GURU NANAK INSTITUTE OF TECHNOLOGY · KOLKATA

DEPARTMENT OF ELECTRICAL ENGINEERING

ElekTOR

The Annual Technical Magazine

ISSUE 01 · JANUARY – DECEMBER 2023









INNOVATION · ENERGY · EXCELLENCE

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INDUSTRIAL VISITS	SEMINARS	IEEE-IAS FDP	TECH FEST	CSR DRIVE	PUBLICATIONS

ElekTOR

The Annual Special Edition of the Department of Electrical Engineering

ISSUE 01 · ANNUAL SPECIAL EDITION JANUARY – DECEMBER 2023

LEAD STORY · SAMATVA 2K23

SAMATVA 2K23 Powers Up Engineer's Day on Campus

SAMATVA 2K23, the Electrical Engineering Department's annual technical fest, celebrated Engineer's Day with great enthusiasm and innovation.





SAMATVA 2K23

GNIT, 15–16 SEPTEMBER 2023 — The event featured exciting technical competitions, creative project displays, and interactive activities that showcased students' technical skills and problem-solving abilities. It provided an excellent platform for students to explore innovative ideas, demonstrate their engineering talents, and foster teamwork.

IN THIS ISSUE

- Messages from the Editorial Board, Principal & HOD
- Department at a Glance
- 2023 — The Year in Review
- Campus News: seminars, FDP, fest
- Industrial Visits & Outreach
- Research Desk: publications
- Tech Trends: feature articles
- साहित्य कोण / साहित्य कोना
- Laugh Circuit — cartoons
- Brain Games & Quiz

TOP HEADLINES

- IEEE-IAS co-sponsored FDP on Energy Storage Systems (11–15 July)
- Five industrial visits — thermal plant to railway workshop
- 17 papers in journals & conferences, incl. a Scopus-indexed journal
- Hybrid seminar on HEV dynamics with a CSIR–IIP scientist
- ULLAS-2K23: food drive for the underprivileged

"Powering ideas, engineering the future — a chronicle of learning beyond the classroom."

— Elektor

FROM THE EDITOR'S DESK

Editorial

Why this special edition, and what you will find in its pages

It is a matter of great pleasure for the Department of Electrical Engineering to present this **Annual Special Edition** of "Elektor", bringing together the highlights of both 2023 issues — January–June and July–December — in a single volume.

Elektor chronicles departmental activities, faculty and student accomplishments, and academic milestones. This year's pages carry seminars, an IEEE-IAS co-sponsored FDP, five industrial visits, our annual tech fest SAMATVA 2K23, the CSR drive ULLAS-2K23 and eleven research publications.

Alongside the news, we have opened new windows for our readers: feature articles on research trends shaping the future, a Bengali short story, a Hindi poem, a cartoon strip and a page of brain games and quizzes.

The Editorial Board thanks the Management, the Principal and the Head of the Department for their constant encouragement, and every faculty member and student who contributed. We hope you enjoy reading it as much as we enjoyed putting it together. – **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 coloured "Key Points" boxes for quick facts.
- Stories in Bengali and Hindi are in the সাহিত্য কোণ / साहित्य कोना section.
- Answers to the quiz and puzzles are on the last inside page.

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Students Editorial Message

It is a matter of great pride and pleasure for the Department of Electrical Engineering to bring out its departmental magazine **"ELEKTOR"**, initiated in the year 2023. The Editorial Board of the Department of EE sincerely acknowledges and appreciates the valuable contributions of all students who have made this edition successful through their articles and creative inputs. This magazine aims to highlight emerging technologies, innovations, and recent developments in the field of Electrical Engineering while creating greater awareness and promoting advanced technical knowledge among students. The Editorial Board also expresses its heartfelt gratitude to the Management of the Institute and the Head of the Department for their constant encouragement, motivation, and support in this initiative. We sincerely look forward to receiving the same enthusiasm and cooperation from all contributors and stakeholders in bringing out the next edition in 2024.

Editorial

Chandrima Ghosh (3rd year, EE)
Ramanuj Bhowmick (4th year, EE)
Aditi Maity (3rd year, EE)
Attundra Ghosh (2nd year, EE)
Payel Chakraborty (2nd year, EE)

FROM THE LEADERSHIP

Messages



MESSAGE FROM THE PRINCIPAL

It gives me great pleasure to present this Annual Special Edition of 'Elektor,' the newsletter of the Department of Electrical Engineering, GNIT, covering January–December 2023.

This edition reflects the department's vibrant academic culture through faculty development programmes, seminars, industrial visits, the annual technical fest, community outreach and research publications. The continued NBA accreditation of the Electrical Engineering programme and the Institute's NAAC A+ status are outcomes of sustained academic commitment and teamwork.

I congratulate the faculty members, students, contributors and editorial team for documenting these achievements with dedication, and I extend my best wishes to the Department for continued excellence in teaching, research, innovation and meaningful industry–society engagement.

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



MESSAGE FROM THE HOD

It is a matter of immense pleasure to share the Annual Special Edition of 'Elektor'. *This edition presents the collective academic, technical, and professional journey of the Department of Electrical Engineering throughout 2023.*

A remarkable achievement of the department has been its continued success in securing National Board of Accreditation (NBA) accreditation, reflecting the collective dedication, hard work, academic excellence, and commitment of our faculty members, students, and technical staff towards maintaining quality education and continuous improvement.

This edition also opens new windows to creativity and knowledge through research trends, inspiring stories, poems, quizzes, and games, written for and by our students. I sincerely congratulate every contributor and the editorial team for their valuable efforts and wish our students and faculty members continued success in all their future endeavours.

Dr. Barnali Kundu
HOD, Dept. of EE, GNIT

Vision, Mission, PEOs and PSOs

OUR VISION

To produce new generation technologists and entrepreneurs with 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 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 the sustainable growth of the society.

Program Educational Objectives

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

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 System, Smart Grid, Power Electronics and Electric Drives.	**PSO3** To use modern software tools for simulation, analysis and designing electrical and electronic Systems.

THE YEAR AT A GLANCE

2023 — The Year in Review

Sixteen milestones, month by month, from both halves of the year

Date (2023)	What happened	Category
02 Feb	Industrial visit to Kolaghat Thermal Power Station (WBPDCL)	VISIT
22–24 Feb	Paper at IEEE-co-sponsored ICECCT 2023 on EV charging & renewable mix	RESEARCH
07 Mar	Journal paper in IETE Journal of Research (Taylor & Francis)	RESEARCH
13 Mar	Visit to MSME Tool Room, Bon Hoogly — PLC-based production	VISIT
02 May	Seminar: E-Mobility & Renewable Energy Infrastructure (IIC & EDC)	SEMINAR
08 May	Seminar: Electrical O&M System of Indian Railways	SEMINAR
22 May	Visit to Carriage & Wagon Workshop, Eastern Railway, Liluah	VISIT
26 May	Hybrid seminar: Dynamics of Hybrid and Electric Vehicle (CSIR–IIP)	SEMINAR
28 Jun	Review on Green Hydrogen Technology at NIT conference	RESEARCH
11–15 Jul	One-week FDP: Energy Storage Systems (IEEE-IAS, Kolkata Chapter)	FDP
17 Jul	Seminar: Safe Electric Future — Passion for Power	SEMINAR
15–16 Sep	SAMATVA 2K23 Annual Tech Fest & “Tech-Creation” display	FEST
21 Sep	Visit to CAS Electrical & Automation Pvt. Ltd.	VISIT
10 Nov	ULLAS-2K23 — food drive for the underprivileged	CSR
24 Nov	Visit to Racily Udyog, P.B. Samadder Industrial Estate, Khardah	VISIT
Dec	Scopus-indexed paper in Journal For Basic Sciences (IF 6.1)	RESEARCH

ON CAMPUS

Campus News

Seminars, an international-standard FDP and our annual tech fest — in brief

KEY POINTS

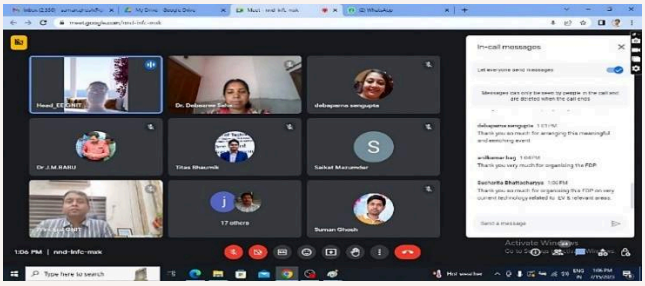
- 1 one-week FDP technically co-sponsored by IEEE-IAS, Kolkata Chapter
- 4 technical seminars — e-mobility, railways O&M, HEV dynamics and electrical safety
- SAMATVA 2K23 Annual Technical Fest with the Engineer’s Day “Tech-Creation” display

FACULTY DEVELOPMENT PROGRAMME

One-Week FDP on Energy Storage Systems

The Department of Electrical Engineering organised a one-week Faculty Development Programme (FDP) on Energy Storage Systems, focusing on emerging technologies, recent advancements, and their applications in modern power systems. The programme provided valuable insights into battery technologies, renewable energy integration, and sustainable energy solutions. Experts from academia and industry shared their knowledge, encouraging faculty members and participants to explore innovative research opportunities in energy storage.

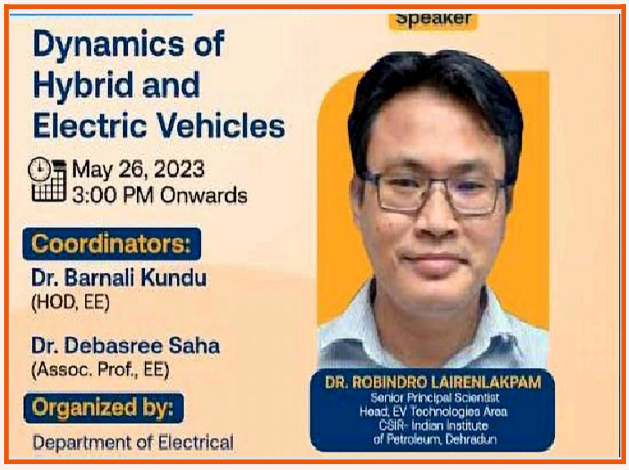


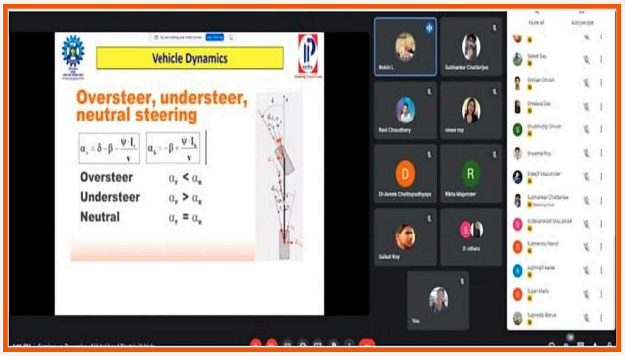


FDP brochure — co-sponsored by IEEE IAS, Kolkata Chapter

HYBRID SEMINAR

Dynamics of Hybrid and Electric Vehicles





Seminar poster — speaker from CSIR–IIP, Dehradun

EE, GNIT, 26 MAY 2023 — The Department of Electrical Engineering organised a technical seminar on "Dynamics of Hybrid and Electric Vehicles", highlighting the latest developments in EV technology, vehicle dynamics, and hybrid propulsion systems. The session provided valuable insights into electric mobility, energy efficiency, and emerging automotive technologies.

Coordinated by **Dr. Barnali Kundu** (HOD, EE) and **Dr. Debasree Saha** (Assoc. Prof., EE), the hybrid seminar featured **Dr. Robindro Lairenlakpam**, Senior Principal Scientist, CSIR – Indian Institute of Petroleum, Dehradun.

SEMINAR

E-Mobility & Renewable Infrastructure for Budding Entrepreneurs





Students at the seminar in the Seminar Hall

EE, GNIT, 2 MAY 2023 — A seminar on "Electrical Mobility and Renewable Energy Development Infrastructure for Budding Entrepreneurs" was held in association with IIC and the Entrepreneurship Development Cell.

SEMINAR

Inside the O&M System of Indian Railways





Expert session on railway electrical maintenance

EE, GNIT, 8 MAY 2023 — A seminar on "Electrical Operation and Maintenance System of Indian Railways" was organised with IIC-GNIT and EDC-GNIT.

SEMINAR

Safe Electric Future: Passion for Power





Electrical safety awareness session

EE, GNIT, 17 JULY 2023 — The department organised a seminar on "Safe Electric Future: Passion for Power" in the Seminar Hall, focusing on safe practices in the use of electricity.

ANNUAL TECH FEST

SAMATVA 2K23 Lights Up the Campus



SAMATVA 2K23 — Engineer's Day celebration

EE, GNIT, 15–16 SEPTEMBER 2023 — SAMATVA 2K23, the Annual Technical Fest, featured the Engineer's Day Celebration "Tech-Creation" model display, with students showcasing working models and ideas.

BEYOND THE CLASSROOM

Industrial Visits & Outreach

From a thermal power station to a railway workshop — learning where engineering happens

KEY POINTS

- **5 industrial visits for 2nd- and 3rd-year students**
- **Power generation, PLC automation, railway rolling stock and electrical manufacturing**
- **ULLAS-2K23: food packets distributed to the underprivileged**

INDUSTRIAL VISIT

Inside Kolaghat Thermal Power Station



3rd-year EE students at WBPDCL, Kolaghat

EE, GNIT, 2 FEBRUARY 2023 — A one-day industrial visit for 3rd-year students was organised at **West Bengal Power Development Corporation Limited (WBPDCL), Kolaghat Thermal Power Station**, Purba Medinipur.

INDUSTRIAL VISIT

PLC-Based Production at MSME Tool Room



At the MSME Tool Room, Kolkata

EE, GNIT, 13 MARCH 2023 — 3rd-year EE students visited the **MSME Tool Room, Bon Hoogly**, focusing on PLC-based production units.

INDUSTRIAL VISIT

Automation at CAS Electrical



Visit to CAS Electrical & Automation Pvt. Ltd.

EE, GNIT, 21 SEPTEMBER 2023 — Students were introduced to industrial automation and control panels at **CAS Electrical & Automation Pvt. Ltd.**

INDUSTRIAL VISIT

Manufacturing at Racily Udyog



At P.B. Samadder Industrial Estate, Khardah

EE, GNIT, 24 NOVEMBER 2023 — An industrial visit to **Racily Udyog** at the P.B. Samadder Industrial Estate was organised by the department.

CSR · COMMUNITY OUTREACH

ULLAS-2K23 Spreads Smiles



ULLAS-2K23 — food distribution drive

EE, GNIT, 10 NOVEMBER 2023 — "ULLAS-2K23" — an initiative of distributing food packets to underprivileged brothers and sisters — reminded us that engineering is ultimately about serving people.

RESEARCH DESK

Faculty & Student Publications

Selected research output of the department in 2023

JOURNAL PUBLICATIONS

- **Sagnik Datta, Aveek Chattopadhyaya, Surajit Chattopadhyay, Arabinda Das**
  "ANN-Based Statistical Computation for Remote End Fault Monitoring of the IEEE 14 Bus Microgrid Network" — *IETE Journal of Research, Taylor & Francis, 7th March 2023, pp. 1–15. DOI: 10.1080/03772063.2023.2182371*

- **Barnali Kundu, Subhamoy Dey, Souvik Pal, Aniruddha Sengupta, Manoshi Biswas**
  "Automated Transmission Line Fault Detection using Distance Locator" — *American Journal of Advanced Computing, Volume 2, Issue 1, April 2023, pp. 1–5. (ISSN No: 2368-1209)*

- **Aveek Chattopadhyaya**
  "ANN-Based Statistical Computation for Remote End Fault Monitoring of the IEEE 14 Bus Microgrid Network" — *IETE Journal of Research, Taylor & Francis, 07th March 2023, pp. 1–15. DOI: 10.1080/03772063.2023.2182371*

- **Susovan Dutta, Barnali Kundu, Rikta Majumder**
  "GSM Based Smart Power Monitoring" — *American Journal of Advanced Computing, Volume 1, Issue 1. https://doi.org/10.15864/ajac.21007*

INTERNATIONAL CONFERENCES

- **Susovan Dutta, Bishaljit Paul, Barnali Kundu**
  "Modelling Impact Analysis of EVCSL and Effect of Renewable Mix in Distribution Grid" — *Fifth International Conference on Electrical, Computer and Communication Technologies (ICECCT), Erode, India, 22–24 February 2023. Published in IEEE Digital Library, DOI: 10.1109/ICECCT56650.202310179760*

- **Barnali Kundu, Susovan Dutta, Debasree Saha**
  "Cloud Based Intelligent Accident Proof Helmet and Detect State of Intoxication" — *3rd International Conference on Artificial Intelligence and Smart Energy (ICAIS 2023), JCT College of Engineering and Technology, 2–4 February 2023*

NATIONAL CONFERENCE PUBLICATIONS

- **Susovan Dutta, Barnali Kundu, Bishaljit Paul, Chandan Kumar Chanda**
  "Modelling Impact Analysis of EVCSL and Effect of Renewable Mix in Distribution Grid" — *IEEE Technically Co-sponsored International Conference on Electrical, Computer and Communication Technologies (ICECCT 2023), 22–24 February 2023*

- **Shyamal Kumar Roy, Suman Ghosh, Madhumita Chakraborty, Amit Debnath, Kaushik Maji, Sushovon Paul**
  "Smart Traffic System Using Arduino" — *13th Inter-University Engineering, Science & Technology Academic Meet 2023, FOSET*

- **Subhamoy Dey, Souvik Pal, Aniruddha Sengupta, Manoshi Das, Dr. Barnali Kundu**
  "Automated Transmission Line Fault Detection Using Distance Locator" — *13th Inter-University Engineering, Science & Technology Academic Meet 2023, FOSET*

- **Tushar Ghosh, Sahil Mondal, Soumya Das, Amit Debnath, Susovan Dutta**
  "Home Automation Using Node-MCU Wi-Fi Module" — *13th Inter-University Engineering, Science & Technology Academic Meet 2023, FOSET*

- **Aditi Maity, Diya Barui, Suman Ghosh, Barnali Kundu Sarkar, Shyamal Kumar Roy, Aveek Chattopadhyaya**
  "Optimal Placement of Phasor Measurement Unit for Complete Observability of the Power System" — *13th Inter-University Engineering, Science & Technology Academic Meet 2023, FOSET*

PUBLICATIONS BY DEPARTMENTAL FACULTY MEMBERS

- **Dr. Barnali Kundu, Subhamoy Dey, Souvik Pal, Aniruddha Sengupta, Manoshi Biswas**
  "Automated Transmission Line Fault Detection using Distance Locator" — *American Journal of Advanced Computing. ISSN: 2368-1209*

- **Dr. Barnali Kundu, Dwaipayan Mazumdar, Debmalya Das, Sujoy Ghati, Arnab Dutta**
  "Design of Two Stage Isolated Bidirectional Converter for Plug-in Electric Vehicles" — *YMER, 07/07/2023. ISSN: 0044-0477*

- **Dr. Barnali Kundu, Dr. Debasree Saha, Chandrima Ghosh, Sarnava Mallick, Koushik Majhi**
  "Review on Green Hydrogen Technology: Applications and Challenges" — *International Conference on Energy, System, Drives, Measurement and Sensors, organized by Department of Electrical Engineering, NIT, 28/06/2023. ISBN: 978-93-89817-95-9*

- **Sumangal Bhaumik, Dr. Aveek Chattopadhyaya, Titas Bhaumik, Suman Ghosh, Shyamal Roy, Amit Debnath, Pinaki Biswas**
  "Transient Behavior Analysis of Induction Motor in Grid Connected PV Microgrid Using ETAP and MATLAB" — *Journal For Basic Sciences, Vol. 23, Issue 12, Dec 2023, Impact Factor 6.1 (Scopus Indexed). ISSN: 1006-8341 · DOI: 10.37896/JBSV23.12/2763*

PUBLICATIONS BY DEPARTMENTAL STUDENTS

- **Subhamoy Dey, Souvik Pal, Aniruddha Sengupta, Manoshi Biswas**
  "Automated Transmission Line Fault Detection using Distance Locator" — *American Journal of Advanced Computing. ISSN: 2368-1209*

- **Dwaipayan Mazumdar, Debmalya Das, Sujoy Ghati, Arnab Dutta**
  "Design of Two Stage Isolated Bidirectional Converter for Plug-in Electric Vehicles" — *YMER, 07/07/2023. ISSN: 0044-0477*

TECH TRENDS

New Ideas Powering Tomorrow

Five research areas reshaping electrical engineering — compiled by the editorial team

ENERGY STORAGE by KAUSHIK MAJI (3rd yr EE)

Beyond Lithium: Sodium-ion & Solid-State Batteries

Lithium, cobalt and nickel are costly and geographically concentrated. **Sodium-ion batteries** replace lithium with sodium — abundant in ordinary salt — and can use cheap aluminium current collectors on both electrodes. Lower energy density is offset by cost, cold-weather performance and safety, making them attractive for two-wheelers and grid storage; several major cell makers have begun commercial production.

Solid-state batteries replace the flammable liquid electrolyte with a solid ceramic, sulphide or polymer, promising higher energy density, faster charging and better safety — if dendrite growth, interface resistance and large-scale manufacturing can be solved.

KEY TAKEAWAY *BMS design, state-of-charge estimation and grid storage are booming fields — the theme of our July 2023 FDP.*

PHOTOVOLTAICS by RIMA DUTTA (2nd yr EE)

Perovskite–Silicon Tandem Solar Cells

Crystalline-silicon cells are nearing their practical limit of about 29%. **Perovskites**, deposited from solution at low temperature, absorb blue-green light efficiently; stacked on silicon, which harvests red and infrared light, they form **tandem cells** that have crossed 33% in certified lab tests.

Stability under heat, moisture and light, the use of lead and scaling to full-size modules remain the hurdles. For India, targeting 500 GW of non-fossil capacity by 2030, higher efficiency means more power from the same rooftop.

KEY TAKEAWAY *Tandem-cell modelling and MPPT design for new PV technologies make strong final-year projects.*

POWER ELECTRONICS by ARUNABHA PAUL (2nd yr EE)

Wide-Bandgap Devices: SiC & GaN

Silicon carbide and **gallium nitride** have a bandgap of about 3.3–3.4 eV versus 1.12 eV for silicon, so they handle higher fields, temperatures and switching frequencies — meaning lower losses, smaller heat sinks and smaller magnetics.

SiC MOSFETs now drive many EV traction inverters (especially 800 V platforms) and fast DC chargers; GaN powers compact laptop chargers and is entering data-centre supplies. Engineers must tame high dv/dt, EMI and layout parasitics.

KEY TAKEAWAY *Compare Si, SiC and GaN converters in MATLAB/Simulink, PLECS or LTspice — building on our EV converter research.*

SMART GRID by SOUPTIK CHAKRABORTY (3rd yr EE)

AI & Digital Twins for Smarter Grids

Machine-learning models forecast renewable output and demand, locate faults from PMU and relay data, and predict equipment failure. A **digital twin** — a live virtual replica of a grid or machine — lets engineers test "what-if" scenarios safely.

This links directly to our own work: ANN-based fault monitoring of the IEEE 14-bus microgrid and optimal PMU placement. Data quality, explainability and cybersecurity are the open challenges.

KEY TAKEAWAY *Python + data analytics + power-system fundamentals is a powerful combination for careers.*

CLEAN FUELS by MAINAK CHANDA (2nd yr EE)

Green Hydrogen: India's Next Frontier

Green hydrogen is made by splitting water in an **electrolyser** powered by renewable electricity. India's **National Green Hydrogen Mission**, approved in January 2023, aims for at least 5 million tonnes of annual production capacity by 2030.

Alkaline, PEM and solid-oxide electrolysers are, electrically, very large DC loads: high-current rectifiers, power quality and coordination with variable solar and wind are core EE challenges — explored in our 2023 green hydrogen review paper.

KEY TAKEAWAY *Rectifier design and power-quality analysis are emerging niches with growing demand.*

সাহিত্য কোণ · साहित्य कोना · LITERARY CORNER

Stories in Bengali & Hindi

A short story, riddles, a poem and a little humour — from the editorial team

বাংলা ছোটগল্প by **ADITI MAITY (3rd yr EE)**

এক টুকরো রোদ্দুর

সুন্দরবনের কাছে ছোট্ট গ্রাম গোসাবা। দুর্গাপুজোর ছুটিতে বাড়ি ফিরেছে **অদিতি** — গুরু নানক ইনস্টিটিউট অফ টেকনোলজির ইলেকট্রিক্যাল ইঞ্জিনিয়ারিং বিভাগের **তৃতীয় বর্ষের** ছাত্রী। সন্ধে নামতেই আবার লোডশেডিং। উঠোনে হ্যারিকেনের টিমটিমে আলোয় পাশের বাড়ির ছোট্ট বাবলু অঙ্ক কষছে, আর বারবার চোখ কচলাচ্ছে।

ঠাকুমা পান সাজতে সাজতে বললেন, "তোরা তো কলকাতায় কত কী শিখিস, আমাদের এই অন্ধকারটা একটু তাড়াতে পারিস না, দিদিভাই?"

কথাটা **অদিতি** মনে গেঁথে গেল। পরদিন সকালেই সে জোগাড় করল একটা ছোট সোলার প্যানেল, একটা পুরোনো ব্যাটারি, কয়েকটা এলইডি আর কিছু তার। ক্লাসে শেখা চার্জ কন্ট্রোলারের সার্কিট খাতায় এঁকে নিয়ে দুপুরভর চলল ঝালাই আর মাপজোখ। মাল্টিমিটারের কাঁটা যখন ঠিক জায়গায় থামল, **অদিতি** মুখে হাসি ফুটল।

সন্ধেবেলা গ্রামের প্রাথমিক বিদ্যালয়ের বারান্দায় জ্বলে উঠল সাদা ঝকঝকে আলো। বাবলু আর তার বন্ধুরা হইহই করে বই নিয়ে বসে পড়ল। ঠাকুমা আঁচলে চোখ মুছে বললেন, "দেখ, সারাদিনের রোদ্দুরটা তুই কেমন বোতলে ভরে রাখলি!"

ছুটি শেষে কলকাতায় ফেরার সময় **অদিতি** ঠিক করল, এবার বন্ধুদের নিয়ে আরও দশটা বাতি বানাবে — আশপাশের প্রতিটা গ্রামের স্কুলের জন্য একটা করে। ট্রেনের জানলা দিয়ে বাইরে তাকিয়ে সে ভাবছিল, পাঠ্যবইয়ের সূত্রগুলো আসলে শুধু পরীক্ষার জন্য নয় — ঠিক জায়গায় পৌঁছলে ওরাই এক টুকরো রোদ্দুর হয়ে যায়।

> *"বিজ্ঞান তখনই সার্থক, যখন তা মানুষের ঘরে আলো জ্বালায়।"*

ধাঁধার আসর

তিনটি ধাঁধা

১. এক থালা সুপারি, গুনতে নারে ব্যাপারী।

২. তার আছে, পাখা আছে, ঘোরে সারাদিন; তবু এক চুলও উড়তে পারে না কোনোদিন।

৩. কাচের ঘরে থাকে, সুতোয় বাঁধা প্রাণ; সুইচ টিপলেই হাসে, ছড়ায় আলোর গান।

हिंदी कविता by **ANKUR VAIBHAV (2nd yr EE)**

बिजली की कहानी

तारों में दौड़ती, चुपचाप चलती,
हर घर के अँधेरे को रोशनी में बदलती।
कभी पंखे की हवा, कभी बल्ब की मुस्कान,
इंजीनियर के हाथों में बसती इसकी जान।

सूरज की किरणों से, हवा के झोंकों से,
नदियों की धारा से, नए-नए मोड़ों से —
जब हरित ऊर्जा के दीप जलाएँगे,
तब ही सच्चे अर्थों में भविष्य बनाएँगे।

बचाओ हर यूनिट, बंद करो स्विच बेकार,
छोटी-सी आदत से बचेगा संसार।

शब्दकोश · GLOSSARY

तकनीकी शब्द हिंदी में

विद्युत धारा → Current
विभवांतर → Voltage
प्रतिरोध → Resistance
संधारित्र → Capacitor
प्रेरकत्व → Inductance
परिणामित्र → Transformer
अर्धचालक → Semiconductor
नवीकरणीय ऊर्जा → Renewable Energy

चुटकुला

शिक्षक: बताओ, बिजली कहाँ से आती है?

छात्र: सर, मामा के घर से!

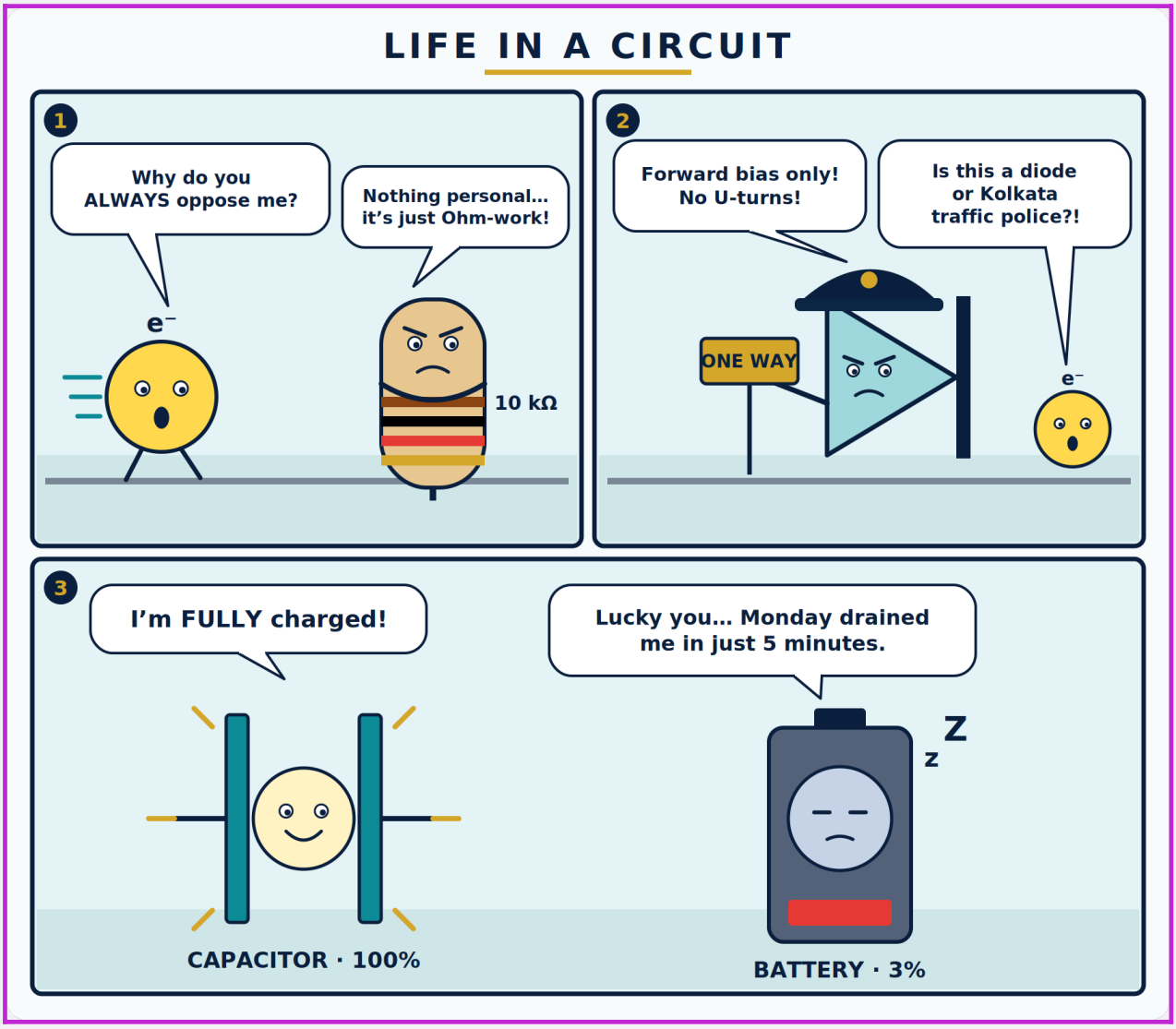
शिक्षक: वो कैसे?

छात्र: जब भी बिजली जाती है, पापा कहते हैं — "तुम्हारे भाई ने फिर काट दी!" (मामा बिजली विभाग में हैं)

CARTOON CORNER

Laugh Circuit

Because even electrons need a break — original cartoon by the editorial team



"Life in a Circuit" — concept & art: Elektor editorial team

SHORT CIRCUITS

One-Liners

- **Teacher:** What is the unit of power? **Student:** What? **Teacher:** Correct! (Watt)
- **Ohm's Law of Exams:** Stress (V) = Syllabus left (I) × Time wasted on phone (R).
- Why did the electron never get lost? It always followed the **current** path!
- Resistance is futile … unless it is less than 1 Ω.
- Why do transformers make great friends? They always **step up** when you need them.

DID YOU KNOW?

- A typical lightning bolt carries a current of tens of thousands of amperes.
- India's national grid runs at 50 Hz — the voltage reverses direction 100 times every second.
- The first public electricity supply in Kolkata began in 1899.
- An electric eel can generate a shock of several hundred volts.

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

— A.P.J. Abdul Kalam

BRAIN GAMES · মগজাস্ত্র · दिमागी कसरत

Switch On Your Brain!

Puzzles, riddles and a lightning quiz for curious engineers — answers at the end of this section

01 Electric Word Search

Find the 14 electrical words hidden in the grid — across, down, diagonally and even backwards.

A	E	R	H	G	A	D	M	B	U	A	V
L	S	F	J	U	F	O	I	D	K	O	U
S	U	C	S	N	T	I	C	L	L	H	N
E	F	N	C	O	S	U	W	T	I	M	V
T	N	E	R	R	U	C	A	N	S	R	W
G	D	M	S	S	D	G	V	H	L	A	K
D	P	E	D	I	E	E	C	B	T	L	R
A	M	H	O	R	R	J	R	T	R	O	F
R	N	D	E	T	A	J	O	S	M	S	E
A	E	L	E	W	I	H	T	E	B	P	V
F	A	R	A	W	C	A	O	O	H	M	Y
Y	U	M	I	T	D	I	R	G	E	H	W

FIND THESE WORDS

OHM · VOLTAGE · CURRENT · DIODE · RELAY · MOTOR · TESLA · FARAD · INVERTER · ROTOR · GRID · SOLAR · FUSE · WATT

BONUS

▸ Which of these is NOT an SI unit: FUSE, FARAD or WATT?

02 Sudoku

	9					8		
6	8		9		4			
7		5			6	9		4
1				4		6		
	6				3			
			5				7	9
				1		2		
	4	2		3	7	5		1
		1		5	2	4	3	6

Fill every row, column and 3 × 3 box with the digits **1 to 9**. Every digit appears exactly once in each.

DIFFICULTY

⚡⚡ **Medium — 33 clues given**

03 Unscramble the Component

Rearrange the letters to find the electrical word.

A	**TOOMR** → _____	**B**	**GRACHE** → _____
C	**TTAW** → _____	**D**	**DOEID** → _____
E	**RYENGE** → _____	**F**	**CTAPAIRCO** → _____
G	**NRAEOLWBE** → _____	**H**	**SFUE** → _____

04 Mind Benders

M1. *I have a core but I am not a fruit; I have windings but I am not a clock; I step voltages up and down. What am I?*

M2. *The more of me you take, the more you leave behind. What am I?*

M3. *Which current never flows through a wire?*

M4. Find the next number: 2, 6, 12, 20, 30, ?

M5. You have three 6 Ω resistors. How can you connect all three to get exactly 4 Ω?

M6. Three switches are outside a closed room; one of them controls a filament bulb inside. You may enter the room only once. How do you find the right switch?

05 Lightning Quiz

1. The SI unit of magnetic flux is: (a) Tesla (b) Weber (c) Henry (d) Gauss

2. In a purely inductive AC circuit, the current: (a) Leads voltage by 90° (b) Is in phase with voltage (c) Lags voltage by 90° (d) Lags voltage by 180°
3. Synchronous speed of a 4-pole, 50 Hz machine is: (a) 3000 rpm (b) 1500 rpm (c) 1000 rpm (d) 750 rpm
4. Kirchhoff's Current Law is based on the conservation of: (a) Energy (b) Momentum (c) Charge (d) Power
5. Transformer cores are made of CRGO silicon steel mainly to reduce: (a) Copper loss (b) Hysteresis loss (c) Friction loss (d) Dielectric loss
6. A Buchholz relay protects: (a) Alternators (b) Transmission lines (c) Oil-immersed transformers (d) Induction motors
7. The bandgap of silicon at room temperature is about: (a) 0.67 eV (b) 1.12 eV (c) 3.3 eV (d) 5.5 eV
8. Which wide-bandgap material is widely used in modern EV traction inverters? (a) Germanium (b) Silicon carbide (SiC) (c) Copper oxide (d) Selenium
9. The power factor of a purely resistive circuit is: (a) 0 (b) 0.5 (c) 0.707 (d) 1
10. The nominal frequency of India's national power grid is: (a) 50 Hz (b) 60 Hz (c) 25 Hz (d) 400 Hz
11. Which thermal power station did our 3rd-year students visit in February 2023? (a) Bandel TPS (b) Kolaghat TPS (c) Bakreswar TPS (d) Farakka STPS
12. What is the name of the department's 2023 annual technical fest? (a) SAMATVA 2K23 (b) TECHNIX 2K23 (c) ULLAS 2K23 (d) SPARK 2K23

Score: *11–12 Power Plant · 8–10 Transformer · 5–7 Battery · below 5 Time to recharge!*

ANSWER KEY · উত্তর · उत्तर

01 Word Search — solution

A	**E**	R	H	G	A	D	**M**	B	U	A	**V**
L	**S**	F	J	U	F	**O**	I	D	K	**O**	U
S	**U**	C	S	N	**T**	I	C	L	**L**	H	N
E	**F**	N	C	**O**	S	U	W	**T**	**I**	M	V
T	**N**	**E**	**R**	**R**	**U**	**C**	**A**	**N**	S	**R**	**W**
G	D	M	S	S	**D**	**G**	**V**	H	L	**A**	K
D	P	E	D	**I**	**E**	**E**	C	B	**T**	**L**	R
A	M	H	**O**	**R**	**R**	J	**R**	**T**	R	**O**	F
R	N	**D**	**E**	**T**	A	J	**O**	S	M	**S**	E
A	**E**	**L**	**E**	W	I	H	**T**	E	B	P	V
F	**A**	**R**	A	W	C	A	**O**	**O**	**H**	**M**	Y
Y	U	M	I	T	**D**	**I**	**R**	**G**	E	H	W

Bonus: FUSE is not an SI unit (farad and watt are).

02 Sudoku — solution

2	**9**	4	1	7	5	**8**	6	3
6	**8**	3	**9**	2	**4**	7	1	5
7	1	**5**	3	8	**6**	**9**	2	**4**
1	3	9	7	**4**	8	**6**	5	2
5	**6**	7	2	9	**3**	1	4	8
4	2	8	**5**	6	1	3	**7**	**9**
3	5	6	4	**1**	9	**2**	8	7
8	**4**	**2**	6	**3**	**7**	**5**	9	**1**
9	7	**1**	8	**5**	**2**	**4**	**3**	**6**

03 Unscramble

A. TOOMR → **MOTOR**
B. GRACHE → **CHARGE**
C. TTAW → **WATT**
D. DOEID → **DIODE**
E. RYENGE → **ENERGY**
F. CTAPAIRCO → **CAPACITOR**
G. NRAEOLWBE → **RENEWABLE**
H. SFUE → **FUSE**

04 Mind Benders

M1. A transformer.
M2. Footsteps.
M3. An ocean current — or "current affairs"!
M4. 42 (differences are 4, 6, 8, 10, 12; i.e. n × (n + 1)).
M5. Put two in series (12 Ω) and connect that combination in parallel with the third: 12 × 6 / (12 + 6) = 4 Ω.
M6. Turn switch 1 ON for five minutes, then OFF. Turn switch 2 ON and enter. Bulb ON → switch 2; bulb OFF but warm → switch 1; OFF and cold → switch 3.

05 Lightning Quiz

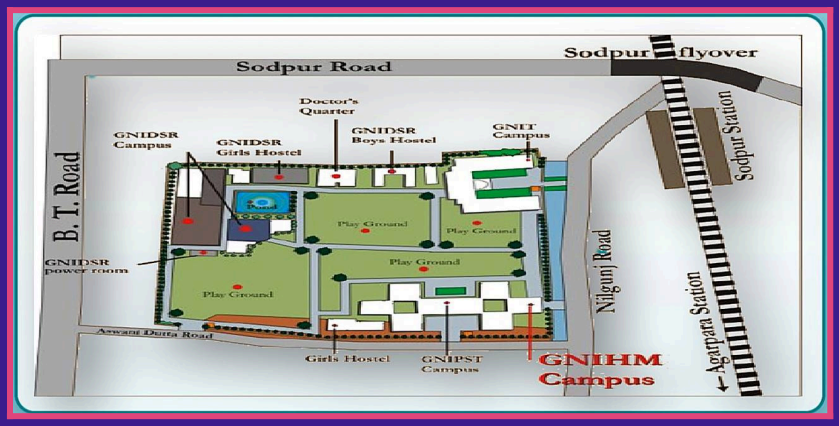
1 (b) Weber · 2 (c) Lags voltage by 90° · 3 (b) 1500 rpm · 4 (c) Charge · 5 (b) Hysteresis loss · 6 (c) Oil-immersed transformers · 7 (b) 1.12 eV · 8 (b) Silicon carbide (SiC) · 9 (d) 1 · 10 (a) 50 Hz · 11 (b) Kolaghat TPS · 12 (a) SAMATVA 2K23

06 বাংলা ধাঁধা

১. আকাশের তারা ২. সিলিং ফ্যান ৩. বৈদ্যুতিক বাল্ব

Elektor

DEPARTMENT OF ELECTRICAL ENGINEERING
GURU NANAK INSTITUTE OF TECHNOLOGY



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WRITE FOR THE NEXT ISSUE

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