

NANDHA TECHPULSE- 22

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.

Litre of light



The concept of a "litre of light" in Africa symbolizes the urgent need for accessible and sustainable lighting solutions in regions where electricity is scarce. With approximately 600 million Africans lacking reliable power, many rely on traditional fuels like kerosene for illumination. This reliance not only poses health risks—such as respiratory illnesses and fire hazards—but also perpetuates economic challenges.

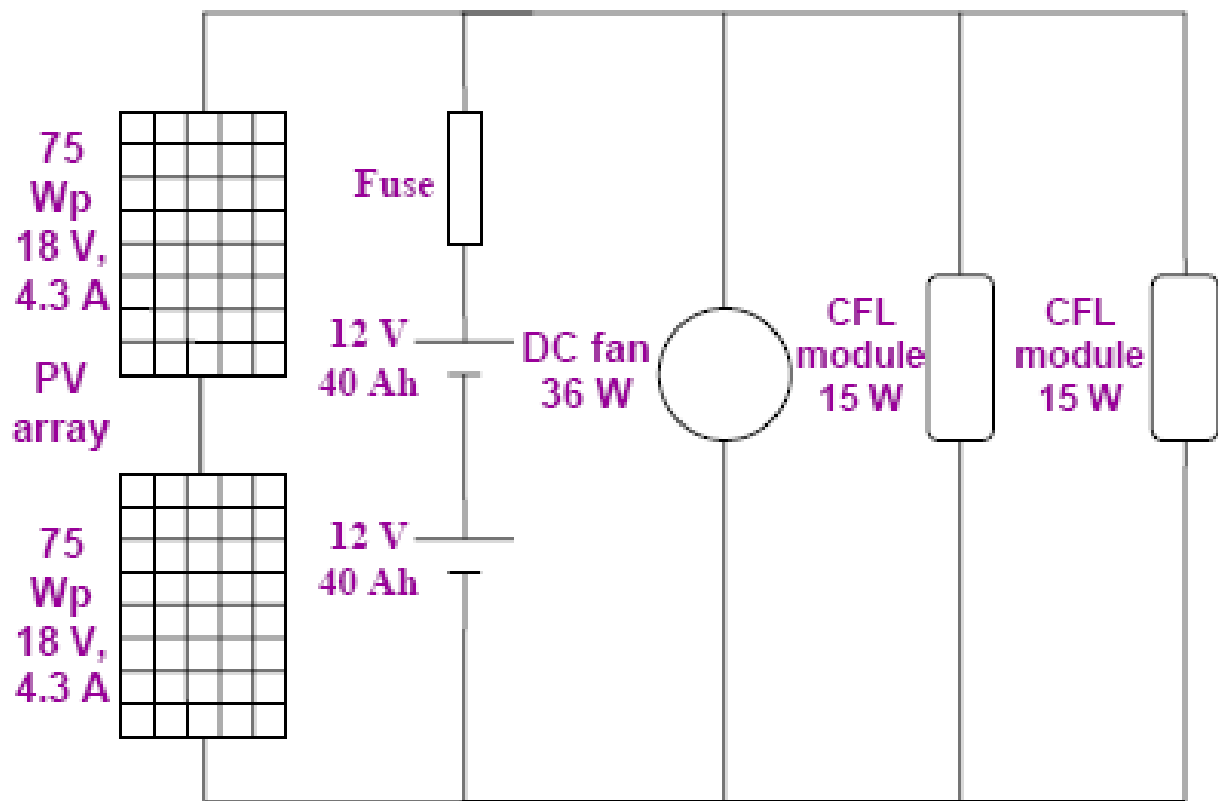
Solar lighting solutions have emerged as a transformative alternative. Solar lanterns and LED lights harness the abundant sunlight available in many African regions, providing a safe and cost-effective means of lighting. These solutions empower households, allowing children to study after dark and small businesses to extend their operating hours, ultimately enhancing educational and economic opportunities.

Organizations like "Lighting Africa" are leading initiatives to distribute solar lighting products, often utilizing microfinance options to make them affordable. By raising awareness about the dangers of kerosene and the benefits of solar energy, communities are gradually shifting toward sustainable lighting.

The transition to solar not only improves living conditions but also promotes environmental sustainability by reducing reliance on fossil fuels. This shift is crucial for fostering economic growth, social equity, and environmental health. In essence, the "litre of light" represents more than just illumination; it embodies empowerment, offering a brighter future for millions of Africans. Access to sustainable lighting can catalyze change, enhancing lives and paving the way for a more equitable and prosperous continent.

KAVIARASU.K, Third Year Student

Sample design of Solar PV system



Total load = $36\text{W} + 15\text{W} + 15\text{W} = 66\text{W}$

For ten hours 8pm to 6 am

Total demand = 660Wh

The capacity of battery required = $660/24 = 27.5\text{ Ah}$

Assuming 70% of discharge, the **battery capacity is chosen as 40Ah.**

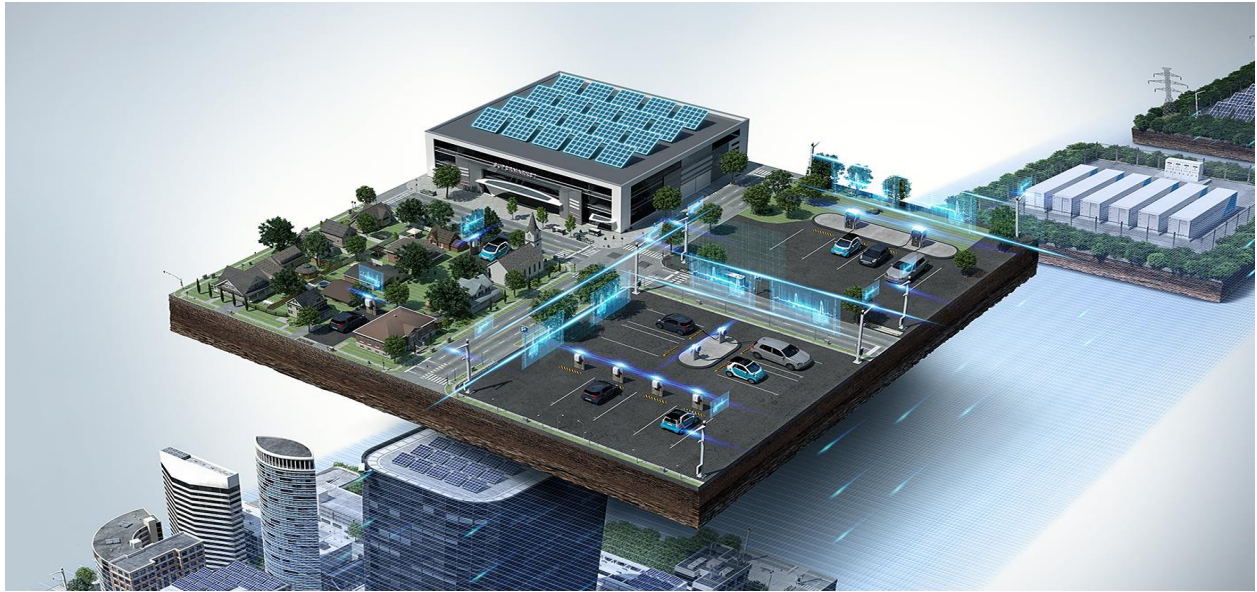
To charge the battery 40Ah, a 4A source supplying for 10 hours is needed.

Therefore, **two PV panels of 75W, 18V** with

$I_{sc} = 4.3\text{A}$ are connected in series.

ROHINI.P, Third Year Student

Renewable Energy Integration



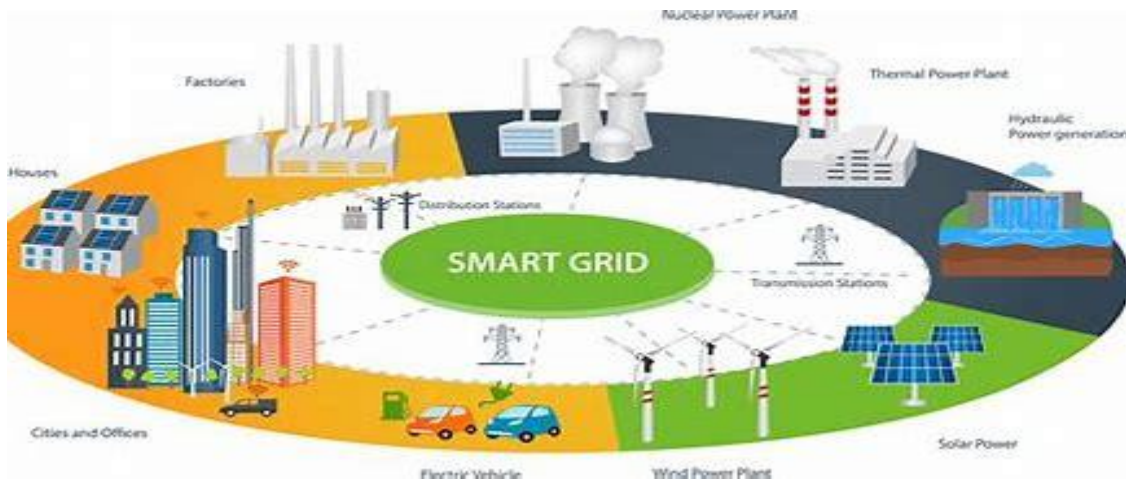
Renewable energy integration refers to incorporating clean energy sources, like solar, wind, and hydropower, into existing power systems. This shift is critical for reducing reliance on fossil fuels and tackling global climate change. However, it poses several challenges due to the intermittent nature of renewable energy sources. For instance, solar power is only available during the day, and wind energy depends on weather conditions. To ensure a stable power supply, power grids must be adapted to manage fluctuations in energy production.

One major solution is the development of **smart grids**, which use advanced technology like sensors and data analytics to balance energy demand and supply in real-time. These smart grids can adjust the flow of electricity and integrate distributed energy sources, such as rooftop solar panels installed in homes or businesses. They also help optimize energy storage systems like batteries, which store excess energy for later use, ensuring power is available even when renewable sources aren't producing.

Energy storage solutions are another key aspect of renewable energy integration. Large-scale battery systems, like **lithium-ion** batteries, play a crucial role in storing renewable energy and releasing it when needed. This smoothens out the variability of renewable sources and helps maintain grid stability. With increasing political and public pressure to combat climate change, countries are investing heavily in renewables and energy infrastructure upgrades. This transformation is vital for meeting carbon reduction goals and creating a sustainable future, where clean energy can reliably power homes, businesses, and industries.

SNEKA.M, Third Year Student

Smart Grid Technology



Smart Grid Technology is a modernized version of the traditional electrical grid, designed to be more efficient, reliable, and sustainable. This advanced system integrates digital technology, communication, and automation to optimize the production, distribution, and consumption of electricity.

One of the core benefits of smart grids is real-time monitoring. Sensors and smart meters installed across the grid provide real-time data, allowing energy companies to track electricity usage and detect any issues like outages or inefficiencies. This improves the overall reliability of the power supply and helps reduce the frequency and duration of power cuts.

Another significant advantage is the integration of renewable energy sources like solar and wind power. Traditional grids often struggle to handle the variability of renewable energy, but smart grids can balance supply and demand more effectively, ensuring a stable power supply even when renewable energy sources fluctuate.

Smart grids also empower consumers to manage their energy consumption better. Smart meters provide detailed information on how much electricity is being used and when, allowing users to adjust their usage during off-peak times, reducing energy bills.

Moreover, smart grids support the development of electric vehicles (EVs) by enabling more efficient charging solutions. Smart grids can ensure that EVs are charged during times of low electricity demand, preventing strain on the system.

SURYA PRAKASH.R, Third Year Student

Wireless Power Transmission



Wireless Power Transmission (WPT) is a technology that allows the transfer of electrical energy from a power source to a device without the need for physical connections like wires or cables. This method uses electromagnetic fields to transmit energy over a certain distance, powering devices remotely. WPT has become a critical area of research due to its potential to revolutionize how we charge and use electronic devices. The concept of WPT is not entirely new. The famous inventor Nikola Tesla first explored wireless energy transfer in the late 19th century. However, recent technological advancements have made this idea more practical and efficient. Today, WPT is used in many applications, such as charging smartphones, electric vehicles, and medical devices like pacemakers.

One of the most common forms of WPT is inductive coupling, which involves two coils — a transmitter and a receiver. When an alternating current flows through the transmitter coil, it generates a magnetic field. The receiver coil, placed nearby, captures this field and converts it back into electrical energy. This method is widely used in wireless charging pads for phones and other small devices. There are challenges to WPT, including limited transmission distance and efficiency losses over large distances. However, ongoing research aims to overcome these hurdles. Companies and researchers are working on long-distance wireless charging solutions, including using microwave or laser-based energy transmission for powering drones or remote sensors.

As this technology advances, wireless power transmission could significantly impact industries such as healthcare, transportation, and consumer electronics, making power cables and cords a thing of the past.

SUBAHARINI.S, Third Year Student

Robotics in Electrical Systems



Robotics plays an increasingly important role in electrical systems, particularly in areas like maintenance, inspections, and manufacturing. As electrical grids and equipment grow more complex and essential, the need for precision, efficiency, and safety is paramount. Robotics offers the ability to perform tasks that are either too dangerous or too tedious for humans, enhancing the reliability and longevity of electrical systems.

In manufacturing, robots are widely used to assemble electrical components with a high degree of precision, ensuring consistent quality in products such as circuit boards and semiconductors. Robots are capable of working continuously without fatigue, which increases productivity and reduces errors. In terms of maintenance and inspection, robots and drones are now employed to monitor power lines, substations, and other electrical infrastructure. These robots can detect issues like overheating, corrosion, or physical damage that may lead to outages. By utilizing advanced sensors, they can perform detailed inspections from difficult-to-reach areas, minimizing human risk and improving response times to potential problems.

Autonomous robots are also being developed to carry out repair tasks in hazardous environments, such as in nuclear power plants or high-voltage areas, where human intervention would be too risky. These robots can restore functionality or replace faulty components, preventing costly disruptions. Overall, robotics in electrical systems is revolutionizing how the industry handles critical tasks, from manufacturing and installation to ongoing maintenance and repair, making the entire process safer, faster, and more reliable. The integration of robotics continues to push forward efficiency and innovation in electrical engineering.

NELSON S, Second Year Student

Hydrogen Fuel Cell



Hydrogen fuel cells are emerging as a promising technology for sustainable energy solutions, offering a clean alternative to traditional fossil fuels. These electrochemical devices convert hydrogen and oxygen into electricity, with water as the only byproduct, making them environmentally friendly.

The fundamental principle of hydrogen fuel cells lies in the reaction between hydrogen gas and oxygen, which generates electricity, heat, and water. The process occurs in an anode and cathode setup, where hydrogen is fed into the anode and oxygen into the cathode. This reaction produces protons and electrons, the latter flowing through an external circuit to create electricity.

One of the significant advantages of hydrogen fuel cells is their efficiency. Compared to internal combustion engines, they can achieve higher energy conversion rates, making them ideal for various applications, from powering vehicles to providing electricity for homes and businesses. Additionally, hydrogen can be produced from renewable sources, such as water electrolysis using solar or wind energy, enhancing its sustainability.

However, challenges remain. Hydrogen production, storage, and distribution require significant infrastructure investment. Moreover, the current methods for hydrogen production can involve carbon emissions unless renewable energy sources are utilized.

Despite these hurdles, advancements in technology and growing investments in hydrogen infrastructure suggest a bright future. As the world seeks to transition to cleaner energy, hydrogen fuel cells represent a pivotal step toward reducing greenhouse gas emissions and fostering a sustainable energy landscape.

PRAVEENKUMAR P , Second Year Student

Hybrid Power System



A hybrid power system combines multiple energy sources, such as solar, wind, and conventional generators, to generate electricity efficiently and reliably. This approach enhances energy resilience, especially in remote or off-grid locations where traditional power infrastructure is limited. One of the primary advantages of hybrid systems is their ability to provide a stable power supply. By integrating renewable sources like solar photovoltaic panels and wind turbines with backup fossil fuel generators, these systems can mitigate fluctuations in energy production caused by variable weather conditions. Energy storage solutions, such as batteries, play a crucial role by storing excess energy generated during peak production times for later use, thus smoothing out supply and demand.

Moreover, hybrid power systems contribute significantly to reducing greenhouse gas emissions. By decreasing reliance on fossil fuels, they support the transition to cleaner energy and help combat climate change. Additionally, these systems can lead to cost savings over time, as the operational expenses of renewable sources are typically lower than those of conventional generators. Despite their benefits, hybrid systems face challenges, including high initial setup costs and the complexity of integrating different technologies. However, advancements in control systems and energy management are making these systems more accessible and efficient. In conclusion, hybrid power systems offer a sustainable and reliable energy solution for diverse applications. As global energy demands increase, these systems will be pivotal in fostering energy independence and contributing to a greener future.

SAKTHI PRIYAN K, Second Year Student

Pelamis



The Pelamis, often referred to as the "Pelamis Wave Energy Converter," is a pioneering technology designed to harness ocean wave energy. Developed in the late 1990s by the company Ocean Power Delivery, this innovative system represents a significant step toward sustainable energy generation, tapping into one of the most abundant and untapped natural resources.

The Pelamis device is a floating structure composed of several interconnected sections, each capable of moving with the waves. As the ocean swells, these segments flex, creating relative motion between them. This motion is converted into electricity through hydraulic systems, which drive generators located onshore or offshore. The Pelamis design is particularly advantageous because it can operate in a variety of sea conditions, making it versatile and effective.

One of the primary benefits of the Pelamis system is its minimal environmental impact. Unlike fossil fuel extraction or large-scale hydroelectric projects, wave energy converters have a smaller ecological footprint. They do not require the same level of land disruption and can be deployed offshore, reducing visual and environmental concerns. However, the technology is not without challenges. The harsh marine environment poses risks to the durability and maintenance of the devices, and the initial investment costs can be substantial. Additionally, the integration of wave energy into existing power grids requires careful planning and infrastructure development.

In conclusion, the Pelamis represents a significant advancement in renewable energy technology. By harnessing the power of ocean waves, it offers a sustainable solution to meet growing energy demands while minimizing environmental impact. As research and development continue, wave energy technologies like Pelamis could play a crucial role in the global transition to clean energy.

EZHILARASI J, Second Year Student

Autonomous vehicles



Autonomous vehicles, or self-driving cars, represent a revolutionary advancement in transportation technology, promising to reshape how we navigate the world. Utilizing a combination of sensors, cameras, artificial intelligence, and machine learning, these vehicles can operate without human intervention, making decisions in real time based on their surroundings.

One of the primary benefits of autonomous vehicles is the potential to enhance road safety. Human error is a leading cause of traffic accidents, and with self-driving technology, the likelihood of such errors can be significantly reduced. Additionally, autonomous vehicles can improve traffic flow and reduce congestion through optimized route planning and communication with other vehicles.

Moreover, these vehicles hold the promise of increased accessibility for individuals unable to drive, such as the elderly and disabled. This could lead to greater independence and mobility for many people, fostering inclusivity within society. However, the widespread adoption of autonomous vehicles faces several challenges. Regulatory frameworks are still evolving, and there are significant ethical considerations regarding decision-making in unavoidable accident scenarios. Public perception and trust in this technology are also crucial for its acceptance.

In conclusion, while autonomous vehicles present exciting opportunities for improving safety, efficiency, and accessibility in transportation, their successful implementation will require addressing regulatory, ethical, and social challenges. As technology continues to advance, the vision of a fully autonomous transportation system moves closer to reality, potentially transforming our daily lives and urban landscapes.

RATHIKAKUMARI K, Second Year Student

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