

NANDHA TECHPULSE- 23

A TECHNICAL MAGAZINE

DEPARTMENT OF EEE



NANDHA

COLLEGE OF TECHNOLOGY

NANDHA COLLEGE OF TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION OF THE DEPARTMENT

- To be a Centre of Excellence in the field of Electrical and Electronics Engineering with Global Standards of Academic and Research for the need of Society and Industry.

MISSION OF THE DEPARTMENT

- To provide value based Electrical Engineering Education and Produce Innovative, Competent and High Quality Electrical and Electronics Engineering Professionals for the growing demand of Society and Industry.
- To facilitate the students for the constant up gradation of Technical Expertise and Perform Research Activities to Solve the Real-World Problems.

PROGRAMME OUTCOMES:

Program outcomes are statements conveying the intent of a program of study. Specifically, program outcomes refer to what a student should know or be able to do at the end of a program. They are often seen as the knowledge and skills students will have obtained by the time they have received their intended degree.

Programme Outcomes

- 1.Engineering knowledge:** Apply knowledge of mathematics, basic science and engineering science
- 2.Problem analysis:** Identify, formulate and solve engineering problems.
- 3.Design/development of solutions:** Design an electrical system or process to improve its performance, satisfying its constraints.
- 4.Conduct investigations of complex problems:** Conduct experiments in electrical and electronics systems and interpret the data.
- 5.Modern tool usage:** Apply various tools and techniques to improve the efficiency of the system.
- 6.The engineer and society:** Conduct themselves to uphold the professional and social obligations.
- 7.Environment and sustainability:** Design the system with environment consciousness and sustainable development.
- 8.Ethics:** Interacting industry, business and society in a professional and ethical manner.
- 9.Individual and team work:** Function in a multidisciplinary team.
- 10.Communication:** Proficiency in oral and written Communication.
- 11.Project management and finance:** Implement Cost effective and improved system.
- 12.Life-long learning:** Continue professional development and learning as a life-long activity.

The Program Educational Objectives (PEOs) 2017 regulation

- To have successful technical and professional careers in their chosen fields such as circuit theory, Field theory, control theory and computational platforms.
- To Engross in life long process of learning to keep themselves abreast of new developments in the field of Electronics and their applications in power engineering.

The Program Educational Objectives (PEOs) 2021 regulation

- Find employment in Core Electrical and Electronics Engineering and service sectors.
- Get elevated to technical lead position and lead the organization competitively.
- Enter into higher studies leading to post-graduate and research degrees. Become consultant and provide solutions to the practical problems of core organization.
- Become an entrepreneur and be part of electrical and electronics product and service industries.

Program Specific Outcomes (PSOs) – 2017 Regulation

- **PSO1:** To Analyze the Foundations of Electrical and Electronics Engineering
- **PSO2:** To Computing the Mathematical Concepts and Research in Electrical Sectors

Program Specific Outcomes (PSOs) – 2021 Regulation

- **PSO1:** Foundation of Electrical Engineering: Ability to understand the principles and working of electrical components, circuits, systems and control that are forming a part of power generation, transmission, distribution, utilization, conservation and energy saving. Students can assess the power management, auditing, crisis and energy saving aspects.
- **PSO2:** Foundation of Mathematical Concepts: Ability to apply mathematical methodologies to solve problems related with electrical engineering using appropriate engineering tools and algorithms.
- **PSO3:** Computing and Research Ability: Ability to use knowledge in various domains to identify research gaps and hence to provide solution which leads to new ideas and innovations.

Cybersecurity in Electrical Systems

Cybersecurity in electrical systems has become a critical concern as power grids, industrial control systems, and smart devices become increasingly digitized and interconnected. With the rise of smart grids, Internet of Things (IoT) devices, and automated systems, the vulnerability of electrical infrastructure to cyberattacks has grown significantly.



Power grids, which once operated in isolation, are now part of vast, interconnected networks with real-time data flows between power generation, distribution, and consumers. This digitization has improved efficiency but also exposed grids to cybersecurity threats such as hacking, malware, and denial-of-service (DoS) attacks. A successful attack on a power grid can disrupt electricity supply, cause financial losses, and even threaten national security.

Industrial control systems (ICS), widely used in electrical systems for power plants and manufacturing, are also at risk. Cyberattacks targeting ICS could result in equipment malfunction, production delays, or even safety hazards. Protecting these systems requires advanced cybersecurity measures such as firewalls, intrusion detection systems, and secure communication protocols.

In the era of **smart devices** and the IoT, the challenge extends to millions of interconnected devices used in homes, businesses, and industries. Devices like smart meters, thermostats, and sensors collect and transmit vast amounts of data, creating potential entry points for cybercriminals. Ensuring security involves encrypting data, securing wireless communications, and constantly updating software to patch vulnerabilities.

As the electrical infrastructure continues to evolve, cybersecurity must be prioritized to safeguard critical systems, protect data, and ensure the reliability of essential services in an increasingly connected world.

VASANTH.S, second Year Student

BATTERY TECHNOLOGY

Battery technology is undergoing rapid advancements, driven by the demand for more efficient, durable, and sustainable energy storage systems. Traditional lithium-ion batteries, which dominate the market, are seeing improvements in energy density, charging speed, and lifespan. However, emerging battery technologies are addressing the limitations of current systems.



One major innovation is **solid-state batteries**. Unlike conventional lithium-ion batteries that use liquid electrolytes, solid-state batteries employ solid electrolytes, improving safety by reducing the risk of fires and allowing for higher energy densities. This makes them ideal for electric vehicles (EVs) and portable electronics.

Another promising development is the **lithium-sulfur (Li-S) battery**, which offers up to five times the energy density of lithium-ion batteries. Li-S batteries are cheaper and lighter, making them attractive for applications such as drones, EVs, and aerospace technologies. The use of **silicon anodes** in batteries is another breakthrough. Silicon can store more lithium ions than graphite, the current standard, which increases the battery's capacity and extends the range of EVs.

In the quest for sustainability, researchers are exploring **sodium-ion batteries**. Using sodium, which is more abundant and cheaper than lithium, these batteries are a promising alternative, particularly for large-scale energy storage systems.

Additionally, **flow batteries** are gaining attention for grid storage due to their ability to store large amounts of energy for extended periods, supporting renewable energy integration. These innovations are set to revolutionize multiple industries, pushing the boundaries of energy storage and transforming the future of power consumption.

SANJAY KUMAR KUNKAL B, Second year Student

AI and Machine Learning in Electrical Engineering

AI and machine learning (ML) are transforming electrical engineering by automating complex tasks, optimizing system performance, and enabling smarter, more adaptive technologies.

In **power systems**, AI and ML are being used to predict energy consumption, optimize power distribution, and manage the integration of renewable energy into smart grids. Machine learning algorithms analyze vast amounts of data from sensors, helping utilities prevent outages, detect faults, and enhance grid stability.



In the realm of **signal processing**, AI improves accuracy in filtering and extracting meaningful information from noisy data. Applications range from telecommunications, where machine learning optimizes data transmission, to medical devices, where AI helps in analyzing complex biological signals like ECGs or EEGs.

Automation and robotics are other areas where AI and machine learning are essential. Engineers use AI-driven control systems to develop smarter, more autonomous robots for manufacturing, healthcare, and even space exploration. These robots can learn from their environments, improving over time to handle tasks with greater precision and efficiency.

AI is also making strides in **circuit design and optimization**, where algorithms assist in creating efficient, low-power electronics. This reduces development time and improves performance in everything from consumer electronics to complex industrial systems. As AI and ML become more integrated with electrical engineering, they enable the creation of intelligent systems that can adapt, learn, and optimize—redefining innovation across industries.

DAVID R, Second Year Student

Power Electronics in Renewable Energy

Power electronics plays a crucial role in the integration and optimization of renewable energy systems, enabling the efficient conversion and management of electrical power generated from sources such as solar, wind, and hydropower. By utilizing power electronic converters, renewable energy can be transformed from its native form—often variable and intermittent—into a stable, usable output that can be seamlessly integrated into the electrical grid.



One of the primary applications of power electronics in renewable energy is in the development of inverters. Inverters convert direct current (DC) generated by solar panels or stored in batteries into alternating current (AC), which is the standard form of electricity used in homes and industries. Advanced inverter technologies enhance grid stability, allowing for the synchronization of distributed energy resources with the main grid.

Moreover, power electronics facilitates energy storage solutions, such as battery management systems, which are essential for addressing the variability of renewable sources. These systems ensure that energy is efficiently stored during peak production times and released when demand is high, thus optimizing resource use.

The rise of smart grids further underscores the importance of power electronics, enabling real-time monitoring and control of energy flows. This integration not only enhances the reliability and resilience of energy systems but also supports the transition to a more sustainable energy future. As renewable energy adoption continues to grow, the advancements in power electronics will be pivotal in addressing challenges related to efficiency, reliability, and system integration.

KARUPPANNASAMY N, Second Year student

Microgrid

Microgrid development represents a transformative approach to energy management, combining local energy generation with advanced control systems to enhance reliability and sustainability. These decentralized energy systems can operate independently or in conjunction with the main power grid, making them ideal for various applications, from urban settings to remote communities.



One of the primary benefits of microgrids is their ability to integrate renewable energy sources, such as solar panels and wind turbines. By generating energy locally, microgrids reduce transmission losses and increase energy security. In the face of natural disasters or grid failures, microgrids can operate autonomously, providing critical power to essential services like hospitals and emergency response centers.

Additionally, microgrid development fosters innovation in energy storage technologies, allowing for efficient management of energy supply and demand. Batteries and other storage solutions enable the balance of intermittent renewable generation, ensuring a stable energy supply even during periods of low production.

Furthermore, microgrids enhance community engagement in energy management, encouraging participation in local energy initiatives and fostering awareness of energy conservation practices. This localized approach not only empowers consumers but also drives economic development through job creation in renewable energy sectors.

As cities and communities strive for greater energy resilience and sustainability, microgrid development stands out as a viable solution. Its ability to harness local resources, integrate advanced technologies, and promote energy independence positions microgrids as a critical component of the future energy landscape.

BALAJI A, Third year Student

Electric vehicle in India

The electric vehicle (EV) revolution is gaining momentum in India, driven by the need for sustainable transportation and energy efficiency. As one of the fastest-growing automotive markets, India faces significant challenges related to air pollution, fuel dependency, and climate change. The adoption of EVs presents a viable solution to these pressing issues.



Government initiatives, such as the Faster Adoption and Manufacturing of Electric Vehicles (FAME) scheme, have been pivotal in promoting EV adoption by providing incentives for manufacturers and consumers alike. These efforts aim to reduce the cost of EVs, making them more accessible to the average consumer. Additionally, state-level policies and subsidies further encourage the transition from traditional internal combustion engine vehicles to electric alternatives.

The growth of charging infrastructure is crucial for EV adoption. Investments in charging stations are expanding across urban areas, addressing range anxiety—a major concern for potential EV buyers. The development of fast-charging technologies is also enhancing convenience for users.

Indian automakers are increasingly investing in EV technology, with several companies launching electric models across various segments. This shift is supported by advancements in battery technology, which are improving range and reducing costs.

However, challenges remain, including the need for robust supply chains for battery materials and addressing concerns about grid capacity. Overall, the future of electric vehicles in India looks promising, with continued government support, growing public awareness, and advancements in technology paving the way for a cleaner, more sustainable transportation landscape.

NANDHINI P, Third Year Student

Solar bottle bulb



Solar bottle bulbs represent a transformative and cost-effective solution for providing light to impoverished communities lacking access to electricity. This innovative concept involves using clear plastic bottles filled with water and a small amount of bleach, which are inserted into roofs to refract sunlight and illuminate indoor spaces. The simplicity of the design makes it accessible for widespread implementation. In areas where traditional electric lighting is unattainable, solar bottle bulbs offer a sustainable alternative. During daylight hours, the bottles act like skylights, diffusing sunlight and creating a bright, ambient glow in homes, schools, and community centers. This not only improves visibility but also enhances the quality of life for residents, enabling children to study and families to engage in evening activities. Moreover, solar bottle bulbs contribute to environmental sustainability by promoting the reuse of plastic waste, which is a significant issue in many developing regions. By turning discarded bottles into practical lighting solutions, communities can reduce litter and foster a sense of responsibility toward the environment. The implementation of solar bottle bulbs also serves as a model for community involvement and empowerment. Local workshops can be organized to teach residents how to create and install these lights, promoting skills development and fostering a sense of ownership.

Overall, solar bottle bulbs exemplify how simple, innovative solutions can address pressing energy challenges while enhancing the quality of life and promoting sustainability in marginalized communities. Their impact underscores the potential of grassroots initiatives in driving social change.

BHUVANESWARAN S, Third Year Student

Vertical Farming

Vertical farming is an innovative agricultural practice that utilizes vertical space to grow crops, often within controlled indoor environments. This method addresses critical challenges faced by traditional farming, such as land scarcity, food security, and environmental sustainability. By stacking layers of crops in vertical formations, vertical farming maximizes space usage, allowing for high-density food production in urban settings where



arable land is limited. One of the primary benefits of vertical farming is its ability to produce food year-round, independent of seasonal changes. Utilizing advanced technologies such as hydroponics, aeroponics, and LED lighting, vertical farms can optimize growing conditions, enhancing crop yield and quality while reducing water usage by up to 90% compared to conventional farming. This efficiency is crucial in regions facing water scarcity.

Additionally, vertical farms can significantly reduce the carbon footprint associated with food transportation. By locating farms closer to urban centers, the need for long-distance transportation is minimized, leading to fresher produce and lower emissions. Vertical farming also promotes sustainability by reducing pesticide usage and minimizing the risk of soil degradation. The controlled environments help prevent pest infestations and diseases, leading to healthier crops and less reliance on chemical treatments. As the global population continues to grow and urbanization increases, vertical farming presents a viable solution to ensure food security while promoting environmental stewardship. Its potential to revolutionize urban agriculture highlights the need for innovative approaches to meet the demands of a changing world.

NAVEEN S, Third Year Student

Floating solar farms

Floating solar farms represent an innovative and efficient approach to harnessing solar energy while addressing land scarcity and water conservation concerns. By installing solar panels on bodies of water, such as lakes, reservoirs, and ponds, these farms maximize space utilization and reduce competition for arable land. This is particularly valuable in densely populated areas or regions where land availability is limited.



One of the key advantages of floating solar farms is their ability to mitigate water evaporation. The panels provide shade over the water surface, significantly reducing evaporation rates and conserving precious water resources, which is especially critical in arid regions. Additionally, the cooler temperatures of the water enhance the efficiency of the solar panels, allowing them to generate more energy compared to their land-based counterparts.

Floating solar farms also help in reducing algae growth in water bodies by limiting sunlight exposure, improving water quality and ecosystem health. Moreover, they can be integrated with existing water management infrastructures, such as hydropower systems, to create hybrid energy solutions.

As technology advances and costs decrease, floating solar farms are becoming increasingly viable. Countries like China, India, and Japan are already implementing large-scale projects, showcasing their potential for large-scale energy production.

In summary, floating solar farms offer a promising solution to the dual challenges of energy generation and land use, contributing to a more sustainable and resilient energy future while promoting environmental conservation.

SUJITH S, Third year Student

Agrivoltaics

Agrivoltaics is an innovative approach that combines agricultural practices with solar energy generation, optimizing land use while promoting sustainability and food security. This dual-use strategy allows farmers to cultivate crops beneath solar panels, creating a symbiotic relationship that maximizes the potential of agricultural land.



One of the primary benefits of agrivoltaics is the efficient use of space. As urbanization and population growth increase the demand for both food and energy, traditional farming practices often face land constraints. By integrating solar panels into farmland, agrivoltaics enables simultaneous production of food and clean energy, addressing two pressing challenges at once.

Additionally, the presence of solar panels can offer various microclimatic benefits. They provide shade, which can reduce heat stress on crops, particularly in arid regions, thereby improving yield and water efficiency. This is particularly advantageous for water-intensive crops, as the shade helps conserve moisture and reduce evaporation rates.

Moreover, agrivoltaics can enhance farm profitability by providing an additional revenue stream through energy production. Farmers can sell excess energy back to the grid, diversifying their income sources and contributing to economic resilience. As the world increasingly shifts toward renewable energy and sustainable agricultural practices, agrivoltaics stands out as a promising solution. By harmonizing food production with clean energy generation, this approach not only helps mitigate climate change but also fosters sustainable land management, ensuring a resilient future for both agriculture and energy systems.

KARTHIKEYAN.D, Third Year Student

Micro Art



S.Nelson, Third Year Student

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