MINCHU Newsletter

Department of Electrical & Electronics Engineering

Volume 11 | Issue 1 | February 2025

Mission of the Institute

Vision

- To be one of the premier Institutes of Engineering and Management Education in the country

Mission

- To provide Engineering and Management education that meets the needs of human resources in the country
- To develop leadership qualities, team spirit and concern for environment in students

Objectives

- To provide Engineering and Management education that meets the needs of human resources in the country.
- To develop leadership qualities, team spirit and concern for environment in students.

Vision and Mission of the Department

Vision

- To be a premier department for education in Electrical & Electronics Engineering in Karnataka State, molding students into professional Engineers.

Mission

- To provide teaching/learning facilities in Electrical & Electronics Engineering better than prescribed by the University for easy adaptation to industry and higher learning.
- To Provide environment for self-learning to meet the challenges of changing technology and inculcate team spirit and leadership qualities to succeed in professional career.
- Empathize with the societal needs and environmental concerns in Electrical & Electronics engineering practices.

Josh Wong

*Josh Wong, **the CEO of ThinkLabs** AI, is a prominent figure in the field of AI-driven smart grid management.*

Under his leadership, ThinkLabs AI is pioneering the integration of artificial intelligence into the electrical grid systems, aiming to enhance efficiency, reliability, and sustainability. Wong's vision involves developing autonomous grid management solutions that leverage "physics- or engineering-informed AI" to automate dynamic planning and grid orchestration. This approach seeks to modernize energy distribution and consumption, facilitating a smoother transition to renewable energy sources and smarter electrical infrastructure. His work is instrumental in transforming traditional power grids into intelligent systems capable of real-time decision-making and adaptive responses, thereby addressing the complexities of modern energy demands and contributions significantly to the advancement of smart grid technologies.

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EDITOR'S DESK

Hello Readers!

Welcome to another electrifying edition of MINCHU! The world of electrical and electronics engineering is evolving at an unprecedented pace, shaping the future with groundbreaking advancements. Innovation is at the heart of this field, powering industries, revolutionizing energy solutions, and enhancing everyday life. From harnessing renewable energy more efficiently to developing smarter electrical grids, technology is redefining the way we generate, store, and distribute power. The rapid rise of automation, artificial intelligence, and semiconductor technologies is paving the way for faster, more efficient, and sustainable solutions. Wireless energy transfer, quantum computing, and next-generation power systems are breaking traditional barriers and opening up limitless possibilities. Electric mobility and advancements in battery storage are ensuring a cleaner and more efficient future. As the world transitions towards smarter and more connected systems, the role of electrical and electronics engineers has never been more crucial. This issue brings you the latest trends, insights, and innovations that are shaping the future.

Happy reading

-The MINCHU Editorial Team

ABOUT THE DEPARTMENT

Since its inception in 2002, the Department of Electrical and Electronics Engineering at BNMIT has garnered a respected name in the state. Renowned for its commitment to excellence, the department offers a comprehensive Undergraduate Program in Electrical and Electronics Engineering. The faculty at BNMIT's Department of Electrical and Electronics Engineering are distinguished professionals who ensure that the courses foster deeper learning and increased engagement among students. The department boasts state-of-the-art research centers in High Voltage Technology and Electric Vehicle (EV) Technology. These centers provide a platform for cutting-edge research and innovation, contributing significantly to advancements in these critical fields. Additionally, the department regularly invites industrial personnel to train students, ensuring they are equipped with the latest skill sets required in the industry. The Department of Electrical and Electronics Engineering has been accredited by the National Board of Accreditation (NBA), a testament to our commitment to maintain high standards of education. The department also hosts an Electric Vehicle (EV) Club, providing students with opportunities to explore the exciting world of electric vehicles. This club encourages innovation and practical application of theoretical knowledge, further enhancing the learning experience.

PUNNY ELECTRICAL CROSSWORDS

By Darshan S gowda

ACROSS

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7 Why was the wire always confident?(9)

8 What's a tranformer's favorite sport?(5)

9 EE students' Worst nightmare(7,4)

10 Why did the inductor fail the test?(3)

14 What a resistor says when it gets too much voltage? (4,3,4)

15 The Worst thing to drop in a circuit?(8)

16 What do you call an overworked electrical engineer?(7)

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2 Why do electrical engineers love AC? Because it's... (9)

3 What's an electrical engineer's favorite place to relax?(6,5)

4 What do you call an electrician with superpowers?(9)

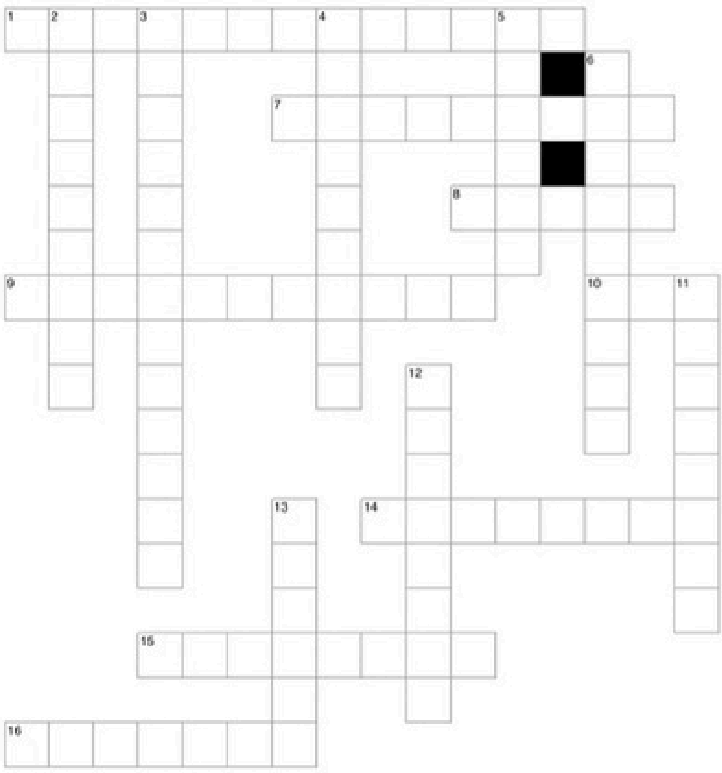
5 What do electrical engineer who just won the lottery?(6)

6 An electrical engineer's favorite metal band?(9)

11 Why was the circuit always calm?(8)

12 What electricians say when they finish a circuit.(6,2)

13 What electrical engineers do when they meet? (6)



Across: **1** MagneticField, **7** Insulated, **8** Relay, **9** LaplaceTest, **10** Lag, **14** OhmMyGod, **15** Resistor, **16** Burnout.

Down: **2** Alternate, **3** NeutralGround, **4** Conductor, **5** Loaded, **6** Metallica, **11** Grounded, **12** LightsOn, **13** Resist.

TECHNICAL ARTICLES

The Future of Power Electronics: The Rise of Wide Bandgap Semiconductors

The landscape of power electronics is transforming with Wide Bandgap (WBG) Semiconductors, which are redefining efficiency, power density, and energy sustainability. Traditional silicon (Si) is reaching its limits, paving the way for Silicon Carbide (SiC) and Gallium Nitride (GaN) to revolutionize electric vehicles, renewable energy, smart grids, aerospace, and high-frequency power applications

Why Wide Bandgap?

A semiconductor's bandgap determines its electrical properties. Compared to Si (1.1 eV), SiC (3.3 eV) and GaN (3.4 eV) offer:

Higher Breakdown Voltage – Handles high power levels.

Faster Switching Speeds – Reduces power losses.

Lower Heat Dissipation – Enables compact, high-efficiency designs.

Greater Energy Efficiency – Minimizes power consumption.

Enhanced Thermal Conductivity – Improves device reliability.

Industries Being Revolutionized

1. Electric Vehicles (EVs) & Charging Infrastructure

SiC-based MOSFETs are replacing traditional silicon-based IGBTs, offering:

Extended EV Range – Reduced switching losses.

Ultra-Fast Charging – Higher power density in charging stations.

Compact, Lightweight Powertrains – Improved thermal management.

2. Renewable Energy & Smart Grids

SiC & GaN are advancing:

- Solar & Wind Energy Conversion – Increased inverter efficiency.
- Grid Integration – Decentralized energy distribution.
- Battery Storage Systems – Improved retention and supply.

3.High-Frequency Power Supplies & Wireless Power Transfer

GaN transistors are revolutionizing:

- Wireless Charging – Higher efficiency, minimal losses.
- Compact Power Adapters – Ultra-fast charging for devices.
- Advanced RF & Satellite Communication – Enhanced signal transmission.

4. Power Transmission & Smart Infrastructure

SiC power devices support:

- HVDC Transmission – Reducing losses over long distances.
- Smart Cities & AI-Driven Energy Management – Optimizing power distribution.
- Industrial Automation & Robotics – High-efficiency power applications.

Challenges and Innovations

Despite advantages, WBG adoption faces:

- Higher Material Costs – Fabrication remains expensive.
- Complex Manufacturing – Requires advanced packaging techniques.
- Limited Large-Scale Production – Scaling challenges exist.

However, R&D investments are making WBG semiconductors more accessible, accelerating a global energy-efficient transition.

Conclusion:

A New Era in Power Electronics SiC and GaN are not just improving existing technologies but leading technological revolution. Their unmatched efficiency and high-power capabilities are transforming EVs, renewable energy, wireless power, and intelligent grids. As industries embrace WBG technologies, the future of power electronics is set to be faster, more powerful, and more sustainable than ever before.

Happy reading and stay inspired as we move towards a smarter, electrified future!

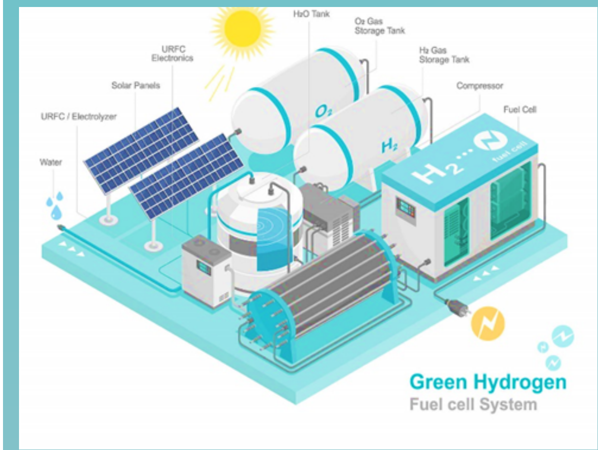
-Daneshwari Surkod
4th Sem,EEE

GREEN HYDROGEN AND ELECTRICAL SYSTEM

Green hydrogen is poised to play a vital role in the global transition to sustainable energy. This is produced through the electrolysis of water powered by renewable energy sources, offers a clean and versatile energy carrier. This process involves using electricity to split water molecules into hydrogen and oxygen, resulting in zero greenhouse gas emissions.

Green hydrogen is an essential component in combating climate change. Hydrogen fuel cells are more efficient than many other energy sources, including many green energy solutions. This fuel efficiency allows for the production of more energy per unit of fuel. Green hydrogen can be used flexibly in a variety of applications, including energy transmission, generation, and storage. It can also be utilized in vehicles powered by hydrogen, such as trains, ships, and planes, eliminating emissions of atmospheric pollutants in transport. Advancements in electrolysis technologies are enhancing the efficiency and scalability of green hydrogen production. Integrating electroliers directly with renewable energy sources, such as solar and wind, eliminates the need for traditional power converters, streamlining operations and reducing costs. In India, regions like West Bengal are exploring the integration of green hydrogen into renewable energy systems. Studies have modelled hybrid energy systems that combine photovoltaic and wind power with hydrogen production, aiming to optimize energy output and economic feasibility.

Internationally, countries are actively pursuing green hydrogen initiatives. Germany plans to invest heavily in hydrogen infrastructure including the development of hydrogen pipelines and production facilities, aiming to transform its energy landscape. Similarly, Denmark is leveraging its North Sea wind resources to produce green hydrogen, positioning the region as a "green power plant of Europe."Green hydrogen is a sustainable and environmentally friendly alternative to traditional hydrogen production methods. This aligns with global efforts to transition to cleaner energy systems. In summary, green hydrogen's zero-emission production, high energy efficiency, versatility, and sustainable production methods position it as a superior alternative to other gases in the pursuit of clean energy solutions.



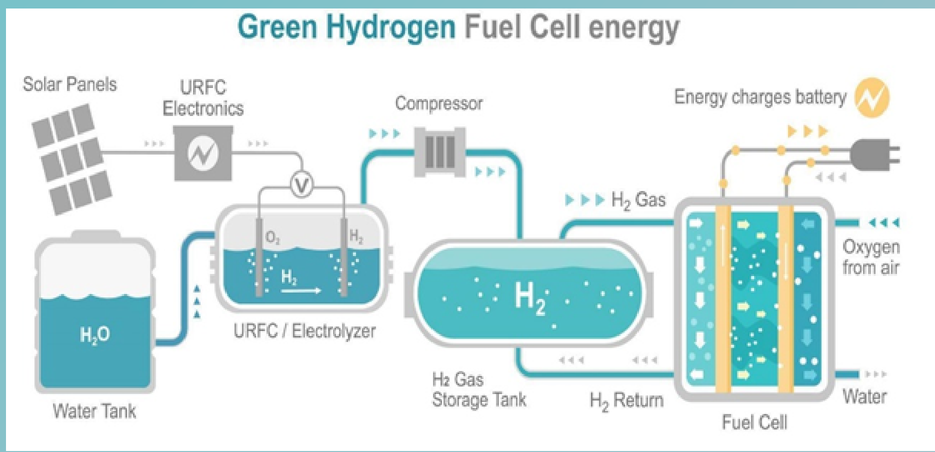


Fig 1.Green Hydrogen Fuel Cell energy

- Sowmya.M.Kumarji
4th sem,EEE

AI-Driven Smart Grid Management

As the world becomes increasingly dependent on technology and sustainability, electrical infrastructure must evolve to meet new demands. Traditional power grids, built for a different era, are no longer sufficient to address the challenges of modern energy systems. From the rise of renewable energy sources to the unpredictability of energy demand, the need for a more resilient, efficient, and flexible system is undeniable. Enter the era of AI-driven smart grid management -a transformative shift that promises to optimize electrical grid performance and make energy consumption smarter, more sustainable, and reliable.

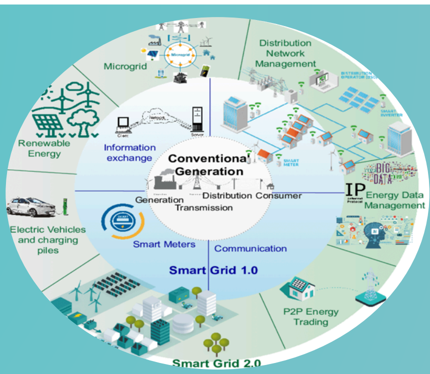
Real-time monitoring: AI algorithms continuously analyze data from smart meters, sensors, and other grid components to identify potential issues like voltage fluctuations, overloaded lines, or impending outages.

Demand Forecasting: By analyzing historical usage patterns and weather data, AI can predict future energy demand, allowing utilities to proactively adjust generation and distribution accordingly.

Load balancing: AI can optimize power flow across the grid by dynamically adjusting power distribution to different areas based on real-time demand, minimizing energy losses.

Renewable energy integration: AI can effectively manage the intermittent nature of renewable sources like solar and wind power by adjusting grid operations to accommodate fluctuations in generation.

Predictive maintenance: By identifying patterns in sensor data, AI can predict equipment failures before they occur, enabling preventative maintenance and reducing downtime. By proactively addressing potential issues and optimizing power flows, AI can reduce the frequency and duration of power outages resulting in improved grid reliability. Efficient grid management can lead to lower operating costs by minimizing energy losses, helping in cost reduction. As these technologies continue to evolve, the potential for AI to revolutionize energy management is limitless, helping to build the energy grid that is smarter, greener, and more reliable.



Shreya S
IV Sem,EEE

Battery Swapping Stations: A Solution for Electric Vehicle Adoption

The transition to electric vehicles (EVs) is pivotal in reducing greenhouse gas emissions and mitigating climate change. While EVs offer a sustainable alternative to traditional vehicles, challenges such as limited driving range, long charging times, and inadequate infrastructure continue to hinder their widespread adoption. Battery swapping stations (BSS) have emerged as a promising solution to these barriers, offering several advantages over conventional charging methods. One of the primary concerns of EV drivers is range anxiety, the fear of running out of battery charge before reaching a charging station. Battery swapping stations address this by allowing drivers to quickly exchange depleted batteries for fully charged ones, reducing downtime and eliminating concerns about battery life. This method offers significant time-saving benefits, as swapping a battery can take just minutes, compared to several hours for traditional charging. The infrastructure challenges faced by EV adoption are particularly evident in developing nations, where rapid urbanization has strained existing facilities. BSS offers a practical alternative by creating flexible, mobile charging options that don't require as much infrastructure investment. The accessibility of these stations can be further enhanced by strategically placing them along popular routes, benefiting areas where charging stations may be sparse or unavailable. The cost-effectiveness of battery swapping stations is another compelling advantage. While setting up a BSS may require substantial initial investment, it can become cheaper than traditional charging infrastructure over time. By ensuring more efficient battery usage and extending the lifespan of batteries, BSS can reduce the frequency of replacements and lower the overall costs for both consumers and service providers. Battery swapping techniques vary based on the vehicle type and the design of the station. Some common techniques include ,sideways battery swapping, where batteries are replaced from the side of the vehicle, bottom battery swapping, used for vehicles with bottom-mounted batteries. The functioning of a BSS involves a well-coordinated system of communication between the vehicle, the station, and an information management system. When an EV's battery is low, the vehicle communicates with the station via cloud-based data storage. The station prepares the appropriate battery, and upon the vehicle's arrival, the driver verifies their identity and battery details. The old battery is then inspected for wear and degradation, ensuring it is suitable for future use or disposal.

In conclusion, battery swapping stations present a highly effective solution to the barriers hindering the widespread adoption of electric vehicles. By addressing concerns about range anxiety, infrastructure limitations, time efficiency, cost, and environmental impact, BSS could play a critical role in accelerating the global transition to sustainable transportation. As the technology evolves, it is expected that battery swapping will become a key component in the EV ecosystem, further enhancing the convenience and efficiency of electric mobility.

Revanth BV
6th sem,EEE

Application of Power Electronics in Smart Grids Introduction

The increasing demand for efficient, reliable, and sustainable power systems has led to the evolution of smart grids. A smart grid integrates digital communication, automation, and control technologies to enhance electricity generation, distribution, and consumption. Power electronics plays a crucial role in smart grids by enabling efficient power conversion, grid stabilization, and the integration of renewable energy sources.

Key Applications of Power Electronics in Smart Grids

1. Renewable Energy Integration

Power electronics facilitates the seamless integration of renewable energy sources like solar and wind into the grid. Grid-tied inverters convert the DC output from solar panels and wind turbines into AC for grid compatibility.

- **Energy Storage Systems (ESS)**

Energy storage helps balance supply and demand, ensuring grid stability. Battery Energy Storage Systems (BESS) use bidirectional converters to charge and discharge energy efficiently. Super capacitors and flywheels provide rapid response to voltage fluctuations and frequency variations.

- **Electric Vehicles (EVs) and Charging Infrastructure**

Power electronics enables fast charging stations and wireless power transfer(WPT) for EVs. Vehicle-to-Grid (V2G) technology allows EVs to feed power back into the grid, enhancing energy management and demand response.

- **Power Quality and Grid Stability**

Maintaining high powerquality is essential for a reliablesmart grid. FlexibleAC Transmission Systems (FACTS) and Dynamic Voltage Restorers (DVRs) help regulate voltage, reduce harmonics, and improve power factor. Active Power Filters (APFs) mitigate power distortions caused by non-linear loads.

- **Micro grids and Distributed Generation**

Micro grids, which operate independently or in conjunction with the main grid, rely on power electronics for seamless transitions between grid-connected and islanded modes. DC-DC converters and grid-forming inverters enable stable micro grid operation with solar, wind, and energy storage integration.

Conclusion:

Power electronics is a fundamental enabler of smart grids, ensuring efficient energy conversion, grid stability, and seamless renewable energy integration. As smart grid technologies advance, innovations in wide-bandgap semiconductors (SiC and GaN), artificial intelligence (AI)- based control systems, and advanced power converters will further enhance grid reliability and efficiency.

Reference IEEE papers :

A. Ghosh, “Power Electronics in Smart Grid: Progress and Challenges,” IEEE Transactions on Smart Grid.

B. Singh et al., “Power Electronics in Renewable Energy Systems and Smart Grid,” IEEE Transactions on Industrial Electronics.

Vaishnavi Kotarki
6th sem,EEE

Polymer Insulator: A Modern Alternative in Electrical Systems

Polymer insulators have gained significant attention in the electrical industry as a modern alternative to traditional porcelain and glass insulators. Their lightweight nature, high mechanical strength, and superior resistance to environmental factors make them a preferred choice for high-voltage transmission and distribution systems.A polymer insulator is an electrical insulator made from composite materials, primarily consisting of a fiberglass-reinforced core, an elastomeric housing, and sheds made of silicone rubber, EPDM (ethylene propylene diene monomer), or other polymeric materials. These insulators are used to support and isolate electrical conductors while preventing leakage currents and ensuring reliable operation.

Advantages of Polymer Insulators:

1. Lightweight – Polymer insulators are significantly lighter than porcelain and glass insulators, reducing transportation and installation costs.
2. High Mechanical Strength – The fiberglass core provides excellent tensile strength, making them ideal for high-tension applications.
3. Resistance to Pollution – Their hydrophobic nature prevents the accumulation of contaminants, reducing the risk of flashover.
4. Impact and Vibration Resistance – Unlike porcelain, polymer insulators do not shatter under mechanical stress or vibration.
5. Better Performance in Harsh Environments – They withstand extreme weather conditions, UV radiation, and chemical exposure.

Disadvantages of Polymer Insulators

1. Aging and Degradation – Exposure to UV rays, moisture, and pollution can cause surface degradation over time.
2. Limited Long-Term Experience – Compared to porcelain and glass insulators, polymer insulators have a shorter field history.
3. Potential for Manufacturing Defects – Quality control is crucial as inconsistencies in production may lead to failures.

Applications of Polymer Insulators

1.Transmission and Distribution Networks – Used in high-voltage overhead lines for power transmission.
2.Railway Electrification – Provides electrical isolation in railway traction systems.
3.Substations and Switchgear – Ensures safe operation of electrical components.
4.HVDC and HVAC Systems – Applied in high-voltage direct current and alternating current systems.

Conclusion

Polymer insulators have revolutionized electrical insulation technology due to their superior performance, lightweight structure, and resistance to environmental degradation. While they come with certain challenges, advancements in material science and manufacturing techniques continue to improve their reliability and lifespan. As the electrical industry moves toward modern and efficient solutions, polymer insulators are expected to play a crucial role in the future of power transmission and distribution.

Shreelakshmi P
6th sem,EEE

DEPARTMENT ACTIVITIES

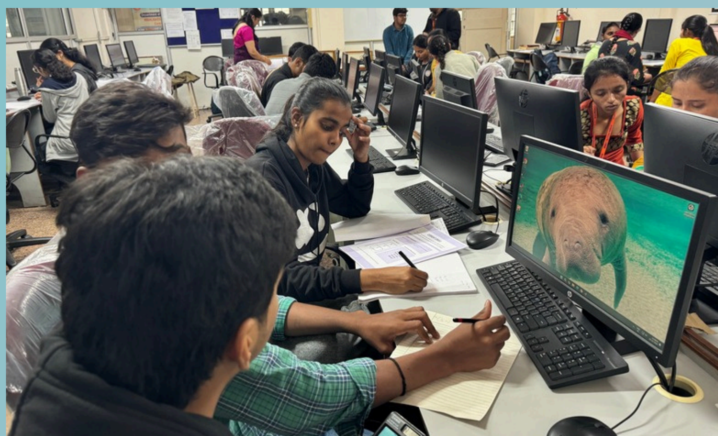
IEEE PES Inauguration

IEEE VTS Inauguration

Raguveer Talk

Talk on Overwiew of Power Sector In Karnataka

SDP Program conducted

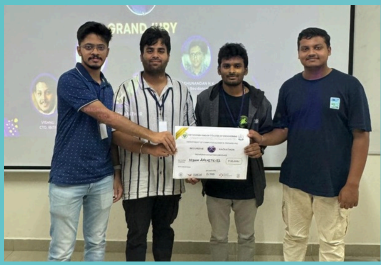


IEEE week Current crisis event-4

IEEE International Conference on Intelligent and Innovative Technologies in Computing, Electrical and Electronics (ICIITCEE 2023) was organized by BNM Institute of Technology, Bengaluru, India on 27 and 28 January 2023

STUDENT ACHIEVEMENTS

Gaurav Anand B.M 8th sem,EEE reached the #EcoEquify #Hackathon finals by IBM Skills Build & BNM Institute of Technology.



Anjan Kumar with his team members won the recursive hackathon conducted by DSCE bangalore and won a cash prize of Rs 20K

NCC conducted an event on Pick n Speak, in collegeon NCC Day, Rishith Kakshyap won 1st prize

AutoDesk Fusion India Design Week, Chennai 2024

Tejal Ravikumar, Prisha Vutti, Varuniha M, and Vaibhav B Patil (6th sem, EEE) secured 2nd place at the IEEE Project Expo, GSSS Institute, Mysore, for their project on a smart voting mechanism using face and fingerprint recognition with ML.

The Code Crunch Hackathon by BNMIT and MathWorks focused on AI, vision, and signal processing. Participants used MATLAB to tackle real-world challenges, fostering creativity and teamwork.

The EV car has been designed by IV semester students from scratch by the gudiance of Capabl.

STAFF ACHIEVEMENTS

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2. Dr. P.N Champa and Abhay. A. Deshpande, Multilevel inverter: harmonic analysis with and without filters for RL load using SPWM techniques Indonesian Journal of Electrical Engineering and Computer Science Vol. 34, No. 2, May 2024, pp. 756~767 ISSN: 2502-4752, DOI: 10.11591/ijeecs.v34.i2.pp756-76 (Q3-SCI Journal).
3. Dr. P.N Champa and Abhay. A. Deshpande Asymmetric Multilevel Inverter using Nearest Level Control JOURNAL OF TECHNOLOGY, volume-12-issue-4-2024, Page No:75-87 DOI:18.15001/JOT.2024/V12I4.24.3154 (Scopus Journal).
4. Dr. Madhu S Effect of varying stiffness on the performance of Air Foil Journal Bearing Tuijin Jishu/ Journal of Propulsion Technology, ISSN: 1001-4055, Vol. 45, No.2 (Scopus Journal).
5. Dr. Ravikumar R N, Dr. Madhu S Over the Air Updates in Modern vehicles Scopus and UGC approved journal Computer Research and Development, December 2024, ISSN: 1000-1239, Volume 24, Issue 12.
6. Dr. Shubha Rao K System Modelling and Simulation Analysis of Battery Pack with Passive Cell Balancing International Journal of Latest Technology in Engineering, Management & Applied Science, Volume XII Issue VII/July 2023,ISSN 2278-2540.
7. Dinesh.B, Kaushik. K, Pavan. A. C, Yashas.R, Dr. Shubha Rao K IoT Enabled Solar Panel Cleaning System International Journal of Research and Analytical Reviews (IJRAR) (www.ijrar.org) UGC Approved - Journal.

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Sanjana Alladwar ,VI Sem(Designer)
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