Arpan Das, Debasree Saha, Shrayasee Gain, Payel Chakraborty, Brishti De** — "Optimizing Wind Energy Forecasting: A Comparative Study of ANN and Decision Tree Algorithms", *International Conference on Big Data Analytics in Bioinformatics (DABCon-2024), Narula Institute of Technology, 21–23 November 2024.*

International Journal

- **Barnali Kundu, Dwaipayan Mazumdar, Debmalya Das, Sujoy Ghati, Arnab Dutta** — "Design of Two stage Isolated Bidirectional Converter for Plug-in Electric Vehicles", *YMER, July, 2023 (ISSN NO: 0044-0477).*
- **Soumya Kanti Bandyopadhyay, Sumangal Bhaumik, Aveek Chattopadhyaya, Sananda Pal, & Diptan Sinha** — "Sequence Component Based RMS Computation for the Detection of Single Phasing of SVPWM Fed Induction Motor", *Journal of Computational Analysis and Applications (JoCAAA), Vol. 33, No. 07, pp. 8–15, 05.09.2024. (SCOPUS, Q4 Journal) eudoxuspress.com/index.php/pub/article/view/997*

International Conference

- **Barnali Kundu, Dwaipayan Mazumdar, Arpan Das, Ankur Vaivav, Saurav Das** — "Integrated MPTA Control Framework for Hybrid Electric Vehicle Performance using Space Vector Pulse Width Modulation", *2nd IEEE International Conference on Advancements and Key Challenges in Green Energy and Computing (AKGEC2024), AKGEC, Ghaziabad, Uttar Pradesh, 21–23 November 2024 (Paper ID: 461), Accepted.*
- **Susovan Dutta, Bishaljit Paul, Barnali Kundu, Chandan Kumar Chanda** — "Market Clearing with Renewable Integration, Storage and Network Limits", *3rd Odisha IEEE Conference, ODICON-2024, Institute of Technical Education and Research (ITER), Siksha 'O' Anusandhan, Bhubaneswar, Odisha, 8–9 November 2024. Accepted & Paper presented.*
- **Susovan Dutta, Bishaljit Paul, Barnali Kundu, Chandan Kumar Chanda** — "Co-optimization of Reserves in Energy Market to Mitigate Congestion", *6th IEEE International Conference on Energy, Power, and Environment, National Institute of Technology Meghalaya, 20–22 June 2024. DOI: 10.1109/ICEPE63236.2024.10668942, Electronic ISSN: 2832-8973, Print ISSN: 2832-8965.*
- **Banshari Deb Majumder, Joy Halder, Dipu Mistry, Tanmoy Sinha Roy, Barnali Kundu** — "Development of Low Cost Inventory Management System using UAV", *International Conference on Big Data Analytics in Bioinformatics (DABCon-2024), Narula Institute of Technology, 21–23 November 2024, Accepted.*
- **Arkendu Mitra, Sujoy Bhowmik, Subhra Mukherjee, Pallav Dutta, Barnali Kundu, Debasree Saha** — "A Universal Design of Flyback Converter for Isolated Gate Drive Power Supply", *2024 IEEE Flagship International BIT Conference (BITCON-2024) on Next Generation Applications in Green Energy Technology, 7–8 December 2024, BIT Sindri, Dhanbad.*

Book Chapter

- **Aveek Chattopadhyaya, Niladri Mukherjee, Surajit Chattopadhyay** — "Assessment of Faults in Hybrid System Connected with Main Grid", *Linear and Nonlinear System Modeling, Scrivener Publishing LLC / WILEY, pp. 1–14, September 2024 (Published Online), ISBN 978-1-119847-42-7.*
- **Aveek Chattopadhyaya, Surajit Chattopadhyay** — "Modeling and Simulation of Current Transformer to Study Its Behaviours in Different Conditions", *Linear and Nonlinear System Modeling, Scrivener Publishing LLC / WILEY, pp. 127–142, September 2024 (Published Online), ISBN 978-1-119847-42-7.*
- **Sagnik Datta, Aveek Chattopadhyaya, Surajit Chattopadhyay, Arabinda Das** — "Comparative Study of Different Existing Standard Microgrid Networks", *Linear and Nonlinear System Modeling, Scrivener Publishing LLC / WILEY, pp. 33–48, September 2024 (Published Online), ISBN 978-1-119847-42-7.*

Research Patents — Mr. Amit Debnath

- **Title** — "IOT Based Low Cost Smart Incubator System", *Application No. 202431046358 · Filed 15/06/2024 · Published 21/06/2024*



Departmental patent documents



Departmental granted patent document

STUDENT RESEARCH CORNER

New Ideas Powering Tomorrow

Short explainers on fresh research directions, written for students by the ElekTOR student desk

SOLAR by NILUTPAL CHOWDHURY(2nd Year EE)

Perovskite–Silicon Tandem Cells: Beyond the Silicon Limit

Conventional silicon solar cells are approaching their practical efficiency ceiling of roughly 26–27 per cent. Researchers are now stacking a thin layer of perovskite — a low-cost crystal material that absorbs blue light very well — on top of a silicon cell, which captures the red end of the spectrum.

Laboratory tandem cells built this way have crossed 33 per cent efficiency. The open challenges are long-term stability under heat and humidity, and scaling the perovskite layer to full-size panels.

KEY TAKEAWAY *Two materials, one panel: more electricity from the same rooftop.*

E-MOBILITY by NIVEDITA SAHA(2nd Year EE)

Solid-State Batteries: The Next Leap for EVs

Today's lithium-ion cells use a flammable liquid electrolyte. Solid-state batteries replace it with a solid ceramic or polymer layer, which can make cells safer and may allow a lithium-metal anode for much higher energy density.

For electric vehicles this could mean longer range and faster charging. Engineers are still working on dendrite growth, interface resistance and the cost of manufacturing at scale.

KEY TAKEAWAY *Safer chemistry and more range — if manufacturing can catch up.*

POWER ELECTRONICS by EKARNA CHAKRABORTY(1st Year EE)

Roads That Charge Your Car

Dynamic wireless charging embeds coils under the road surface. When an equipped EV drives over them, energy is transferred by magnetic induction — the same principle as a transformer, but across an air gap.

Pilot stretches have been tested in countries such as Sweden and the USA. Key research areas include coil alignment, efficiency over the air gap, and power-electronic converters that switch at high frequency.

KEY TAKEAWAY *Smaller batteries, endless range: charging while driving.*

SMART GRID by JAYITA SARKAR (2nd Year EE)

AI Watchdogs for Faults on the Grid

Machine-learning models can learn the 'signature' of normal voltage and current waveforms. Combined with signal-processing tools such as the wavelet transform, they can detect and classify faults on transmission lines in milliseconds.

This is close to home: our faculty publish on machine-learning signal classification and fault assessment in power systems. Students can join this work through projects on data acquisition, feature extraction and protection relays.

KEY TAKEAWAY *Faster fault detection means fewer and shorter blackouts.*

GREEN ENERGY by RUDRAYAN BHAUMIK(1st Year EE)

Green Hydrogen: Fuel From Water and Waste

Green hydrogen is produced by splitting water using electricity from renewable sources, or from biological processes that turn organic waste into hydrogen-rich gas. It can store surplus solar and wind energy and power fuel cells.

Efficiency of electrolysers, safe storage and cost remain the big questions. Fittingly, our Smart India Hackathon 2024 runner-up team called itself 'Bio Hydro Pioneers'.

KEY TAKEAWAY *Hydrogen could become the battery of the renewable era.*

RESEARCH POINTS TO REMEMBER

- Tandem solar cells: perovskite on silicon, lab efficiency above 33%
- Solid-state batteries: solid electrolyte, safer cells, higher energy density
- Wireless EV charging: magnetic induction across an air gap
- AI + wavelets: faster fault detection on power lines
- Green hydrogen: store renewable energy as fuel

STUDENT INSIGHTS

Articles by Our Students

INSTRUMENTATION

Spectrum Analyzer

A spectrum analyzer measures the magnitude of an input signal versus frequency within the full frequency range of the instrument. Its primary use is to measure the power of the spectrum of known and unknown signals. The input it measures is electrical, but the spectral composition of other signals, such as acoustic pressure waves and optical light waves, can be studied using an appropriate transducer.

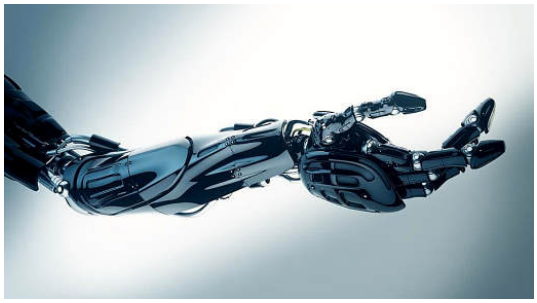
By analysing the spectra of electrical signals, dominant frequency, power, distortion, harmonics, bandwidth and other components can be observed that are not easily detectable in time-domain waveforms. The display shows frequency on the horizontal axis and amplitude on the vertical axis — to the casual observer it looks like an oscilloscope, and some instruments can work as either.

Analyzers are distinguished by how they obtain the spectrum: swept-tuned and Fast Fourier Transform (FFT) based. They come in four form factors: benchtop, portable, handheld and networked.

ARNAB DUTTA · 4TH YEAR, EE

ROBOTICS

A Low-Cost Robotic Hand



For the more than 5 million people worldwide who have undergone an upper-limb amputation, prosthetics have come a long way. Commercial neuroprosthetics — highly articulated bionic limbs that sense a user's residual muscle signals — can cost tens of thousands of dollars and use heavy, rigid metal skeletons and motors.

This project replicates the movements of the human hand using a plastic 3D-printed hand frame, flex sensors and servo motors at a low cost. An Arduino acts as the mediator: the sensors send values to the Arduino, which processes the data and drives the servo motors that pull the hand into position, replicating the motion of the hand.

ARPAN DAS · 3RD YEAR, EE

SPACE TECH

Reusable Rockets



Reusable rockets are exactly what they sound like — rockets that aren't limited to a single launch. They can be reused for multiple launches, which makes space travel more affordable and sustainable. In 2015 SpaceX launched a Falcon 9 rocket into orbit and then landed it upright back on Earth, a feat years in the making.

Reusable launch vehicles don't need new parts for each launch, reducing cost — though recovery and refurbishment eat into the savings. They carry extra avionics and propellant, and parts re-entering the atmosphere need heat shields, grid fins and other control surfaces; parachutes or retro-rockets may also slow them down.

MAINAK CHANDRA · 3RD YEAR, EE

ALTERNATIVE ENERGY

Electricity From Urine

Energy from urine is an alternative way to generate electricity, first demonstrated by Gerardine Botte at Ohio University, who obtained hydrogen by oxidising urea.

Layout: urine → electrolytic cell → H_2 gas → water filter → gas cylinder → liquid-borax cylinder (removes moisture) → generator → electricity. In the electrolytic cell, urea acts as the electrolyte between copper and zinc plates, and hydrogen is separated out to fuel the generator.

Applications include public toilets, households and cinema halls. Advantages: no fuel cost, pollution-free, low maintenance. Disadvantages: hydrogen's explosive risk and high insulation cost.

NIVEDITA SAHA · B.TECH 2ND YEAR

POSTER ARTICLE

Neuralink: Wiring the Brain to the Machine



Poster by Avi Ghosh, 2nd Year, EE

Avi Ghosh's poster introduces Neuralink, the neurotechnology company developing implantable brain–computer interfaces (BCIs). Founded in 2016 by Elon Musk and a team of scientists and engineers, the company works on ultra-thin threads that can be implanted in the brain to read neural signals.

The poster traces the company's journey from early lab demonstrations to approval for human trials in the United States in May 2023 — and the wider goal of helping people with paralysis and neurological conditions.

DID YOU KNOW?

- Benjamin Franklin (1706–1790) is a legendary figure in the history of electrical invention.
- He unravelled the scientific mystery behind lightning with his famous "KITE" experiment.
- — Partha Das, B.Tech 4th Year

DID YOU KNOW?

- Michael Faraday (1791–1867) is one of the greatest experimenters in the history of electricity.
- In 1831 he discovered electromagnetic induction, the principle behind every generator and transformer we use today.
- He began as a bookbinder's apprentice with little formal schooling, and the farad, the unit of capacitance, is named in his honour.
- — Chirantan Sarkar, B.Tech 4th Year

সাহিত্য কোণ · साहित्य कोना · LITERARY CORNER

Stories in Bengali & Hindi

Short stories about light, circuits and the people behind them

বাংলা ছোটগল্প · BENGALI SHORT STORY by ARPAN DAS (3rd Year EE)

শেষ ট্রেনের আলো

রাত তখন সাড়ে দশটা। সোদপুর স্টেশনের প্ল্যাটফর্মে শেষ লোকাল ট্রেনের অপেক্ষায় দাঁড়িয়ে ছিল অর্পণ — গুরু নানক ইনস্টিটিউট অফ টেকনোলজির ইলেকট্রিক্যাল ইঞ্জিনিয়ারিং বিভাগের তৃতীয় বর্ষের ছাত্র। হঠাৎ পুরো স্টেশন অন্ধকারে ডুবে গেল। লোডশেডিং।

প্ল্যাটফর্মের কোণে হরিদার ছোট্ট চায়ের দোকান। কাঁপা হাতে তিনি একটা পুরোনো ইনভার্টারের সুইচ টিপছেন, কিন্তু আলো জ্বলছে না। "বাবা, এটা কি আর চলবে না?" — হতাশ গলায় বললেন তিনি।

অর্পণ ব্যাগ থেকে মোবাইলের টর্চ আর ছোট্ট মাল্টিমিটারটা বের করল — ল্যাবের অভ্যেস। কয়েক মিনিটের মধ্যেই ধরা পড়ল গলদ: ব্যাটারির টার্মিনালে মরচে, আর একটা ঢিলে তার। রুমাল দিয়ে টার্মিনাল ঘষে পরিষ্কার করল, তারটা শক্ত করে জুড়ে দিল। টুং করে একটা শব্দ — আর দোকানের বাল্বটা জ্বলে উঠল।

হরিদার মুখে যে হাসি ফুটল, তা কোনো পরীক্ষার নম্বরে মাপা যায় না। তিনি এক ভাঁড় গরম চা এগিয়ে দিলেন, "পয়সা লাগবে না, বাবা।"

ট্রেনে উঠে জানলার পাশে বসে অর্পণ ভাবছিল — ক্লাসে ওহমের সূত্র তো সে বহুবার পড়েছে, কিন্তু আজ প্রথম বুঝল, ইঞ্জিনিয়ারিং আসলে মানুষের মুখে আলো জ্বালানোর বিদ্যা।

বাংলা ছোটগল্প · BENGALI SHORT STORY by ESHITA DAS (3rd Year EE)

সৌর দাদু

পুজোর ছুটিতে গ্রামের বাড়ি ফিরে ঈশিতা দেখল, দাদু এখনও সন্ধে হলে হারিকেন জ্বালিয়ে বই পড়েন। কেরোসিনের ধোঁয়ায় চোখ জ্বালা করে, তবু অভ্যেস ছাড়েন না।

ঈশিতা সঙ্গে এনেছিল কলেজের প্রোজেক্টে বানানো ছোট্ট একটা সোলার ল্যাম্প — একটা দশ ওয়াটের প্যানেল, একটা ব্যাটারি আর কয়েকটা এলইডি। উঠোনের রোদে প্যানেলটা বসিয়ে দিয়ে সে বলল, "দাদু, আজ সন্ধেবেলা হারিকেন নয়।"

দাদু হেসে বললেন, "রোদ্দুর দিয়ে আলো? তোদের বিজ্ঞান সব পারে বুঝি!" সন্ধে নামতেই সুইচ টিপল রিয়া। ধবধবে সাদা আলোয় ভরে গেল দাওয়া। দাদু চশমা ঠিক করে অবাক হয়ে বললেন, "এ তো দিনের মতো পরিষ্কার!"

পরদিন সকালে পাড়ার আরও তিনজন এসে হাজির — তাঁদেরও এমন একটা আলো চাই। ঈশিতা খাতা খুলে হিসেব কষতে বসল: কতটা প্যানেল, কত বড় ব্যাটারি, খরচ কত।

কলকাতায় ফেরার ট্রেনে সে ঠিক করে ফেলল তার ফাইনাল ইয়ারের প্রোজেক্ট — "গ্রামের জন্য কম খরচের সৌর আলো"। বিদায়ের সময় দাদু মাথায় হাত রেখে বলেছিলেন, "আলো শুধু ঘরে নয়, মনেও জ্বালাস।" সেই কথাটাই এখন তার প্রোজেক্টের প্রথম পাতায় লেখা।

हिंदी लघुकथा · HINDI SHORT STORY by ANSHUMAN SHAW(3rd year)

एक फ़्यूज़ की कहानी

मीटर बॉक्स के एक कोने में एक छोटा-सा फ़्यूज़ रहता था। पास में लगे चमकदार MCB और मोटे-मोटे तार अक्सर उसका मज़ाक उड़ाते — "तू इतना पतला है, किसी दिन यूँ ही टूट जाएगा।"

फ़्यूज़ चुप रहता। उसे पता था कि उसका काम दिखना नहीं, बचाना है।

एक बरसात की रात, आँधी के साथ बिजली की लाइन में ज़ोरदार झटका लगा। घर की ओर अचानक बहुत ज़्यादा करंट दौड़ा। तार गरम होने लगे। उसी पल फ़्यूज़ ने अपना फ़र्ज़ निभाया — वह पिघल गया और सर्किट तोड़ दिया। घर में अँधेरा हो गया, पर कोई उपकरण नहीं जला, कोई आग नहीं लगी।

सुबह बिजली मिस्त्री आया और टूटे फ़्यूज़ को हथेली पर रखकर बोला, "आज इसी ने पूरा घर बचा लिया।"

कभी-कभी सबसे छोटा हिस्सा ही सबसे बड़ी ज़िम्मेदारी निभाता है। इंजीनियरिंग हमें यही सिखाती है — सुरक्षा पहले दिखावा बाद में।

हिंदी लघुकथा · HINDI SHORT STORY

लैब की आख़िरी घंटी

प्रोजेक्ट जमा करने में सिर्फ़ दो दिन बचे थे और नीरज, अनुराग, रेहान का स्मार्ट-मीटर मॉडल अब भी ठीक से काम नहीं कर रहा था। स्क्रीन पर रीडिंग कभी शून्य, कभी बेवजह बहुत ज़्यादा।

"छोड़ो यार, कुछ नहीं होगा," रेहान ने थककर कहा। अनुराग ने सर्किट डायग्राम फिर से खोला — "एक बार शुरुआत से जाँचते हैं, हर कनेक्शन, हर रेज़िस्टर।"

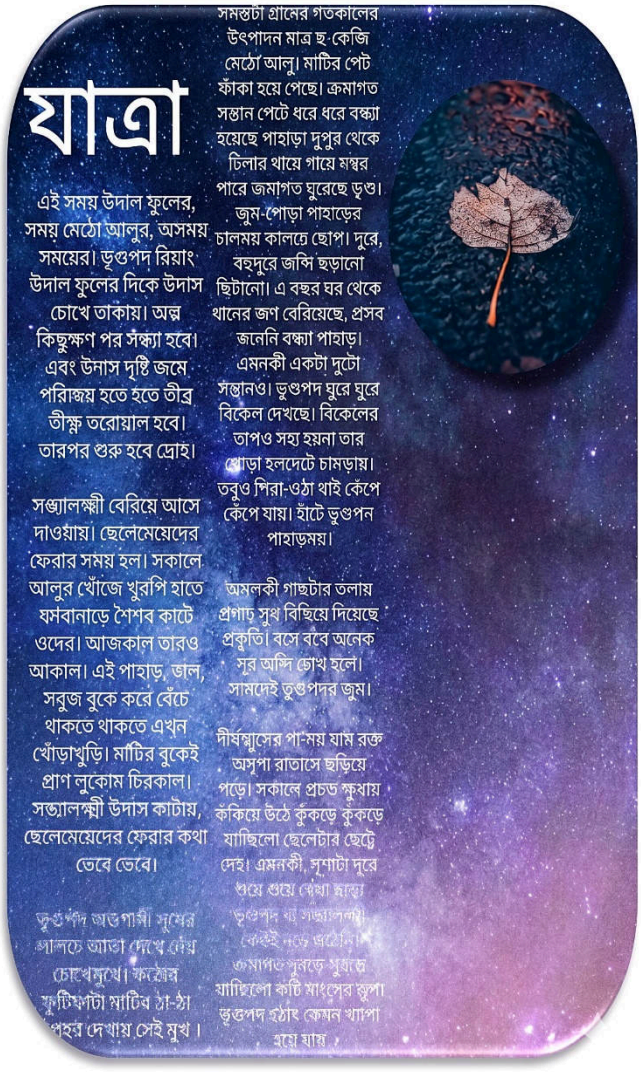
तीनों ने बारी-बारी से हर बिंदु पर मल्टीमीटर लगाया। रात के नौ बजे रेहान चिल्लाया, "मिल गया! करंट सेंसर का ग्राउंड ढीला है!" एक छोटा-सा सोल्डर जोड़ — और स्क्रीन पर सही रीडिंग चमक उठी: 230 वोल्ट।

लैब की आख़िरी घंटी बज चुकी थी, पर तीनों के चेहरे पर थकान नहीं, जीत की मुस्कान थी। लैब असिस्टेंट ने दरवाज़ा बंद करते हुए कहा, "गलतियाँ ढूँढने का धैर्य ही असली इंजीनियर बनाता है।"

उस दिन उन्होंने सीखा — असफलता अक्सर सफलता से बस एक ढीले तार की दूरी पर होती है।

STUDENT CREATIONS · বাংলা

From Our Students' Pens



"যাত্রা" — Rohan Singh, 2nd Year, EE



"প্রাণ" — Payel Chakraborty, 3rd Year, EE

SPORTS

EE Boys Rule the Ground in Football

EE, GNIT, August 2024 — The football team of Guru Nanak Institute of Technology — including five of its best footballers from the Electrical Engineering department — won the finalist trophy at the inter-college football tournament "Soccer Strike 2024".

Sujoy Ghati, Sandip Baral, Md. Faizan, Astik Oraon and Aditya Das from the EE department played a very important role on the ground, contributing to the team's success. The team received the trophy from IPGMER.

These players have brought many trophies to the college with their brilliant skills. We wish them a bright future — and we know the next batch will be inspired by their talent.

KEY POINTS

- Tournament: Soccer Strike 2024 (inter-college)
- Result: Finalist trophy for GNIT
- 5 EE players in the squad



GNIT football team



The squad after the tournament

EE Social Outreach



KOTHARI MEDICAL CENTRE BLOOD CENTRE
8/3, Alipore Road, Kolkata - 700 027
Phone : 033 24567059 / 8420297057 / 9073999448 / 9073999449
E-mail : kothariblooddbank@gmail.com
Drug License No. : DL152-MB/SLA/CLAA/WB

Certificate of Appreciation

We are pleased to appreciate the noble gesture of Shri / Smt. Md Faiyaz Mallick for donating blood voluntarily at Voluntary Blood Donation Camp organized on 25/02/ 20 24 by Kothari Medical Centre Blood Centre at (camp site) in association with Kothari Medical Centre Blood Centre

Date 25/2/2024

Medical Officer
Kothari Medical Centre Blood Centre

In an inspiring act of community service, Electrical Engineering student Md Faiyaz Mallick voluntarily stepped forward to donate blood. The noble contribution was made at a voluntary blood donation camp organized by Kothari Medical Centre Blood Centre, Kolkata, on February 25, 2024.



KOTHARI MEDICAL CENTRE BLOOD CENTRE

Certificate of Appreciation

We are pleased to appreciate the noble gesture of Shri / Smt. Md Rehan Alam for donating blood voluntarily at Voluntary Blood Donation Camp organized on 25/02/ 2024 by Kothari Medical Centre Blood Centre at Purulia (camp site) in association with Kothari Medical Centre Blood Centre

Date 25/2/2024

Medical Officer
Kothari Medical Centre Blood Centre

In an inspiring act of community service, Electrical Engineering student Md Rehan Alam voluntarily stepped forward to donate blood. The noble contribution was made at a voluntary blood donation camp organized by Kothari Medical Centre Blood Centre, Kolkata, on February 25, 2024.

GALLERY

Through Our Students' Lens



Photograph by Diya Barui, 4th Year, EE



Photograph by Diya Barui, 4th Year, EE



4th year EE students at the picnic



Celebrating graduation-day moments

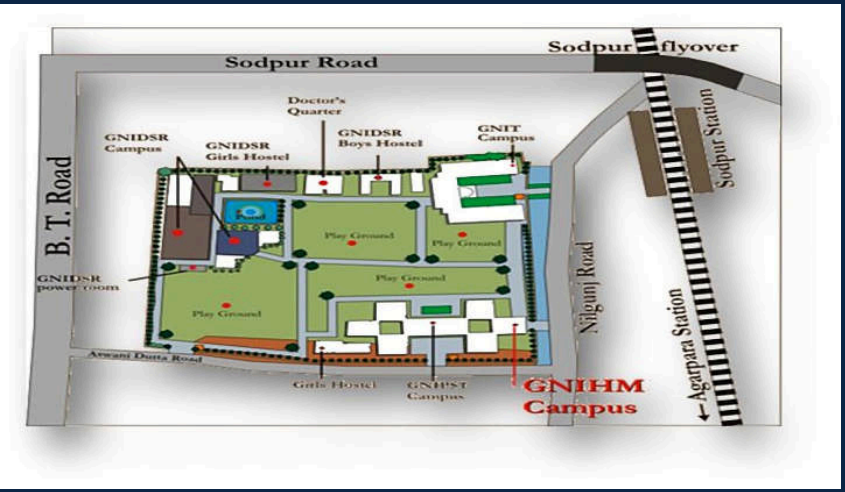


Tollywood portrait drawn by Aditi Maity, 4th Year, EE

> *"Confidence and hard work is the best medicine to kill the disease called failure. It will make you a successful person."*
>
> **— A.P.J. Abdul Kalam**

ElekTOR

DEPARTMENT OF ELECTRICAL ENGINEERING
GURU NANAK INSTITUTE OF TECHNOLOGY



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WRITE FOR THE NEXT ISSUE (2025)

Articles, research notes, stories and poems in English, বাংলা or हिंदी, photographs and sketches are welcome. Contact the Editorial Board, Department of EE.