AY-2024-2025

ELECTROSPHERE

Technical Magazine from

DEPARTMENT OF

ELECTRICAL & ELECTRONICS ENGINEERING



GATES

INSTITUTE OF TECHNOLOGY

Autonomous

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Editors:

Dr. M. Vasu, P. Pravallika.

+919490082001, www.gatesit.ac.in



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FROM THE EDITORS

This edition is arranged the way a magazine should be read — around themes rather than dates. The big story of the year, electric mobility, comes first, followed by our visit to the grid, the skills our students built and the prizes they won. Every programme is listed in *For the Record*, and a new section closes the edition with five recent trends in electrical engineering.

— Dr. M. Vasu FACULTY EDITOR
— P. Pravallika STUDENT EDITOR

A WORD FROM THE HEAD OF DEPARTMENT

Engineers for a changing world

> *"Our students engaged with both the fundamentals and the frontiers of Electrical and Electronics Engineering."*

It gives me immense pleasure to present the annual edition of ElectroSphere, capturing the academic and co-curricular journey of the Department of Electrical & Electronics Engineering through the Academic Year 2024–25.

Over the year, our students took part in 11 carefully chosen programmes with more than 707 participations. A week of hands-on training in Programmable Logic Control and a certification course in Electrical CAD built practical, industry-ready skills. A session on power electronics in electric vehicles opened a year-long focus on e-mobility that culminated in the six-day workshop "The Future is Electric".

Our industrial visit to the 400 kV Power Grid substation at Gooty showed students how bulk power is transmitted, protected and controlled. Sessions on renewable energy, control systems in process industries and research methodology widened their horizons, while our skills programmes prepared them for interviews and the workplace.

I am especially proud of our prize winners at PRAVAHA 2K25, RGMCET — Mr. B. Yugandhar Reddy, Mr. J. Mahesh Babu, Mr. S. Rafi and Mr. S. Md. Umar Farooq (Project Expo), Ms. B. M. Manasa and Mr. S. Baba Vali (Paper Presentation) and Ms. M. Navya Sree (Poster Presentation) — and of Ms. I. Jyoshna, winner of the Coding event at E-Merge 2K24, JNTUACEA.

I thank our faculty coordinators and resource persons, congratulate every student, and encourage all of you to keep learning, keep building and keep pushing the boundaries of what is possible.

Dr. N. Narasimhulu
HEAD OF THE DEPARTMENT, EEE

OUR VISION

To impart the best technical education instilled with discipline, values and leadership qualities that will produce professional technocrats in Electrical and Electronics Engineering.

OUR MISSION

01 To impart fundamental Electrical and Electronics Engineering concepts and a broad set of technical skills.

02 To prepare Electrical and Electronics Engineering graduates who will engage effectively and responsibly in practicing engineering.

03 To impart practical exposure on latest technological developments in Electrical and Electronics Engineering.

2024–25 at a glance

11
PROGRAMMES IN THIS EDITION

707+
STUDENT PARTICIPATIONS

114
AT THE YEAR'S LARGEST EVENT

5
SYMPOSIUM PRIZES

JUL 2024	AUG 2024	SEP 2024	OCT 2024	NOV 2024	DEC 2024	JAN 2025	FEB 2025	MAR 2025
PLC Training	Power Skills	Communication Skills	Life Skills · 114	★ E-Merge 2K24		Renewable Energy	Research Seminar	400 kV Visit
	Power Electronics in EVs	Electrical CAD					★ PRAVAHA 2K25	
		ICT Tools					EV Workshop	
		Process Control						

6
WORKSHOPS & HANDS-ON TRAINING

4
TECHNICAL SESSIONS & SEMINARS

1
CERTIFICATION COURSE

1
INDUSTRIAL VISIT









COVER STORY

The Year of E-Mobility

How a one-day session on power electronics grew into a six-day deep dive into electric vehicles — and what our students learned along the way.

31 AUG 2024 · 66 STUDENTS

17–22 FEB 2025 · 67 STUDENTS

An electric vehicle is, at heart, a power electronics system on wheels. A battery stores energy as direct current; an inverter turns it into the variable-frequency alternating current that drives the traction motor; DC-DC converters supply the vehicle's electronics; and when the driver brakes, the motor becomes a generator and sends energy back to the battery.

ACT ONE: THE SESSION

That idea set the tone for our year. On 31 August 2024, 66 students attended a technical session on the Application of Power Electronics in Electric Vehicle Technology. It covered inverters that drive the traction motor, DC-DC converters that supply the vehicle's electrical systems, motor-drive circuits and their control, and the battery-charging systems used in modern EVs. The presentation included a novel topology for a PV-powered switched reluctance motor (SRM) drive for electric vehicles, with integrated driving and charging control, showing how research ideas are pushing EV technology forward. The session connected core Power Electronics concepts with the fast-growing electric mobility industry and set the stage for the department's larger EV workshop later in the year.



A PV-powered SRM drive for EVs, presented on 31 August 2024.

ACT TWO: SIX DAYS OF EV

From 17 to 22 February 2025, 67 students took part in "The Future is Electric: Understanding EV Technology". The programme covered EV architecture and drivetrain configurations, lithium-ion and solid-state battery technologies and Battery Management Systems. Students then studied the power electronics that drive an EV — inverters and choppers for motor drives — along with regenerative braking. Sessions on charging infrastructure explained AC and DC fast charging and standards such as CHAdeMO and CCS, while Vehicle-to-Grid (V2G) showed how EVs can support the power grid. The workshop closed with India's EV policy, including the FAME-II scheme, career opportunities in the EV sector and emerging research directions.

> ***"A fleet of EVs can act as a large, distributed energy store that helps the grid absorb renewable power."***

WHERE THE CAR MEETS THE GRID

Slow AC charging uses the on-board charger, while DC fast chargers deliver power straight to the battery. With two-way chargers and Vehicle-to-Grid (V2G) technology, parked EVs can return energy to the grid at peak demand — linking this story to our visit to the 400 kV substation.

TAKEAWAY

Students gained a 360-degree understanding of EV technology and the skills and career paths opening up in e-mobility.

DID YOU KNOW?

Regenerative braking lets an EV's motor run as a generator, recovering energy every time the vehicle slows down.

Wide-bandgap devices such as SiC and GaN switches make EV inverters smaller and more efficient.

KEY TERMS

BMS Battery Management System — protects every cell of the pack.

V2G Vehicle-to-Grid — two-way power flow between EV and grid.

CCS / CHAdeMO Standards for DC fast charging.



FIELD NOTES

Inside a 400 kV Substation

Fifty students, one control room and a switchyard humming at transmission voltage — our industrial visit to POWERGRID, Gooty.

06 MARCH 2025 | 50 STUDENTS | POWERGRID, GOOTY

Fifty students visited the 400 kV POWERGRID substation at Gooty for a rare first-hand look at high-voltage transmission infrastructure. In the switchyard they observed power transformers, circuit breakers, isolators, bus bars, current and voltage transformers and protection relay panels operating at transmission voltage.

At the control room, engineers explained how SCADA systems are used for real-time grid monitoring and load dispatch, and how protection schemes detect and clear faults to keep supply reliable. Students also learned about the strict safety practices followed around extra-high-voltage equipment.

> ***"No classroom can show the scale of a 400 kV switchyard. Seeing it changes how students think about power systems."***

The visit brought Power Systems, Switchgear & Protection and Electrical Machines to life on a scale no classroom can match.

TAKEAWAY

Students connected transmission and protection theory with the real operation of a major grid substation.

WHAT STUDENTS SAW

- 400 kV switchyard and EHV equipment
- Transformers, breakers, isolators, CTs & PTs
- Protection relay panels
- SCADA-based monitoring & load dispatch
- High-voltage safety practice

Why 400 kV?

Higher transmission voltage means lower current for the same power — so line losses fall sharply over long distances.



FROM POWER STATION TO YOUR PLUG — WHERE A 400 KV SUBSTATION FITS

Generation	→	400 kV transmission	→	EHV substation	→	220 / 132 kV	→	Distribution
Power stations and solar & wind farms		Bulk power over long distances		Switching, protection & transformation		Sub-transmission network		Homes, industry & campuses

SECTION

01 Skills & Automation

Four programmes that put industry tools into students' hands.



A week with the PLC

HANDS-ON TRAINING ON PROGRAMMABLE LOGIC CONTROL (PLC)

29 JUL – 03 AUG 2024 · 67 STUDENTS · HANDS-ON TRAINING

The academic year began with a week-long, hands-on programme on Programmable Logic Controllers, the backbone of modern industrial automation. Students were introduced to PLC architecture — the CPU, input and output modules, power supply and programming interface — and learned how a PLC scans inputs, executes logic and drives outputs. Most of the week was spent on ladder-logic programming, building control circuits step by step and learning to configure and troubleshoot them. Typical industrial applications such as motor starting, conveyor control and sequential operations were used to show where these skills are applied in manufacturing and process plants. The training gave students practical exposure that directly supports careers in automation, maintenance and plant operations.

TAKEAWAY

Students can read and write basic ladder-logic programs and understand how PLC-based control circuits are used in industry.



Drawing like a professional

SIX-DAY CERTIFICATION COURSE ON ELECTRICAL COMPUTER AIDED DESIGN

FROM 09 SEP 2024 · CERTIFICATION COURSE

This six-day certification course gave students hands-on training in Electrical CAD in the computer laboratory. Students learned to prepare professional electrical drawings and circuit designs with industry-standard CAD software — from schematics and wiring diagrams to layouts — using standard symbols, component libraries and drafting practices. Each session combined demonstration with practice, so participants built their drawings themselves and learned how design changes are made and documented. The course showed how accurate drawings are essential for the design, installation and maintenance of electrical systems in industry and buildings, and gave students a skill that is in demand with design consultants, panel builders and EPC companies.

TAKEAWAY

Participants earned a certificate and industry-ready skills in preparing electrical drawings with CAD tools.



Tools for the digital engineer

WORKSHOP ON ICT TOOLS

20 SEP 2024 · 64 STUDENTS · WORKSHOP

This interactive workshop introduced students to Information and Communication Technology tools that support study and professional work. Topics included productivity software for documents, spreadsheets and presentations, online collaboration platforms for group work, and good practices for digital documentation and file management. Students saw how these tools can make project work more organised, help teams work together from different places and improve the quality of their reports and presentations. The workshop encouraged students to use digital tools confidently and responsibly throughout their course and career.

TAKEAWAY

Students improved their ability to use digital tools for collaboration, documentation and presentation.



Control theory at plant scale

APPLICATION OF CONTROL SYSTEMS IN PROCESS INDUSTRIES AND AUTOMATION

28 SEP 2024 · 50 STUDENTS · EXPERT TALK

In this expert talk, students saw how the control-system theory they study in class is applied in real process industries. The speaker explained how feedback control, sensors and instrumentation work together to keep variables such as temperature, pressure, flow and level at their required values. Examples from industrial plants showed how automation improves product quality, saves energy and protects people and equipment. The session connected the Control Systems course with industrial practice and helped students understand the career opportunities available in process control and automation.

TAKEAWAY

Students related control-system concepts to real industrial automation and its role in efficiency and safety.

SECTION

02 Clean Energy & Research

Thinking about the future — of energy, and of ideas.



Powering a sustainable future

RENEWABLE ENERGY SOURCES — ACADEMIC SESSION AND GUEST LECTURE

20 JAN 2025 · 67 STUDENTS · ACADEMIC SESSION & GUEST LECTURE

This full learning day on renewable energy combined an academic session with a guest lecture by an invited expert. The academic session covered solar photovoltaic systems, wind energy conversion, small hydropower and biomass energy, explaining their working principles, design considerations and the challenges of connecting them to the grid. The guest lecture gave an outside perspective on the global shift from fossil fuels to clean energy, energy storage, smart-grid integration and the growing role of electrical engineers in the renewable sector. Students also learned about India's National Solar Mission and renewable energy targets, linking Power Systems and Non-Conventional Energy Sources to national energy policy.

TAKEAWAY

Students understood renewable energy technologies, their grid integration and their importance for a sustainable future.



Parenting your research

SEMINAR: PARENTING YOUR RESEARCH WORK — OPPORTUNITIES AND CHALLENGES

10 FEB 2025 · 54 STUDENTS · RESEARCH SEMINAR

This research-orientation seminar guided students and faculty through the full life of a research project — from spotting a research gap and forming a hypothesis to collecting and analysing data, reporting ethically and publishing. Expert speakers described the opportunities and challenges of research, including funding, intellectual property and authorship ethics. They also introduced useful digital tools such as Mendeley and Zotero for managing references and Turnitin for checking originality. The seminar encouraged a culture of inquiry in the department and showed students how to nurture an idea into a mature piece of research.

TAKEAWAY

Students understood the stages of a research project and the ethical practices expected in scholarly work.

SECTION

03 People & Skills

The professional and personal skills that make great engineers.



Ready for the real world

PROFESSIONAL SKILLS SERIES: POWER SKILLS AND COMMUNICATION SKILLS

21 – 22 AUG & 03 SEP 2024 · 108 STUDENTS · WORKSHOPS

Two linked programmes helped students build the professional skills that employers value alongside technical knowledge. The two-day Power Skills workshop on 21–22 August (54 students) focused on teamwork, time management, adaptability and workplace etiquette, using discussions and group activities to help students reflect on how they plan their work and cooperate with others. The Communication Skills workshop on 3 September (54 students) followed with professional verbal and written communication, presentation techniques and interview readiness. Students practised speaking before an audience, structuring their ideas clearly and answering questions with confidence. Together, the series prepared students for placement interviews, project reviews and the everyday communication of an engineering workplace.

TAKEAWAY

Students strengthened teamwork, time management and communication, improving their employability and confidence.



Skills for life

LIFE SKILLS PROGRAMME

15 OCT 2024 · 114 STUDENTS · WORKSHOP

With 114 participants, the Life Skills programme was one of the best-attended activities of the year. It focused on the personal skills that support success in study, work and life — self-awareness, sound decision-making, stress management and interpersonal effectiveness. Students discussed how to understand their own strengths, handle pressure during examinations and placements, and build positive relationships with classmates, teachers and future colleagues. The programme supported the holistic development of students and the Institute's mission of producing disciplined, value-based professionals.

TAKEAWAY

Students gained practical strategies for managing stress, making decisions and working well with others.

Our Prize Winners

Five prizes at two inter-collegiate technical symposiums — and eight students who made the department proud.

1st

PROJECT EXPO · PRAVAHA 2K25, RGMCET, NANDYAL · 13–14 FEB 2025

B. Yugandhar Reddy · J. Mahesh Babu · S. Rafi · S. Md. Umar Farooq

A team effort that took the top prize in the Project Expo — a showcase of problem-solving, technical skill and creative teamwork.

1st

B. M. Manasa

PAPER PRESENTATION

PRAVAHA 2K25,
RGMCET, Nandyal
13 – 14 Feb 2025

1st

S. Baba Vali

PAPER PRESENTATION

PRAVAHA 2K25,
RGMCET, Nandyal
13 – 14 Feb 2025

2nd

M. Navya Sree

POSTER PRESENTATION

PRAVAHA 2K25,
RGMCET, Nandyal
13 – 14 Feb 2025

1st

I. Jyoshna

CODING

E-Merge 2K24, JNTUA
College of Engineering,
Ananthapuramu
05 Nov 2024

MOMENTS FROM PRAVAHA 2K25



Certificate presentation
PRAVAHA 2K25 · RGMCET, NANDYAL



Winners with their certificates
PRAVAHA 2K25 · RGMCET, NANDYAL



The prize-winning team
PRAVAHA 2K25 · RGMCET, NANDYAL

Student projects & moments from the year



Design and Fabrication of an Automatic Fire Fighting Robot — on display


Student project demonstration for faculty




EV technology workshop in the computer laboratory


Research seminar resource persons


In the CAD laboratory

Activity Register

Every programme of 2024–25 with its date, type and the number of students who took part.

#	DATE	PROGRAMME	TYPE	STUDENTS
1	29 Jul – 03 Aug 2024	**Hands-on Training on Programmable Logic Control (PLC)**	Hands-on Training	67
2	21 – 22 Aug & 03 Sep 2024	**Professional Skills Series: Power Skills and Communication Skills**	Workshops	108
3	31 Aug 2024	**Application of Power Electronics in Electric Vehicle Technology**	Technical Session	66
4	From 09 Sep 2024	**Six-Day Certification Course on Electrical Computer Aided Design**	Certification Course	—
5	20 Sep 2024	**Workshop on ICT Tools**	Workshop	64
6	28 Sep 2024	**Application of Control Systems in Process Industries and Automation**	Expert Talk	50
7	15 Oct 2024	**Life Skills Programme**	Workshop	114
8	20 Jan 2025	**Renewable Energy Sources — Academic Session and Guest Lecture**	Academic Session & Guest Lecture	67
9	10 Feb 2025	**Seminar: Parenting Your Research Work — Opportunities and Challenges**	Research Seminar	54
10	17 – 22 Feb 2025	**The Future is Electric: Six-Day Workshop on EV Technology**	Six-Day Workshop	67
11	06 Mar 2025	**Industrial Visit to the 400 kV Power Grid Substation, Gooty**	Industrial Visit	50
			Total student participations recorded	**707**

11	707	114
PROGRAMMES IN 2024–25	STUDENT PARTICIPATIONS	LARGEST SINGLE PROGRAMME

SECTION · TECHNOLOGY WATCH

04 Recent Trends in Electrical Engineering

Five shifts reshaping the profession — and what each one asks of an EEE graduate.

Electrical engineering is changing faster than at any time since the grid was built. Power now comes from the sun and the wind, cars run on batteries, meters talk to control rooms and hydrogen is made with electricity. The pages that follow look at five trends our students met in seminars, workshops and the industrial visit this year — and at the skills that will keep them employable as the field moves.

220.10 GW	29.52 GW	500 GW	236 GWh
RENEWABLE CAPACITY IN INDIA, 31 MAR 2025	RECORD RENEWABLE ADDITION IN FY 2024–25	NON-FOSSIL CAPACITY TARGET BY 2030	BATTERY STORAGE CEA SAYS INDIA NEEDS BY 2031–32

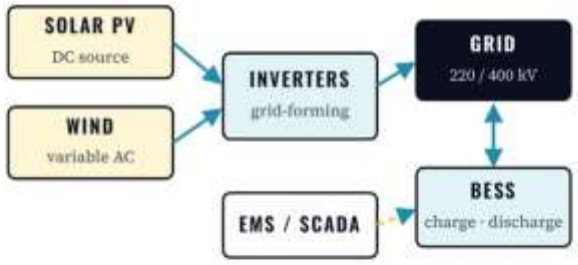
TREND 01

The renewable surge — and the storage it demands

Solar and wind are now the backbone of capacity addition. Keeping the lights on after sunset is the engineering challenge of the decade.

India's renewable fleet grew by a record margin in 2024–25, with solar alone crossing 100 GW and wind passing 50 GW. But sunshine peaks at noon while demand peaks in the evening, and wind follows the weather rather than the clock. Every gigawatt of renewables therefore brings a new question for the power engineer: how do we balance a grid whose largest sources cannot be dispatched on command?

The answer is storage. Battery energy storage systems (BESS) absorb surplus solar in the afternoon and release it at night, and pumped-storage hydro does the same at larger scale. The Central Electricity Authority estimates that India will need 37 GWh of battery storage by 2027, and the Government has backed the build-out with viability-gap funding. Inverters are changing too: *grid-forming* inverters can set voltage and frequency themselves, a job that used to belong only to the spinning mass of large synchronous generators.



A renewable-rich grid: inverter-based sources, battery storage and an energy-management system working together.

WHY IT MATTERS TO YOU

Power-system studies, inverter control and storage sizing are now core jobs at utilities, EPC firms and renewable developers.

PV SYSTEM DESIGN · POWER ELECTRONICS · BATTERY SIZING · PSPICE · MATLAB

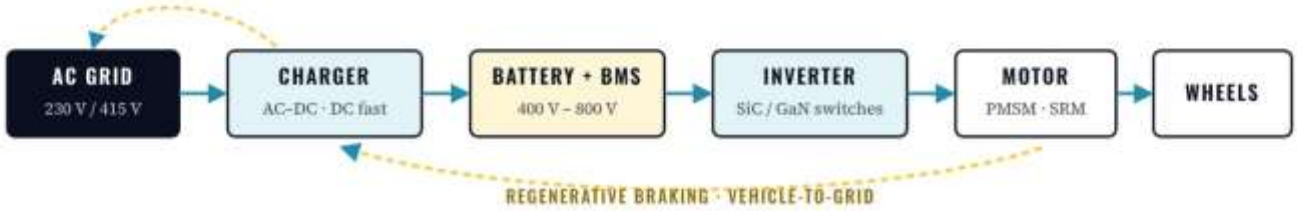
DID YOU KNOW? Our own campus is part of this story: the institute's 200 kW rooftop solar plant reflects the green-campus commitment in GATES' mission, and gives students a working PV system to study.

Sources: MNRE press release, 10 Apr 2025 (220.10 GW, 29.52 GW addition, 500 GW target); Central Electricity Authority estimate of BESS requirement as reported June 2025.

TREND 02

Electric mobility runs on power electronics

An electric vehicle is a power-electronics system on wheels — and the charging network behind it is a new kind of grid load.



Energy path of an EV: every stage is a converter or an electrical machine that EEE students study in the classroom.

Our cover story told of the week our students spent with engineers from Bolt, OBEN Electric and ORXA Energies. What they saw is a global shift: transport is becoming electrical engineering. The battery pack, the battery-management system, the DC–DC converter, the traction inverter and the motor are all subjects from our own syllabus, pushed to new limits of efficiency, weight and cost.

WIDE-BANDGAP SWITCHES

Silicon carbide (SiC) and gallium nitride (GaN) devices switch faster and run hotter than silicon IGBTs, cutting losses and shrinking chargers and inverters. Many new vehicles are moving from 400 V to 800 V battery systems so that ultra-fast charging needs less current and thinner cables.

CHARGING AS A GRID PROBLEM

Thousands of fast chargers switching on together look to the distribution network like a new industrial load. Smart charging, battery swapping for two- and three-wheelers and bidirectional vehicle-to-grid (V2G) chargers that feed energy back at peak hours are turning EV fleets into a flexible grid resource.

MACHINES WITHOUT MAGNETS

Concern over rare-earth supply has revived interest in switched-reluctance and induction motors — the PV-powered SRM drive presented by our students is part of this story.

BY THE NUMBERS · PM E-DRIVE

₹10,900 crore
Scheme outlay approved Sept 2024 to promote electric mobility

22,100
Fast chargers planned for electric four-wheelers

48,400
Fast chargers planned for e-2W / 3W

1,800
Fast chargers planned for e-buses

WHY IT MATTERS TO YOU

EV makers, charger companies and DISCOMs all need engineers who understand converters, machines and batteries together.

CONVERTER DESIGN · BMS · MOTOR CONTROL · THERMAL

FROM OUR CLASSROOM

Students met every block of this diagram during the year — PLC-based control in July, power electronics for EVs in August and December, and the week-long "Future is Electric" workshop in February.

Source: Press Information Bureau / Ministry of Heavy Industries, PM E-DRIVE scheme (Sept 2024): ₹10,900 crore outlay; ₹2,000 crore for 22,100 e-4W, 1,800 e-bus and 48,400 e-2W/3W fast chargers.

TREND 03

The grid gets a nervous system

Smart meters, digital substations and real-time data are turning a one-way network into an intelligent, two-way system.

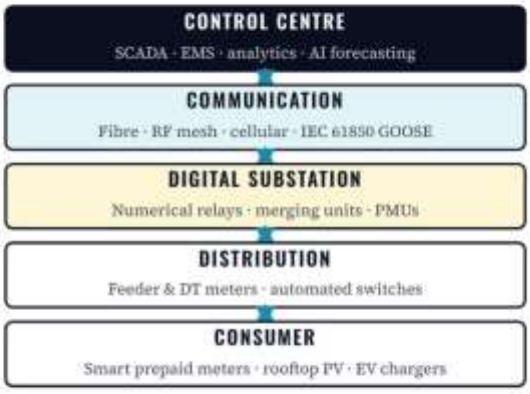
For a century, the distribution grid was almost blind: energy flowed one way, meters were read once a month, and a fault was found when customers phoned in. That is changing quickly. Under the Revamped Distribution Sector Scheme (RDSS), more than twenty crore smart meters have been sanctioned for consumers, distribution transformers and feeders across the country. Each one sends readings to the utility, supports prepaid billing and helps engineers locate losses and theft.

DIGITAL SUBSTATIONS

Inside the substation, copper wiring between instrument transformers and relays is giving way to optical fibre and the IEC 61850 standard. Merging units digitise currents and voltages at the switchyard; numerical relays exchange trip messages in milliseconds. Our students saw the conventional version of this technology at the 400 kV POWERGRID substation — the next generation will be configured as much with software as with spanners.

SEEING THE WHOLE SYSTEM

Phasor measurement units (PMUs), time-stamped by GPS, let operators watch the grid's dynamics many times a second, while analytics and machine-learning models forecast demand and renewable output. With all this connectivity comes a new duty: protecting the grid from cyber attack.



Layers of a smart grid — from the consumer's meter to the control centre.

BY THE NUMBERS · RDSS

20.33 crore
Smart meters sanctioned under RDSS (consumer, DT and feeder)

~99.51 lakh
Installed by early 2025 (4.89%) — the roll-out is just beginning

WHY IT MATTERS TO YOU

Metering, protection and SCADA engineers who also understand data and networks will be in demand at every DISCOM.

PROTECTION · SCADA · IEC 61850 · IOT · PYTHON

THEN AND NOW · THE CONVENTIONAL VS THE DIGITAL SUBSTATION

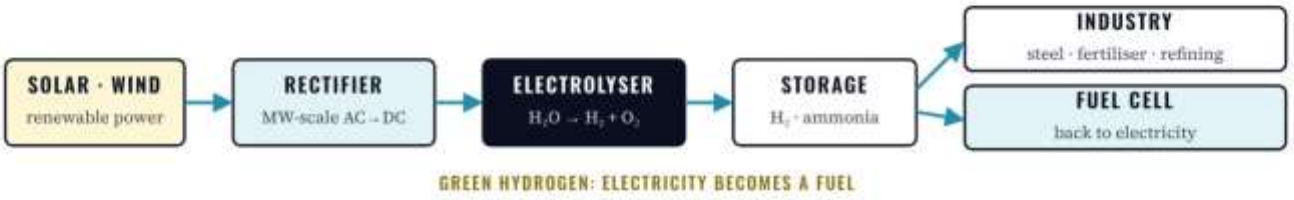
	CONVENTIONAL SUBSTATION	DIGITAL SUBSTATION
SIGNALS	Hundreds of copper cables from CTs and PTs to the control room	Merging units digitise signals at the switchyard and send them over optical fibre
PROTECTION	Electromechanical and static relays, hard-wired trip circuits	Numerical relays (IEDs) exchanging IEC 61850 GOOSE messages
MONITORING	Periodic manual readings and SCADA snapshots	Continuous condition monitoring and GPS-synchronised phasor data
MAINTENANCE	Fixed time-based schedules	Condition-based maintenance guided by data

Source: Ministry of Power reply in Rajya Sabha, 10 Feb 2025: of 20.33 crore smart meters sanctioned under RDSS, about 99.51 lakh (4.89%) installed.

TREND 04

Green hydrogen and the super-highways of power

Electricity is reaching sectors it never touched — through electrolysers, and through long-distance HVDC lines that carry renewable power to where it is needed.



GREEN HYDROGEN: ELECTRICITY BECOMES A FUEL

From sunlight to fuel: an electrolyser is, electrically, a very large DC load fed by power electronics.

Some industries — steel, fertilisers, refining, shipping — are hard to electrify directly. Green hydrogen, made by splitting water with renewable electricity, offers them a clean fuel. India's National Green Hydrogen Mission aims to make the country a global hub for producing and exporting it, and every tonne will need large amounts of renewable power, rectifiers, transformers and control systems.

AN ELECTRICAL ENGINEER'S VIEW

An electrolyser plant is a megawatt-scale DC load. Its rectifiers must deliver controlled DC current with low harmonics and high efficiency, and the plant must ride the ups and downs of solar and wind supply. These are classic problems in power electronics, power quality and system protection.

HVDC AND GREEN CORRIDORS

The best sun and wind are often far from the cities and factories that need power. High-voltage DC links — increasingly built with voltage-source converters — move bulk power over long distances with lower losses and fully controllable flow. Together with the Green Energy Corridor transmission projects, they are expanding the grid that carries India's renewable energy.

TRANSMISSION AT HIGHER VOLTAGES

New lines at 765 kV AC and above, FACTS devices and dynamic line rating let engineers push more power through existing corridors safely.

BY THE NUMBERS · NGHM

5 MMT / year
Green hydrogen production capacity targeted by 2030

~125 GW
Associated renewable capacity the Mission expects to add

₹19,744 crore
Initial outlay approved January 2023

WHY IT MATTERS TO YOU

Large converters, HVDC and high-voltage engineering are specialist fields with few experts and growing demand.

HIGH VOLTAGE · HVDC · FACTS · POWER QUALITY · RECTIFIERS

AC OR DC? AC won the "war of the currents" because transformers made voltage easy to change. Today power electronics does the same job for DC — which is why HVDC is chosen for very long overhead lines, undersea cables and links between grids that are not synchronised.

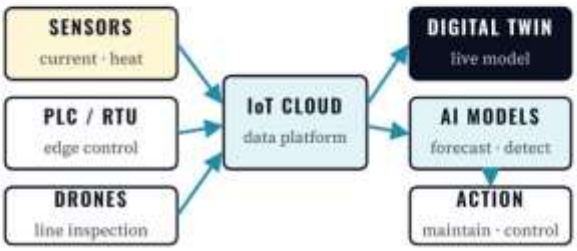
Source: Press Information Bureau / MNRE, National Green Hydrogen Mission (approved 4 Jan 2023): ₹19,744 crore outlay; 5 MMT per annum by 2030 with about 125 GW of associated renewable capacity.

TREND 05

AI, IoT and the digital twin

Data science is becoming part of everyday electrical engineering — from predicting transformer failures to optimising a factory's motors.

Cheap sensors and reliable connectivity mean that motors, transformers, inverters and lines can now report their own health. Machine-learning models trained on this data forecast load and renewable output, detect faults before they happen and schedule maintenance only when it is needed. A *digital twin* — a live simulation kept in step with the real equipment — lets engineers test a change on the model before touching the plant. Industry 4.0 in factories rests on the same foundations our students practised in the PLC and process-control sessions.



From sensor to decision: the data loop behind predictive maintenance.

THE TREND-READY TOOLKIT · WHAT TO LEARN, AND WHERE IT LEADS

TREND	CORE SUBJECTS TO MASTER	TOOLS & CERTIFICATIONS	WHERE IT LEADS
Renewables & storage	Power systems, power electronics, utilisation	PVsyst, ETAP, MATLAB/Simulink; NPTEL courses on solar and grid integration	Solar developers, EPC firms, utilities
Electric mobility	Electrical machines, drives, power electronics	Simulink, PSPICE/Multisim, embedded C; EV certification courses	EV OEMs, charger makers, battery firms
Smart grids	Switchgear & protection, power-system operation	SCADA, IEC 61850 basics, Python for data	DISCOMs, POWERGRID, metering companies
Hydrogen & HVDC	High-voltage engg., FACTS/HVDC, power quality	PSCAD/EMTP, ETAP; GATE preparation for PSU roles	Transmission utilities, PSUs, consultants
AI, IoT & automation	Control systems, instrumentation, microcontrollers	PLC & SCADA, Python, IoT platforms	Process industry, automation & analytics firms

START THIS SEMESTER Pick one trend that excites you · take one matching NPTEL course · build one mini-project in the lab — a PV charge controller, a PLC sequence or an IoT energy meter.

THE EDITORS' TAKEAWAY

None of these trends replaces the fundamentals — circuits, machines, power systems and power electronics remain the foundation. What changes is the toolkit around them. Students who pair strong core knowledge with simulation, programming and one NPTEL certification each semester will be ready for whichever trend shapes their career.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

DEPARTMENT VISION

To impart the best technical education instilled with discipline, values and leadership qualities that will produce professional technocrats in Electrical and Electronics Engineering.

DEPARTMENT MISSION

M1: To impart fundamental Electrical and Electronics Engineering concepts and a broad set of technical skills.

M2: To prepare Electrical and Electronics Engineering graduates who will engage effectively and responsibly in practicing engineering.

M3: To impart practical exposure on latest technological developments in Electrical and Electronics Engineering.

Program Educational Objectives (PEO's)

On successful completion of UG in Electrical and Electronics Engineering, the Graduates will:

PEO1: Have a successful professional career with a strong foundation in basic sciences, along with in-depth knowledge of electrical engineering.

PEO2: Pursue higher studies to contribute for the betterment of the society.

PEO3: Continue in their chosen profession by practicing lifelong learning.

Program Specific Outcomes (PSO's)

PSO1: Using Power Electronics knowledge in conjunction with Electrical Machines understanding to create an engineering solution in the domains of Electrical Drives.

PSO2: Develop innovative cutting-edge technologies in power systems related to efficient electrical power conversion and control.