URJA

Edition 2024–25

Department of Electrical Engineering

Purnea College of Engineering, Bihar

*“The best way to predict the future is to **create** it.”*

— URJA 2024–25

About the Institute

Purnea College of Engineering (PCE), Purnea is one of the premier government engineering colleges in Bihar, functioning under Bihar Engineering University (BEU), Patna. The institute is committed to providing quality technical education and promoting research, innovation, and entrepreneurship among students.

Vision of the Institute

To consistently strive for excellence in engineering education by producing skilled, trained, and knowledge-driven engineers who fit into the current and future requirements of industries, organizations, and society, thereby contributing to the growth of the country.

Mission of the Institute

- To improve the teaching-learning process while making the existing curriculum more contemporary.
- To promote R&D by encouraging innovation.
- To develop practical skills and a high degree of professional ethics.

Vision of the Department

To produce competent electrical engineers with a focus on research, creative minds, innovative ideas, and practical skills for the betterment of mankind.

Mission of the Department

- Impart quality technical education and theoretical foundations.
- Foster research, innovation, and practical aspects in the field of Electrical Engineering.
- Inculcate ethical values and leadership development for creating successful engineers.

HoD's Message

Manoj Kumar Rajak

Head of Department, Electrical Engineering

Welcome to the latest edition of our departmental magazine, **URJA 2024–25**.

The past academic year has been a period of immense growth and resilience. Our students have learned through advanced modalities and rigorous practical sessions. It is a challenge to continually push the boundaries of technology, yet our department thrives through the dedication of our students, teachers, and alumni.

This magazine is a reflection of our department's creativity, innovation, and academic knowledge. We take pride in our outstanding placement records, with top recruiters consistently validating the caliber of our graduates. Our students have shone brightly in competitions like the Smart India Hackathon, proving that outcome-based education is the key to solving real-world problems.

I believe *URJA* will inspire all of you to strive for perfection, design what does not yet exist, and make a lasting impact on society. Let us continue to push the frontiers of what is possible in Electrical Engineering.

EDITORIAL

Priyanka Rani

Assistant Professor

Faculty in Charge, URJA

Engineering is fundamentally about solving real-world problems, but it is also an art of creative execution. **URJA 2024–25** stands as a testament to the fact that our students are not just learners, but innovators and problem solvers.

As the Faculty in Charge, it fills me with immense pride to present this platform which beautifully captures the creativity and knowledge within the Electrical Engineering Department. This magazine is a curated showcase of our students' exceptional talents, blending rigorous technical contributions with remarkable non-technical artistry.

Through these pages, we witness the incredible dedication of our students—whether they are securing top-tier placements, building complex IoT prototypes for the Smart India Hackathon, or expressing themselves through poetry and painting. I sincerely urge every student to utilize this platform to its fullest, to let your ideas flow, and to continue contributing your technical prowess and creative brilliance to our community.

May this edition inspire you to dream bigger and build a brighter future.

EDITORIAL

Sameer

S5, Electrical Engineering

Student Editor, URJA

Creating a magazine that truly reflects the vibrant spirit of our entire department is no small feat. It is a journey of endless collaboration, brainstorming, and collective effort. As the Student Editor for this edition, I am absolutely thrilled to present **URJA 2024–25** to you all.

This magazine represents months of hard work behind the scenes. From curating deeply researched technical articles to gathering stunning artwork, photographs, and personal essays, our editorial team has worked tirelessly to ensure every voice in our department is heard.

I want to express my deepest gratitude to all the students who contributed their articles, art, and time. Your enthusiasm is what makes this magazine come alive. This platform is ours—a space to celebrate our achievements, learn from our technical explorations, and appreciate the immense talent that resides in the classrooms of PCE.

Let's keep this momentum going. Dive in, get inspired, and never stop creating!

“Empowering the Future,” One Circuit at a Time.

“Innovation distinguishes between a leader and a follower.”

CONTENTS

PLACEMENTS & ACHIEVEMENTS

Placement Highlights 2024–25

47
Total Students

22
Placed

47%
Placement Rate

Salary Packages

Highest Package:
₹10 LPA

Average Package:
₹4.2 LPA

Top Recruiters

- **Q-spiders**
- **Techvein IT Solution Pvt. Ltd.**
- **Rinex Technologies**

PLACEMEN

Comprehensive Placement Roster

Table 1: Detailed Placement Records of EE Graduates (2021–2025 Batch)

Sl No.	Batch	Student Name	Company / Institution	Package
1	2021-2025	Muskan Kumari	Q-spiders	4 - 5 LPA
2	2021-2025	Sahil Raj	Q-spiders	4 - 5 LPA
3	2021-2025	Shalini Kumari	Q-spiders	4 - 5 LPA
4	2021-2025	Abhishek Kumar	Q-spiders	4 - 5 LPA
5	2021-2025	Ashish Kr Sharma	Q-spiders	4 - 5 LPA
6	2021-2025	Poonam Kumari	Q-spiders	4 - 5 LPA
7	2021-2025	Aditya Raj	Q-spiders	4 - 5 LPA
8	2021-2025	Aditya Raj	Techvein IT Solution Pvt. Ltd.	3 LPA
9	2021-2025	Divyanshu Gaurav	Techvein IT Solution Pvt. Ltd.	3 LPA
10	2021-2025	Md Jawed	Rinex Technologies	10 LPA
11	2021-2025	Nandani Priya	Rinex Technologies	10 LPA
12	2021-2025	Pragya Kumari	Rinex Technologies	10 LPA
13	2021-2025	Abhishek Kumar	Rinex Technologies	10 LPA
14	2021-2025	Aditya Raj	Rinex Technologies	10 LPA

RECORDS

Achievements

Innovative Projects

The department has seen an influx of high-quality Mini and Major Projects. Teams have developed working prototypes for:

- IoT-based smart energy meters.
- Automated solar tracking systems.
- Micro-grid load balancing algorithms.

Faculty Achievements

Asst. Prof. Priyanka Rani showcased exceptional performance at the divisional level sports events:

- Table Tennis (TT) – **Winner**
- Carrom – **Runner-Up**
- 100m Sprint – **Runner-Up**

Student Achievements

Utkarsh Jha secured **1st Prize** in Instrumental Music at **Extravagenza 2024** hosted by GEC Vaishali.

Vikash kumar demonstrated outstanding performance in **Kabaddi** at **Umang**,representing his team at the intra-college, divisional, and state levels.

Students and faculty being recognized for their achievements and excellence

CAMPUS LIFE & ACADEMICS

State-of-the-Art Laboratories

The Department of Electrical Engineering houses specialized laboratories designed to provide comprehensive practical exposure.

1. Electrical Machines Lab

Equipped with modern AC/DC motors, generators, and transformers for robust core training.

2. Power Systems Lab

Features advanced simulation tools and hardware to study fault analysis, switchgear, and grid stability.

3. Control Systems Lab

Focuses on linear and non-linear control mechanisms, utilizing MATLAB for system modeling.

4. Measurements Lab

Dedicated to precision engineering, featuring digital oscilloscopes, bridges, and advanced instrumentation.

Students performing experiments in the Machine Lab

SMART INDIA HACKATHON

The SIH Journey: 2024 Edition

The September 12, 2024 Hackathon set a remarkable benchmark for software-hardware integration. The internal hackathon witnessed enthusiastic participation, with a total of 60 brilliant minds collaborating to solve real-world challenges. Under the guidance of our SPOC, Asst. Prof. Dheeraj Kumar, and Principal Prof. (Dr.) Manoj Kumar, the event turned out to be a grand success.

Team Name	Team Lead	Team Members
Team Hisenbug	Sameer (EE)	Abhishek Anand, Raushan Chaudhary, Harsh Kumar, Sneha Kumari, Shama Perween
THE WONDER WOMEN	Ritu Priya	Khushi Anand (EE), Muskan Kumari (EE), Rajlakshmi (EE), Shruti Kumari

Team Hisenbug — Featured Innovation

Among all the participating teams, **Team Hisenbug** stood out with their innovative thinking and impactful problem-solving approach. Led by **Sameer (Electrical Engineering)**, the team demonstrated a strong blend of technical expertise and creativity.

Project Nexus is an intelligent and adaptive learning platform designed to transform the way individuals learn. The system understands each learner's **goals, progress, and weaknesses**, creating **personalized learning paths**.

Using **Artificial Intelligence**, the platform continuously adapts content and difficulty, ensuring an efficient and engaging experience.

"A platform that learns how you learn and then teaches you accordingly."

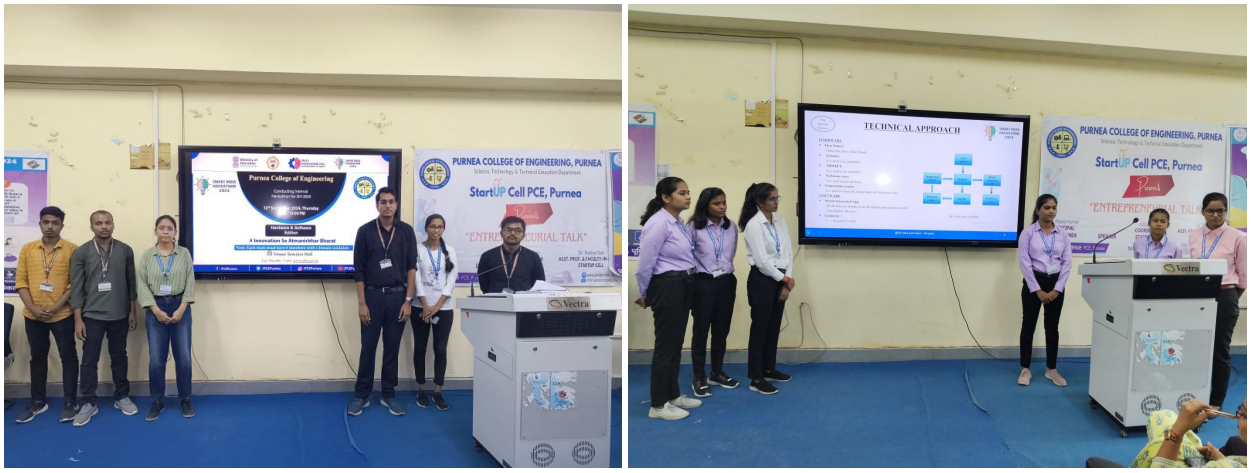
THE WONDER WOMEN — Social Impact Innovation

Another notable team, **THE WONDER WOMEN**, showcased remarkable performance. **Muskan Kumari, Rajlakshmi, and Khushi Anand** from the **Electrical Engineering (EE) branch** played a significant role.

Their project, **MIMA**, is designed to address menstrual health challenges faced by women.

The device combines **heat therapy** and **vibration** to reduce abdominal pain during menstrual cycles. This helps working women continue their daily activities without discomfort.

The idea reflects a meaningful blend of **technology and healthcare**, focusing on improving women's quality of life.



Team Hisenbug and Team Wonder Women presenting their innovative prototypes during SIH 2024.

The hackathon fostered innovation and interdisciplinary collaboration. The active participation of Electrical Engineering students highlights the department's growing impact in national-level platforms like SIH.

TECHNICAL TRENDS

Machine Learning for Load Forecasting

By **Sameer (S5)**

Accurate load forecasting is a critical component of modern power system operation. It enables utilities to balance electricity generation and demand efficiently, reduce operational costs, and ensure grid stability. Traditionally, forecasting relied on statistical models such as linear regression:

$$L(t) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_n x_n$$

where $L(t)$ represents load demand and x_i are influencing factors such as temperature and time.

Machine Learning (ML) is now transforming load forecasting by leveraging large volumes of historical and real-time data. By analyzing patterns such as weather conditions, time of day, seasonal variations, and consumer behavior, ML models can predict electricity demand with significantly higher accuracy.

The rapid evolution of modern infrastructure has placed unprecedented demands on the electrical engineering sector. Today, professionals in the field are required to seamlessly blend classical principles of power generation with cutting-edge digital integration. The shift towards decentralization, marked by the widespread adoption of renewable energy sources such as solar and wind, has fundamentally altered the architecture of the traditional power grid. Microgrids and localized energy storage solutions are no longer experimental concepts but essential components of robust national infrastructures.

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As we look toward the next decade, the electrification of the automotive industry presents another monumental challenge and opportunity. The deployment of vast charging networks necessitates a complete reimagining of urban power distribution. Engineers are currently exploring innovative solutions such as vehicle-to-grid (V2G) technologies, which allow electric vehicles to serve as mobile energy storage units, feeding power back into the grid during peak demand hours.

Coupled with these technological advancements is a growing emphasis on sustainabil-

AIINPOWER

ity and environmental impact. The transition away from fossil fuels is accelerating, driving research into next-generation photovoltaic cells, high-efficiency wind turbines, and advanced battery chemistries like solid-state lithium. To navigate this complex landscape, academic institutions must continually adapt their curricula, ensuring students are exposed to industry-standard software, hands-on laboratory experiences, and interdisciplinary projects.

One of the most widely used approaches is Artificial Neural Networks (ANN), where the output is computed as:

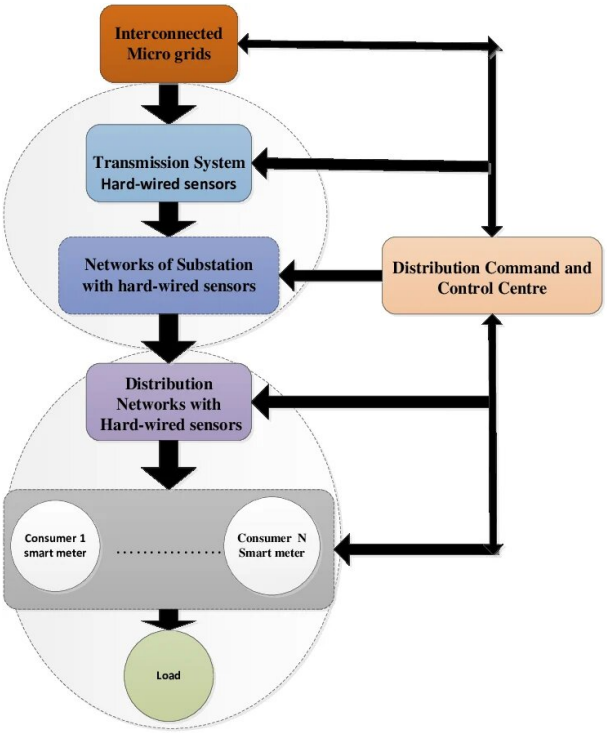
$$y = f\left(\sum_{i=1}^{n} w_i x_i + b\right)$$

Here, w_i represents weights, b is bias, and $f(\cdot)$ is an activation function such as ReLU or sigmoid.

Advanced models like Recurrent Neural Networks (RNN) and Long Short-Term Memory (LSTM) capture time dependencies:

$$h_t = f(W_h h_{t-1} + W_x x_t + b)$$

These models continuously improve as more data becomes available, making them highly adaptive and reliable.



Machine learning-based load forecasting architecture for energy prediction

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Forecast accuracy is typically evaluated using metrics such as Mean Absolute Error (MAE) and Root Mean Square Error (RMSE):

$$MAE = \frac{1}{n}\sum_{i=1}^{n}|y_i - \hat{y}_i|$$

$$RMSE = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(y_i - \hat{y}_i)^2}$$

Lower values of these metrics indicate better prediction performance.

> *"Machine learning enables power systems to anticipate demand, adapt in real-time, and operate with unprecedented efficiency."*

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The integration of ML-based forecasting into smart grids enhances decision-making, reduces energy wastage, and supports the integration of renewable energy sources like solar and wind. Mathematically, optimal power scheduling can be expressed as:

$$\min \sum_{t} C(P_t)$$

$$\text{subject to} \quad \mathrm{P}_t = L_t$$

where $C(P_t)$ is generation cost and L_t is predicted load demand.

The New Energy Paradigm

Prepared by: **Manikant Kumar (S1)**, **Ronit Raj (S1)**, **Avinash (S1)**

The Shock of the New: Why Our Grid is in Overdrive

The flip of a light switch has been a defining action of the 20th century, symbolizing reliable comfort. Yet, the invisible infrastructure that powers it—the electrical grid—is undergoing its most profound transformation since its inception. This is not merely an upgrade; it is a complete redesign of how society produces and consumes energy.

Traditionally, power systems relied on centralized generation such as coal and nuclear plants, where electricity flowed in a single direction—from generation to consumers. This model emphasized stability and predictability. However, the growing demand for decarbonization has introduced renewable energy sources like solar and wind, fundamentally changing the dynamics of energy distribution.

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ENERGY

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The Core Integration Challenge

A System Under Strain

The modern grid faces two major challenges:

1. **Intermittent Generation:** Unlike traditional power plants, renewable sources are non-dispatchable. Solar and wind energy depend on environmental conditions, leading to a mismatch between supply and demand.

2. **Unbalanced Grids:** With the rise of distributed generation, consumers are becoming "prosumers." Energy now flows in both directions, creating stress on infrastructure and introducing issues like harmonics and inefficiencies.

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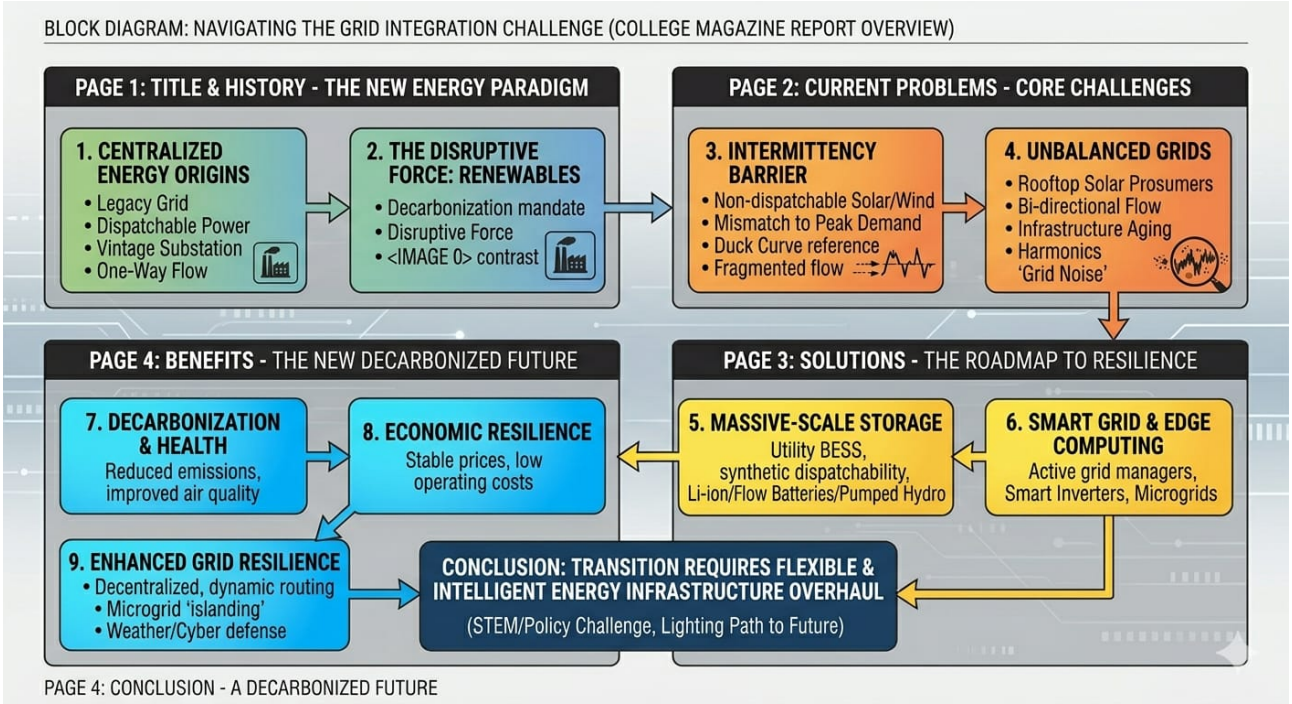

Smart grid integration with renewable energy sources and distributed generation systems

The Roadmap to Resilience

Powering Through: The Solutions

To overcome these challenges, several advanced solutions are being implemented:

1. Energy Storage Systems: Battery Energy Storage Systems (BESS) store excess renewable energy and supply it during peak demand. Technologies such as lithium-ion batteries, flow batteries, and pumped hydro storage play a crucial role in stabilizing the grid.

2. Smart Grid and Edge Computing: Modern grids incorporate intelligent systems such as smart inverters and microgrids. These systems enable real-time monitoring, decentralized control, and improved grid stability.

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> *"The future grid is not just electrical—it is intelligent, adaptive, and decentralized."*

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A Decarbonized Future

Modernizing the grid offers multiple benefits:

• **Environmental Impact:** Significant reduction in CO_2 emissions and improved air quality.

• **Economic Stability:** Renewable energy provides long-term cost efficiency and price stability.

• **Grid Resilience:** Decentralized systems reduce the risk of large-scale failures.

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Conclusion

The electrical grid is the largest machine ever built, and transforming it is one of the greatest engineering challenges of our time. For students, this transition represents an exciting opportunity to innovate at the intersection of electrical engineering, AI, and sustainability. The future of energy is not just about powering homes—it is about powering progress.

Social Initiatives

Our students recognize their duty to society and the environment. We actively organize and participate in:

- **Energy Awareness Campaigns:** Educating local communities on power saving and electrical safety.
- **Tree Plantation Drives:** Contributing to a greener campus and local ecosystem.
- **Swachh Bharat:** Active participation in cleanliness drives within and around the campus.

Future Plans

As we look to the horizon, the department has charted out ambitious goals:

1. **NBA Accreditation:** Strengthening our academic parameters to secure full accreditation.
2. **Renewable Energy Lab:** Establishing a dedicated, state-of-the-art research facility.
3. **Industry Collaborations:** Signing new MoUs with leading power and tech firms.
4. **Smart Classrooms:** Upgrading to fully interactive, digital classroom environments.

Acknowledgement

We sincerely thank the **Principal**, dedicated **faculty members**, hardworking **students**, the entire **editorial team**, and the tireless **supporting staff** for their valuable contributions in making this academic year and this magazine overwhelmingly successful. This platform stands as a testament to our collective effort and unity.

MEGA CAMPUS GALLERY

Glimpses of Academic Year 2024–25

GALLERY

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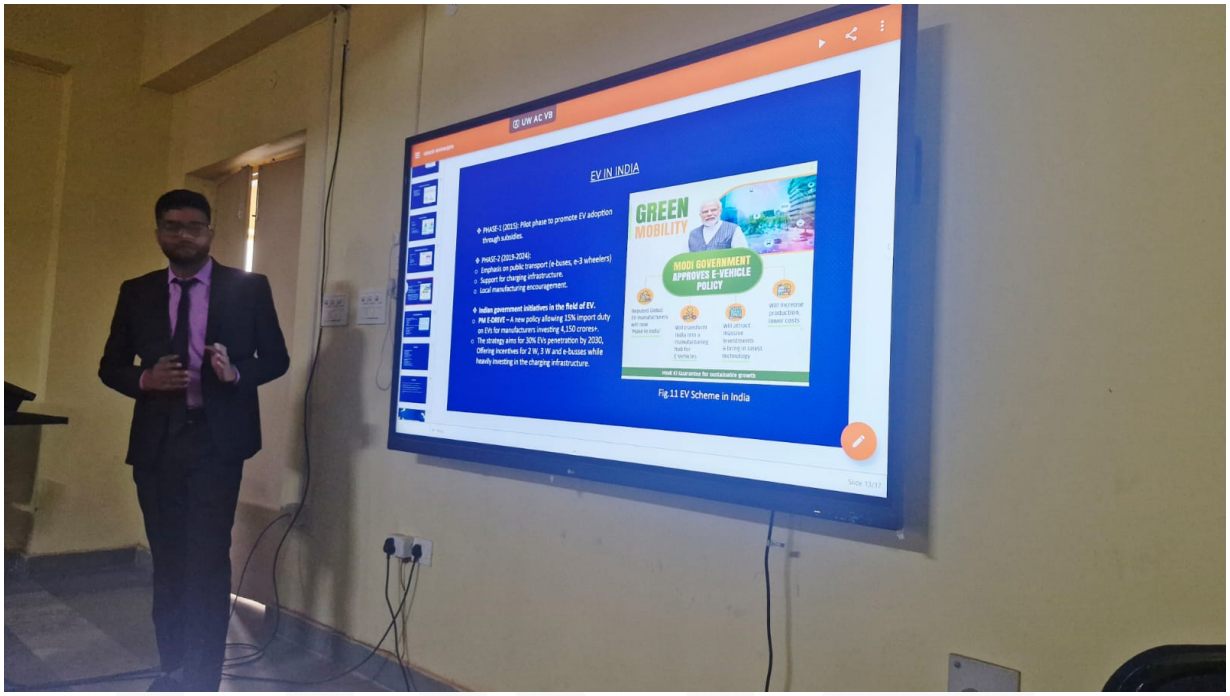

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Department of Electrical Engineering

Purnea College of Engineering, Bihar

Under Science, Technology & Technical Education Department

Govt. of Bihar

Contact Information

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