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DEPARTMENT OF ELECTRICAL ENGINEERING
CAPITAL ENGINEERING COLLEGE
BHUBANESWAR, ODISHA

HALF-YEARLY TECHNICAL MAGAZINE

Institute Vision

To prepare skilled professionals with innovative, ethical, and entrepreneurial spirit.

Institute Mission

M-1: Develop Skilled Professionals– Prepare individuals to excel in evolving global industries through training, hands-on experience, collaboration with industries, and continuous learning.

M-2: Promote Innovation- Encourage creative problem-solving through hands-on research and real-world projects.

M-3: Build Ethical Leaders- Instill integrity, inclusivity, and a commitment to social responsibility in all students.

M-4: Inculcate Entrepreneurial Spirit- Prepare individuals into leaders and entrepreneurs for creating and managing companies.

Department Vision

To foster innovative, ethical, and entrepreneurial electrical engineers who will excel in global technology-driven industries.

Department Mission

- M1** Equip students with technical knowledge and practical skills to excel in the evolving electrical and technology-driven industries.
- M2** Promote innovative problem-solving through hands-on projects, research, and collaboration with industry partners.
- M3** Foster ethical behavior, inclusivity, and social responsibility in students to prepare them for global challenges.
- M4** Develop leadership and entrepreneurial abilities in students to create impactful contributions in the field of electrical engineering.



Er. Anup Kumar Nanda
Head of Department
Electrical Engineering (Diploma)

Greetings from Department of Electrical Engineering!!

I am delighted to share the most recent edition of our department's publication, **"THE CAPITAL CURRENTS"** magazine, which is dedicated to highlighting the exceptional literary potential of our students and faculty members, and fostering their leadership abilities. This publication is intended to inspire aspiring writers to explore new avenues of creative expression, and serve as a platform for sharing their work with a wider audience.

I extend my sincere appreciation and gratitude to the editorial team for their unwavering dedication and invaluable assistance in producing this magazine. Their countless hours of hard work and commitment have ensured that the final product is of the highest quality.

I thank everyone for their valuable contributions to the magazine and hope to receive similar enthusiasm through your precious insight in the fourth coming issues of THE CAPITAL CURRENTS.



Er. Ipsita Nanda
Chief Faculty Editor
Electrical Engineering (Diploma)

I welcome you all to the latest edition of *The Capital Currents*, the technical magazine of the Department of Electrical Engineering! As we step into a new year, we are thrilled to present an issue that reflects the vibrant energy and cutting-edge developments within our field.

This edition brings forward exciting advancements, from the latest research breakthroughs to inspiring student projects, showcasing the innovation that lies at the heart of electrical engineering. We have explored a diverse range of topics, including sustainable energy solutions, smart grid technologies, artificial intelligence in automation, and much more, each demonstrating the extraordinary potential of our discipline to shape the future.

I would like to extend my gratitude to all contributors, and to each one of you who engages with our magazine. Your support and enthusiasm are what make *The Capital Currents* a valuable platform for both learning and sharing knowledge.

We hope you find this edition as exciting and thought-provoking as we do!

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Er. Ipsita Nanda
Chief Faculty Editor
Electrical Engineering (Diploma)

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TECHNICAL ARTICLES BY FACULTIES

- | | |
|----|---|
| 1. | Carbon Credits and the Green Horizon: Navigating the Future of Energy. |
| 2. | The Smart Grid Revolution: Tackling Current Challenges and Embracing AI for Future Innovation |
| 3. | Internet of Things (IoT) in Power Systems: Revolutionizing Energy Management. |
| 4. | The Future is Here: 5G and Beyond in Electrical Engineering. |
| 5. | The Road to Cleaner Transportation: Hybrid Vehicles vs. Electric Vehicles in Pollution Reduction. |
| 6. | Harnessing Innovation: Biogas Plants Revolutionizing Energy, Fuel, and Mobility. |

**TECHNICAL ARTICLES BY STUDENTS**

- | | |
|-----|--|
| 1. | Advancements in Renewable Energy Technologies: A Focus on Solar and Wind Power |
| 2. | Energy management |
| 3. | Flying Electric Generator |
| 4. | Future of Battery Technology |
| 5. | Getting Light, Power, and Automation |
| 6. | Historical Developments in Wind Converters |
| 7. | Inductance and Its Application in a Circuit |
| 8. | Innovations in Electrical Engineering |
| 9. | Looking Forward to Signal Systems Innovations |
| 10. | Microgrids |

Carbon Credits and the Green Horizon: Navigating the Future of Energy

Introduction

In a world grappling with the dual challenges of climate change and increasing energy demands, the concept of carbon credits has emerged as a beacon of hope and innovation. As we stand at the crossroads of the energy transition, this article explores the dynamic role of carbon credits in shaping the future energy landscape, considering current energy scenarios and emerging trends.

The Carbon Credits Landscape

Carbon credits, a mechanism aimed at reducing greenhouse gas emissions, have gained prominence in recent years. In the face of a changing climate, industries, governments, and individuals are turning to these credits as a means of mitigating their carbon footprint. As we delve into the intricate web of energy and environmental dynamics, carbon credits are emerging as a pivotal force in promoting sustainability and combating climate change.

The Evolving Energy Scenario

1. Renewable Energy Revolution

The surge in renewable energy sources, such as solar and wind, has been a game-changer in the global energy scenario. As nations transition towards cleaner power generation, carbon credits play a crucial role in incentivizing renewable energy projects. Investors and corporations earn credits for each ton of carbon dioxide equivalent reduced or sequestered, fostering a sustainable ecosystem for the future.

2. Carbon-Neutral Initiatives

In an era where corporate responsibility is under scrutiny, the concept of carbon neutrality has gained traction. Companies are actively engaging in carbon offsetting by investing in projects that reduce or capture emissions, subsequently earning carbon credits. This shift towards carbon neutrality is not merely a trend but a strategic move towards environmental stewardship and sustainable business practices.

Future Energy Trends and Carbon Credits

1. Technology Integration

The fusion of technology with carbon credit initiatives is set to redefine the energy landscape. Blockchain, artificial intelligence, and IoT are being leveraged to enhance transparency and traceability within carbon credit markets. This technological integration not only streamlines processes but also instills confidence in stakeholders, ensuring the legitimacy and impact of carbon credit projects.

2. Decentralized Energy Systems

The future envisions a move towards decentralized energy systems, where local communities actively participate in energy generation and consumption. Carbon credits will play a pivotal role in empowering these communities to adopt cleaner energy practices, fostering a sense of collective responsibility towards the environment.

3. Innovations in Carbon Capture and Utilization

As the race to achieve net-zero emissions intensifies, innovations in carbon capture and utilization (CCU) are gaining prominence. Carbon credits act as catalysts for investments in CCU projects, paving the way for sustainable solutions that not only reduce emissions but transform carbon into valuable resources.

Conclusion: Navigating Towards a Greener Tomorrow

The integration of carbon credits into the evolving energy scenario paints a hopeful picture for our collective future. As we witness the rise of renewable energy, the surge in carbon-neutral commitments, and the synergy between technology and environmental responsibility, carbon credits emerge as the glue that binds these elements together.

In navigating towards a greener tomorrow, where energy is sustainable, clean, and equitable, carbon credits stand as a testament to human ingenuity and resilience. The future energy trends are not just about meeting the demand for power but doing so in a way that respects our planet's finite resources. As we embark on this transformative journey, carbon credits will undoubtedly continue to play a pivotal role in shaping the sustainable energy landscape of the future.

Sri Gopal Chandra Martha
Sr. Lecturer, EE (Dip.)

The Smart Grid Revolution: Tackling Current Challenges and Embracing AI for Future Innovation

The Smart Grid is a modern and intelligent electricity network that uses advanced technologies like AI to optimize energy delivery. It allows for two-way communication and real-time monitoring of energy usage, making electricity distribution more efficient and resilient than traditional grids. However, there are some challenges that smart grids face:

1. **Cybersecurity Vulnerabilities:** The increased connectivity of smart grids makes them vulnerable to cyber- attacks. Hackers may attempt to disrupt operations or steal sensitive data.
2. **Grid Stability and Resilience:** Integrating renewable energy sources challenges grid stability. Variability in generation from renewables can lead to voltage fluctuations and grid instability.
3. **Data Overload and Management:** Smart grids generate vast amounts of data from sensors and monitoring devices, which can be challenging to manage and analyze in real time.
4. **Consumer Privacy Concerns:** Using smart meters and IoT devices raises concerns about consumer privacy and data security. Unauthorized access to personal energy usage data could compromise privacy and lead to misuse.

Artificial Intelligence offers solutions to these challenges:

1. **Cybersecurity:** AI algorithms can detect cyber threats and analyze network traffic, enabling proactive threat mitigation and incident response. Machine learning models can learn and adapt to evolving cyber threats, enhancing the resilience of smart grid cybersecurity defences.
2. **Grid Stability and Resilience:** AI-based predictive analytics can forecast fluctuations in renewable energy generation and adjust grid operations to maintain stability. Reinforcement learning algorithms can optimize grid control strategies in real time, maximizing efficiency while minimizing disruptions.

3. **Data Analytics:** AI-powered data analytics platforms can process and analyze large volumes of data from diverse sources, providing actionable insights for grid operators and utilities. Natural language processing techniques can extract valuable information from textual data sources, aiding in predictive maintenance and decision-making.
4. **Privacy Preservation:** Differential privacy techniques can be employed to anonymize and aggregate consumer energy usage data, preserving privacy while enabling valuable analytics and insights. Federated learning approaches allow machine learning models to be trained on decentralized data sources without compromising individual privacy, mitigating privacy concerns associated with centralized data repositories.

The future of AI in electrical engineering looks promising. AI algorithms will continue to evolve to optimize energy management systems, enabling more efficient utilization of resources and better grid stability. The development of intelligent power grids powered by AI will enable autonomous decision-making and self-healing capabilities, leading to more resilient and adaptive energy networks. AI will play a crucial role in integrating renewable energy sources into the grid by providing accurate forecasting, real-time optimization, and grid balancing capabilities. AI algorithms will also be used to optimize the operation of energy storage systems, maximizing their efficiency and effectiveness in managing grid variability and demand fluctuations.

Sri Suryanarayan Tripathy
Sr. Lecturer, EE (Dip.)

Internet of Things (IoT) in Power Systems: Revolutionizing Energy Management

IoT in power systems involves using interconnected devices, sensors, and software applications to gather, analyze, and act upon energy generation, transmission, distribution, and consumption data. These IoT devices can collect a wide range of data, including voltage levels, current flows, power quality, equipment health, and environmental conditions. By leveraging this data, utilities and consumers can make

informed decisions to improve energy efficiency, reduce costs, and minimize environmental impact.

Issues in Power Systems

Traditional power systems face several challenges impacting efficiency, reliability, and sustainability. Some of the key issues include:

1. **Aging Infrastructure:** Many power systems have ageing infrastructure that can lead to increased maintenance costs, downtime, and reliability issues.
2. **Limited Visibility and Control:** Traditional power systems often lack real-time visibility and control capabilities, making monitoring and managing energy usage difficult.
3. **Energy Theft and Losses:** Energy theft and losses can occur due to various factors, such as technical losses in transmission and distribution networks and non-technical losses due to theft or meter tampering.
4. **Environmental Impact:** Conventional energy sources, such as coal and oil, contribute to environmental pollution and climate change, highlighting the need for more sustainable energy solutions.
5. **Grid Congestion:** Grid congestion can occur when the electricity demand exceeds the capacity of the transmission and distribution networks, leading to inefficiencies and potential blackouts.

Solutions with IoT

IoT offers several solutions to address the issues faced by traditional power systems:

1. **Remote Monitoring and Diagnostics:** IoT devices can monitor the health and performance of power system equipment remotely, allowing utilities to detect and address issues before they lead to downtime or failures.
2. **Smart Grids:** IoT-enabled smart grids can improve the efficiency and reliability of power systems by integrating renewable energy sources, optimizing energy distribution, and enabling demand-response programs.

3. **Predictive Maintenance:** IoT devices can collect data on equipment health and performance, enabling utilities to predict when maintenance is needed and avoid costly downtime.
4. **Energy Management Systems:** IoT-based energy management systems can help consumers and utilities optimize energy usage, reduce costs, and minimize environmental impact.
5. **Grid Optimization:** IoT devices can provide real-time data on energy usage, grid conditions, and environmental factors, allowing utilities to optimize grid operations and reduce congestion.

Ms. Lipsa Ray
Lecturer, EE (Dip.)

The Future is Here: 5G and Beyond in Electrical Engineering

Understanding 5G

5G, short for fifth-generation wireless technology, is the latest iteration of cellular network technology, succeeding the previous generation, 4G LTE. Unlike its predecessors, 5G offers significantly higher data speeds, lower latency, and greater capacity, thanks to advancements in wireless communication technologies, such as millimetre-wave frequencies, massive MIMO (Multiple Input Multiple Output), and beamforming.

Advantages of 5G

1. **High-Speed Connectivity:** 5G offers data speeds up to 100 times faster than 4G, allowing faster downloads, smoother streaming, and quicker access to cloud-based services.
2. **Low Latency:** With latency as low as one millisecond, 5G enables real-time communication and applications, making it ideal for gaming, virtual reality (VR), and augmented reality (AR).
3. **Massive Connectivity:** 5G can support up to a million devices per square kilometre, making it ideal for IoT applications, such as smart homes, smart cities, and industrial automation.

Future Developments

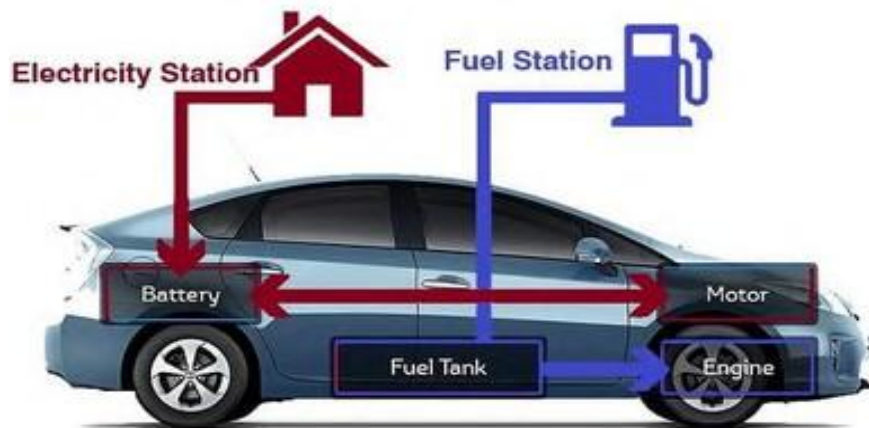
While 5G is already reshaping the landscape of electrical engineering, researchers and engineers are already looking ahead to the next frontier of wireless communication technology. Some of the critical areas of development include:

1. **6G and Beyond:** Researchers are already laying the groundwork for the next generation of wireless technology, exploring concepts such as terahertz communication, quantum communication, and intelligent reflecting surfaces.
2. **AI and Machine Learning:** Integrating artificial intelligence (AI) and machine learning (ML) is expected to be crucial in optimizing 5G networks and enabling new applications and services.
3. **Edge Computing:** With the proliferation of IoT devices and real-time applications, edge computing is poised to become increasingly important, enabling data processing and analysis at the network's edge.
4. **Network Slicing:** Network slicing allows operators to partition their networks into multiple virtual networks, each tailored to specific applications or services, enabling greater flexibility and customization.
5. **Security and Privacy:** As connectivity increases, so does the importance of security and privacy. Future developments in 5G and beyond will focus on enhancing security mechanisms, such as encryption, authentication, and intrusion detection.

Sri. Debswarup Rath
Sr. Lecturer, EE (Dip.)

The Road to Cleaner Transportation: Hybrid Vehicles vs. Electric Vehicles in Pollution Reduction

Are you thinking about getting a new car but worried about pollution? You are not alone! Many people are looking for ways to reduce their environmental impact, and choosing the right car is a big part of it. So, let's talk about two popular options: hybrid cars and electric cars. Which one is better for reducing pollution? Let's end the debate!



Hybrid Cars: A Mix of Gas and Electricity

First up, let's talk about hybrid cars. These cars are like a mix of regular gas and electric cars. They have both a gas engine and an electric motor. When driving at low speeds or stuck in traffic, the electric motor kicks in and helps you save gas. One cool thing about hybrids is that they can recharge their batteries while you are driving. When you hit the brakes, the car uses that energy to recharge the battery. It's like getting a little boost every time you slow down! Hybrid cars are great because they use less gas, producing fewer emissions. That is important because car emissions can harm our air and contribute to climate change. By driving a hybrid, you are helping to keep the air cleaner and reduce your carbon footprint.

However, electric cars are the way to go if you want to make the most significant impact on reducing pollution. They produce zero emissions while you are driving, and as more renewable energy sources are used to generate electricity, they will only get cleaner and greener over time.

Twist in EV's Automobile Industry

In today's EV market, consumers fear buying pure electric vehicles. People with electric cars avoid long travels for fear of getting discharged. India is a developing country, not completely developed. The charging infrastructure is not well developed in India. Moreover, pure EVs are still unsafe for the Indian market.

When the infrastructure gets well developed, EVs are the best option for the Indian market.

Ultimately, your best choice depends on your lifestyle, budget, and environmental values. However, no matter which option you choose, switching to a hybrid or electric car is a great way to help protect the planet and reduce your carbon footprint. So, why not give it a try? Your planet will thank you for it!

Er. Ipsita Nanda
Sr. Lecturer, EE (Dip.)

Harnessing Innovation: Biogas Plants Revolutionizing Energy, Fuel, and Mobility

In an era where sustainability and environmental consciousness have become paramount, the quest for alternative energy sources has led to the rise of innovative biogas plants. These ground-breaking facilities generate renewable energy, produce fuel, and contribute to sustainable mobility solutions. Let us delve into the transformative potential of biogas plants in reshaping our energy landscape and fostering a greener future.



Unveiling the Potential of Biogas:

Biogas is a versatile and renewable energy source produced through the anaerobic digestion of organic matter, such as agricultural waste, food scraps, and sewage. This

process breaks down organic materials, releasing methane gas that can be captured and utilized as a clean energy source.

Energy Generation:

One of the primary benefits of biogas plants is their ability to generate electricity and heat through the combustion of methane gas. The captured biogas can power generators, producing electricity for homes, businesses, and communities. Additionally, the heat generated during the combustion process can be harnessed for heating purposes, further enhancing the energy efficiency of biogas plants.

Fuel Production:

Beyond electricity and heat generation, biogas plants also play a pivotal role in producing renewable fuels such as biomethane and bio-CNG (compressed natural gas). These fuels can be used as eco-friendly alternatives to traditional fossil fuels in transportation, reducing greenhouse gas emissions and mitigating air pollution. Bio-CNG, in particular, holds promise for powering fleets of vehicles, including buses, trucks, and cars, contributing to cleaner and more sustainable mobility solutions.

Sustainable Mobility:

Integrating biogas into the transportation sector represents a significant step towards achieving carbon neutrality and reducing dependence on fossil fuels. Using bio-CNG derived from biogas plants, transportation fleets can significantly reduce their carbon footprint while promoting renewable energy adoption. Moreover, bio-CNG infrastructure can be seamlessly integrated into existing fueling stations, offering consumers a convenient and eco-conscious choice for their transportation needs.

Conclusion:

As we stand on the verge of a renewable energy revolution, biogas plants emerge as beacons of sustainability, offering a pathway towards a cleaner, greener future. By harnessing the power of organic waste and transforming it into valuable energy and fuel resources, biogas plants exemplify the ingenuity and innovation driving the transition towards a low-carbon economy.

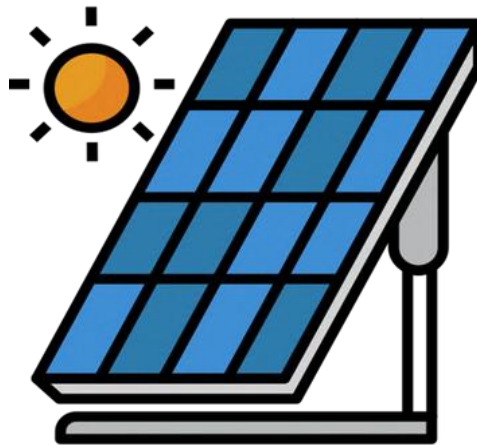
Sri Jitamitra Mohanty
Sr. Lecturer, EE (Dip.)

Advancements in Renewable Energy Technologies: A Focus on Solar and Wind Power

In recent years, the transition towards a sustainable future necessitates a significant shift in our energy technologies, particularly in the domains of solar and wind power. These innovations signify a pivotal shift towards sustainable energy production and have the potential to reshape the global energy landscape. Below, we delve into some of the key advancements in these two critical renewable energy sources:

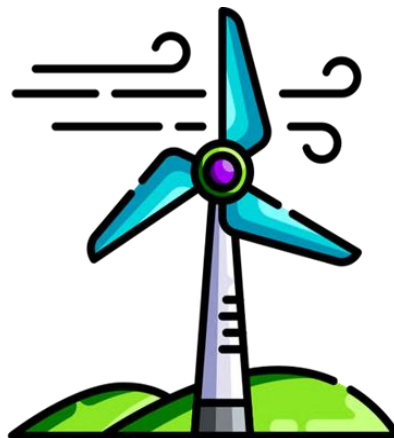
Solar Power:

- 1) **Improvements in Photovoltaic (PV) Efficiency:** Significant strides have been made in enhancing the efficiency of solar panels, resulting in higher energy conversion rates and increased output per unit area. Innovations such as multi-junction solar cells and perovskite-based photovoltaics hold promise for further boosting efficiency levels.
- 2) **Perovskite Solar Cells:** This emerging technology utilizes perovskite materials, promising even higher efficiencies and potential cost reductions compared to traditional silicon-based solar cells. Extensive research is underway to refine their stability and lifespan.
- 3) **Innovative Panel Designs:** Flexible, lightweight, and aesthetically pleasing solar panels are paving the way for integrating solar technology into diverse applications, including building materials, roofs, and even clothing.
- 4) **Bifacial Solar Panels:** Bifacial solar panels, capable of capturing sunlight from both sides, have gained traction due to their increased energy yield compared to traditional single-sided panels. This advancement has led to greater flexibility in installation and improved performance in varied environmental conditions.
- 5) **Integrated Solar Technologies:** Integration of solar panels into building materials such as roofing tiles and windows has emerged as a novel approach, blending energy generation seamlessly with architectural design. This integration enhances aesthetics while maximizing energy capture potential. energy for later use, facilitating grid stability and enhanced reliability.



Wind Power

- 1) **Turbine Design Innovations:** Continuous research in wind turbine design has led to the development of larger, more efficient turbines capable of harnessing wind energy at higher altitudes and lower wind speeds. Aerodynamic enhancements and smart blade designs have contributed to increased energy capture and reduced operational costs.



- 2) **Offshore Wind Farms:** Offshore wind farms have emerged as a burgeoning sector, leveraging strong and consistent wind resources available in coastal regions. Advancements in floating turbine technology have enabled deployment in deeper waters, opening up vast expanses for offshore wind energy development.
- 3) **Digitalization and Predictive Maintenance:** Integration of digital technologies such as Internet of Things (IoT) sensors and machine learning algorithms has revolutionized wind farm management. Real-time monitoring and predictive maintenance strategies optimize turbine performance, minimize downtime, and extend operational lifespan.

Synergy and the Future Outlook:

The advancements in both solar and wind power are becoming increasingly synergistic. Hybrid power plants that combine both technologies are emerging to provide a more reliable and balanced energy source, mitigating the intermittency challenges inherent in each technology alone.

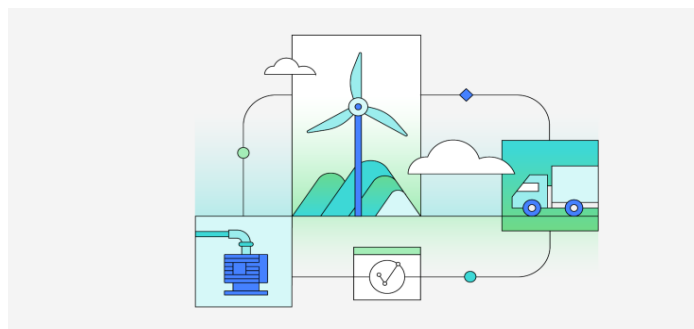
While focusing on solar and wind power, other renewable energy sources like geothermal, hydro, and biomass also play a crucial role in a diversified energy mix.

The article touches upon the importance of energy storage and grid integration, and exploring these areas further can provide valuable insights.

Sameer Pradhan
4th Sem., EE (Dip.)

Energy management

Energy management includes planning and operation of energy production and energy consumption units. Objectives are resource conservation, climate protection and cost savings, while the users have permanent access to the energy they need. It is connected closely to environmental management, production management, logistics and other established business functions. Energy management is the proactive, organized and systematic coordination of procurement, conversion, distribution and use of energy to meet the requirements, considering environmental and economic objectives. It is something like perform the same amount of work with less energy that technique is considered as the energy efficiency. The electrical energy management group researches, designs, builds and tests advanced energy conversion systems containing renewable energy, power electronics and electromechanical conversion systems and energy storage elements in order to optimize efficiency or power.



Sanjib Tandia
4th Sem., EE (Dip.)

FLYING ELECTRIC GENERATOR

High Altitude Wind Power uses flying electric generator (FEG) technology in the form of what have been more popularly called flying windmills, is a proposed renewable energy project and implementation over rural or low-populated areas, to produce around 12,000 MW of electricity with only 600 well clustered rotorcraft kites that use only simple autogyro physics to generate far more kinetic energy than a nuclear plant can. According to Sky Wind Power; the overuse of fossil fuels and the overabundance of radioactive waste from nuclear energy plants is taking our planet once again down a path of destruction, for something that is more expensive and far more dangerous in the long run. FEG technology is just cheaper, cleaner and can provide more energy than those environmentally unhealthy methods of the past, making it a desirable substitute/alternative. The secret to functioning High Altitude Wind Power is efficient tether technology that reaches 15,000 feet in the air, far higher than birds will fly, but creating restricted airspace for planes and other aircraft.

Ashis Sagar
4th Sem., EE (Dip.)

Future of Battery Technology

Battery technology has a long-standing tradition in the electrical field from charging portable gadgets to running electric vehicles (EVs) and powering entire electric grids. Solid-state batteries are touted as the next step in battery technology as the demand for energy storage technologies that are efficient, durable, and safe just keeps getting higher. This explains the significance of solid-state batteries, then compares them to lithium-ion batteries.

Need for Advanced Energy Storage:

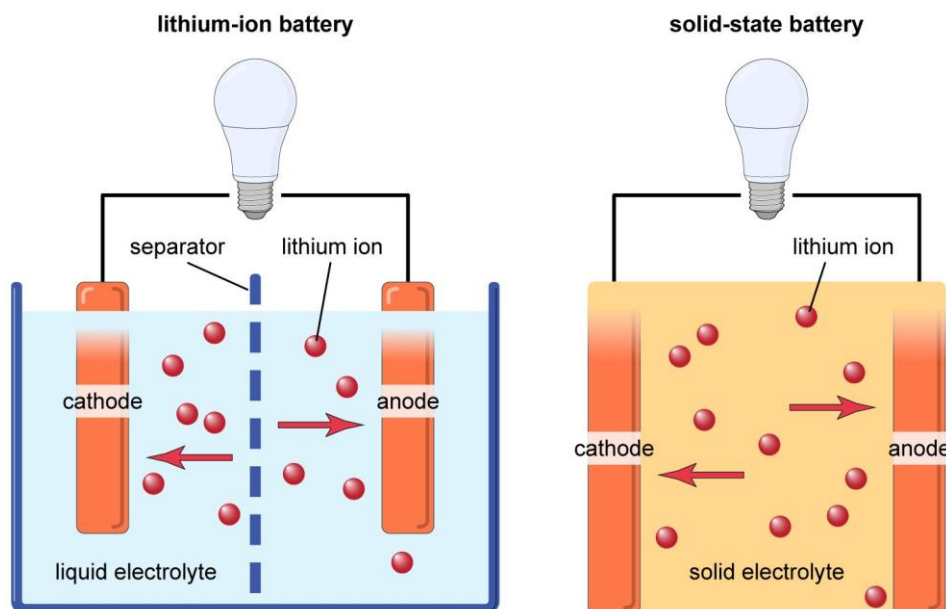
In short, energy storage systems are so important in this modern world that without them we could not adopt renewable energy nor enjoy a sustainable future with less carbon footprint. There would be immense differences between a highly efficient battery and its absence in today's future, making it truly futuristic.

Conventional lithium-ion batteries have kept the innovation alive for decades, but with drawbacks like safety hazards, limited energy density, and a relatively short lifespan. Solid-state batteries, it is claimed, will make the future bright by overcoming nearly all these challenges and revolutionizing the energy storage industry.

Comparison: Lithium-Ion vs. Solid-State Batteries

Lithium ion uses a liquid or gel electrolyte for conduction of ions between the anode and cathode. There are high energy density and efficiency, but the liquid electrolyte makes it unsafe, running the risk of overheating, catching fire, or both. It has a limited life cycle because its performance degrades as the number of charge cycles increases, and it is sensitive to very high and low temperatures, which reduces its efficiency of operation.

Solid-state batteries replace the liquid electrolyte with a solid, usually composed of ceramics or polymers. This modification drastically increases safety levels because it prevents the serious hazards of leakage or combustion. Moreover, due to their superior energy density, solid-state batteries can store power in a smaller space, which makes them more suitable for compact applications such as portable electronics and electric vehicles.



Bikram Behera
4th Sem., EE (Dip.)

Getting Light, Power, and Automation

EE, which stands for electrical engineering, has transformed the world all through the fast-growing advancement of technology and innovation. New Power Systems A new revolution in power systems makes waves by going beyond energy, and hither comes the most promising advancement in the phenomenon of its changes at transmission and distribution levels.

High-voltage direct current (HVDC) technology is becoming widely applied because of its high efficiency for long-distance transmission with much reduced energy losses. The cost of establishing overseas wind farms or large solar facilities is being invested heavily by governments around the world in renewable energy projects. These inspire smart grid systems to be used, providing a more reliable, efficient, and sustainable management of energy.

Innovate Lighting Technology The sector is nosily alive and kicking with advances in illumination technology, especially with LED and smart lighting solutions. They represent either the best in the energy efficiency, durability, and brightness typically found in LED products. In smart cities, AI-powered sensors and adaptive lighting designs provide the innovation that will save energy and ensure public safety.

The energy-efficient solution to modernized cities is found in solar-powered street lighting, which is fast gaining ground in cities and communities. Automation and Robotics Production is changing on speed so fast that things must be produced correctly without sacrificing efficiency compared to yesterday. Here, electrical engineers interface robots with manufacturing systems to conduct operations without the human hand involved, thus assisting in the production process of machinery and robots. Machine learning and AI are also contributing significantly to industrial control systems to improve their decision-making and optimization capabilities.

Remarkable achievement

There has projects in the field of EE, from the pioneering solid-state energy storage batteries to the artificial intelligence-powered power management systems. These

creations are eloquent testimonies to the ingenuity of engineers who continually push beyond the frontiers of possibility.

Market Data and Sector Growth the EE industry has shown robust growth, driven mainly by investments, mergers, and acquisitions. Consumer trends show that smart appliances are favoured, followed by electric vehicles and then the growing demand for greener products. This will act as an incentive for companies to invest in research and development for modernized solutions.

Champeswar Meher
4th Sem., EE (Dip.)

Historical Developments in Wind Converters

For decades, wind turbines have been seen as synonymous with renewable energy. For the purpose of producing power, they convert the energy in the wind into electricity. Wind energy has advanced through technologies, from old, lonesome, land-fixed designs to advanced offshore as well as floating turbine constructs, and now it is capable of fulfilling the international requirements for clean, sustainable energy.

The Journey Progression of Wind Turbine Technology Windmills were essentially machines that produced work by grinding something or pumping water. The very late 1800s had the idea of using wind as a source of energy or electricity to gain momentum. The first one was constructed in the 1940s as the modern wind turbine. Early designs were very simple-fixed blades and not very efficient. Wind turbines became bigger in size and higher in efficiency over the years. The makers of the present wind turbines took up research, development, and adoption of aerodynamic blades, advanced materials, and intricate control systems to maximize energy output by wind. The land-based wind turbine technology has reached heights never imagined before: taller towers and larger rotor diameters are slowly capturing more and more wind.

Innovation: Offshore and Floating Turbines one of the major advances in wind turbine technology has been the construction of offshore wind power plants. Offshore sites are portions of seas or oceans where strong winds blow almost uninterruptedly. Offshore wind turbines are bigger, more powerful, and able to produce much more electricity than

onshore ones. This feature is well-suited to satisfy densely populated coastal areas of electricity demand.

The new technology in this field is floating wind turbines. Floating wind turbines are not anchored to the seabed, unlike traditional offshore turbines, but rather mounted on floating platforms tethered to the ocean floor. This makes much deeper waters accessible to these systems and increases the number of sites to put up wind machines.

These days, wind turbines are present in all environments, from the open plains to deep oceans. Onshore turbines still remain an economical solution for rural and remote places; offshore and floating turbines add to their texture as they guide energy towards urban centres. A journey through innovation, the traditional wind tuning method leading to advanced floating-type wind turbines, shows how innovation can solve real problems. And as the world shifts to renewables, wind turbines will become major avenues for reducing emissions and fulfilling the energy demand of the world.

Satyabrata Behera
6th Sem., EE (Dip.)

Inductance and Its Application in a Circuit

The field of electrical engineering is really important because it entails what we would call fundamentals. Inductance thus becomes one of the essentials in electrical engineering, by virtue of making all systems—power system design, efficient motor development, or signal processing—impressive and functional. This article focuses on understanding inductance, its principles, application, and importance in electrical engineering.

What is inductance?

The inductance is the property of an electric circuit or component applicable to restriction on current changes flowing through it because of a magnetic field created around a conductor along which an electric current flow through it. The energy stored in that magnetic field is what one means by the inductance. The most common measuring units

are Henries (H), and inductance relies on a number of the general coil turns and geometry of coil and core material.

Principle of Operation

The inductance principle is derived from Faraday's Law of Electromagnetic Induction, which holds that a change in the magnetic flux that pierces a circuit induces an electromotive force in that circuit. When an electric current flowing through a coil changes, the magnetic field associated with it changes as well. This change in magnetic field induces a voltage or electromotive force (emf) in the coil that opposes the change of the current. This is explained clearly by Lenz's law. It is this opposition against the change in flow of current that defines the concept of inductance. Inductors are indeed the elements that are constructed for case inductance. It is made by winding a conductor, such as copper wire, into coils. Further, it can be considered in making a core using magnetic properties, such as in the case of iron or ferrate.

Applications

Filters: Inductors are major components of filters that remove unwanted frequencies from the signal. Inductors in an AC application are used in low-pass and high-pass filters to separate signals based on their frequencies.

Transformers: Inductance enables energy transfer from the primary to the secondary winding in transformers for power distribution and voltage regulation.

Motors and Generators: Inductive principles define the operation of motors and generators that convert electrical to mechanical energy and vice versa using magnetic fields.

Energy Storage: An inductor stores energy in magnetic fields, its typical application is in temporary store circuits like that of switching power supplies.

R S Sachidananda
6th Sem., EE (Dip.)

Innovations in Electrical Engineering

Technology has often been credited to the rise of almost every industry, but electrical engineering (EE) was perhaps one of its earliest mysteries. As progress continues to be witnessed in sectors such as renewable energy, microelectronics, so has the scope of this field been challenged. Wired for Innovation turns its focus on emerging technologies, presents interesting students' works, and offers career advice for electrical engineering degree seekers in this issue.

(i) As of late, profound transformations in electrical engineering have been in the offing. Improvements in artificial intelligence AI, renewable engineering power sources, and electrical power apparatuses are revolutionizing industrial sectors worldwide. Smart grid technology is among the most recognized of the changes. Unlike many other developments, this one's most distinguishing factor is the convergence of the digital communication.

(ii) Furthermore, another recently emerging trend is wireless power transfer (WPT). This technology has the capability to revolutionize the manner in which an individual charges their device and it can also be applied on electric vehicles, medical devices and consumer electronics as well. Unlike many other developments, this one's most distinguishing factor is the convergence of the digital communication. The expectations are that such processes will enhance fields such as cryptography and computer science. As there are no wired connections in WPT, it aids in providing comfort without compromising the use of energy.

(iii) Finally, the increase in quantum computing is creating new possibilities for increasing the speeds that data processing and encryption can be achieved alongside the improvements made in electrical engineering. The expectations are that such processes will enhance fields such as cryptography and computer science, which will have become quite advanced, and therefore, will be incorporated into electrical engineering in the course of their training.

Deepak Sahoo
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Looking Forward to Signal Systems Innovations

All-inclusive equipment for signal systems constitutes a vital aspect of electrical engineering practice. This equipment stimulates growth in systems of communication and control, as well as in data signal processing. They provide error-free and real-time information transmission, automatic control of systems, and manipulation of complex data with less effort. Many areas and technologies are influenced and shaped by these systems. The focus of attention and the trend defining the motion of these systems in practice are recently solved and current problems and challenges within society.

Telecommunication Systems

On the other hand, the field of telecommunications has undergone revolutions, especially with the 5G. It has woken up the fundamentals of transfer of data, speed, and connectivity. It has a very low latency and much more bandwidth available that can be employed to functions like cars that drive themselves, operation from a distance, and the IoT systems. Optical fibers also provide these networks with high-speed and long-distance least-loss communications. On the other hand, satellite communication brings rather isolated places into the fold, contributing to systems of global positioning as well as disaster management literally and figuratively. Together, they really change the way people communicate or do business.

Innovations in Signal Processing

Signal processing, one of the oldest fields of electrical engineering, has greatly advanced with all the techniques related to digital signal processing. Newer trends include processing in real-time with multimedia applications as well as more sophisticated algorithms that optimize sound and video. Most recently, AI has found its way to digital signal processing (DSP), incorporating capabilities for data compression, noise suppression, and speech recognition, among several other features. This has improved applications in businesses ranging from movie industries to telephone services as well, on a wider scale.

Alin Ekka
2ND Sem., EE (Dip.)

Microgrids

An electrical engineer is innovating different solutions to meet modern-day challenges of energy. Yet, one of the newer innovations is decentralized systems like microgrids—systems that ensure the availability of energy during difficult times.

What are microgrids?

Localized power systems may include: Microgrids operate either independently or in tandem with the general grid. They generate, store, and distribute electricity for a community, campus, or industrial area, in contrast to traditional, centralized grids. Microgrids are able to operate in an outage and keep everything running by combining with another larger grid. Microgrids are versatile networks that generate from diverse sources: small photovoltaic arrays, wind turbines, or small hydro, together with a special control technology for high flexibility. Thus, microgrids will reliably and effectively supply power to certain disaster-prone areas as well as remote places where connectivity with major grid systems is difficult.

The Three Components of Microgrids

Microgrids mainly share three basic components, which must work together to be functional.

Generation: One way of generating power for microgrid operation is through renewable energy sources—solar, wind, or biomass. This reduces dependency on fossil fuels and leads to environmental sustainability. However, this can also possibly have diesel or natural gas backup generators for increased reliability.

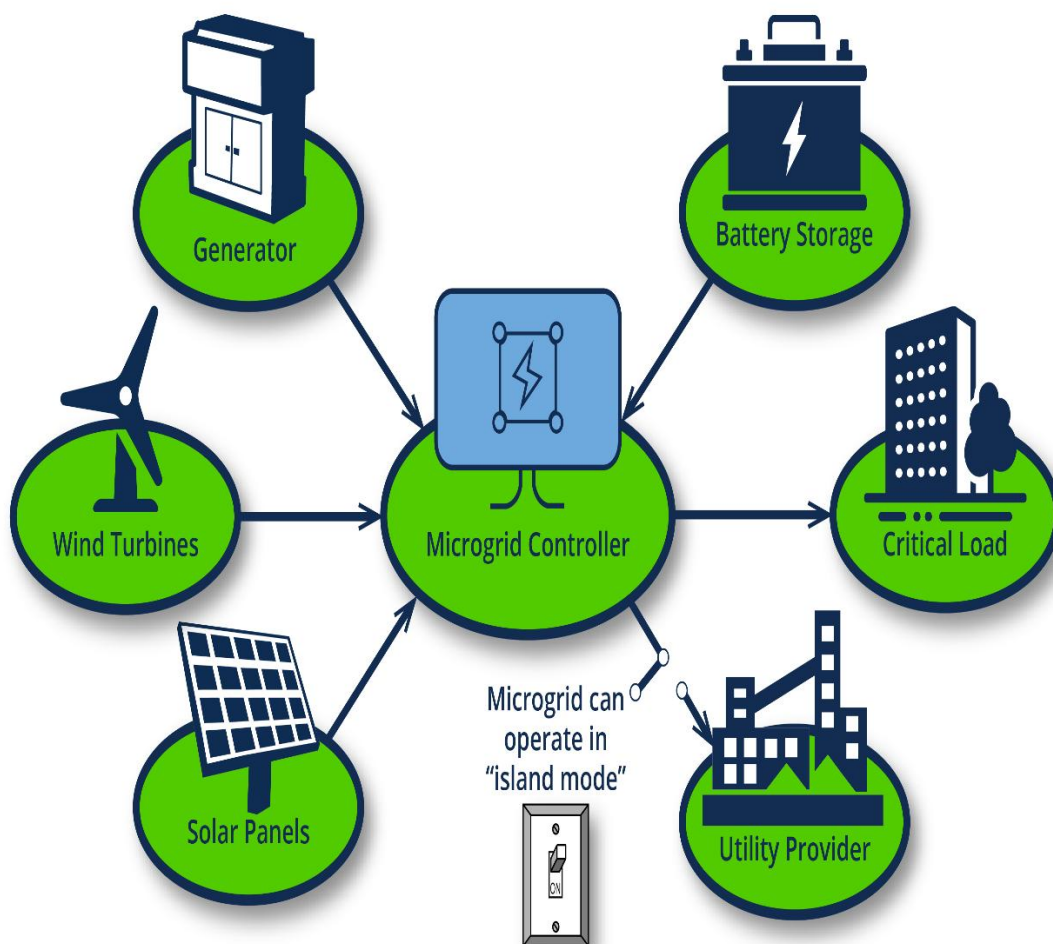
Storage: Energy storage systems—for instance, lithium-ion or solid-state batteries—are the central towers of the microgrids, converting energy from peak generation into storage for subsequent use.

Control Systems: Advanced control systems continuously monitor and manage generation, storage, and distribution of electricity. These integrate IoT and AI

technologies to optimize energy consumption, predict demand patterns, and shift between the grid-connected and islanded modes upon real-time condition use.

Microgrids for Empowering Communities

Microgrids empower communities on the microgrid level to access cleaner, more reliable, and more affordable energy. That is the future as microgrids expand more significantly into shaping the energy landscape in this ever-increasing quest for sustainable solutions. For budding electrical engineers, microgrid learning and work can prove an important stepping stone toward meaningful careers that change the world.



Sandip Digal
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Art Section

👋 Welcome to the Art Section of our Departmental magazine! ✍️

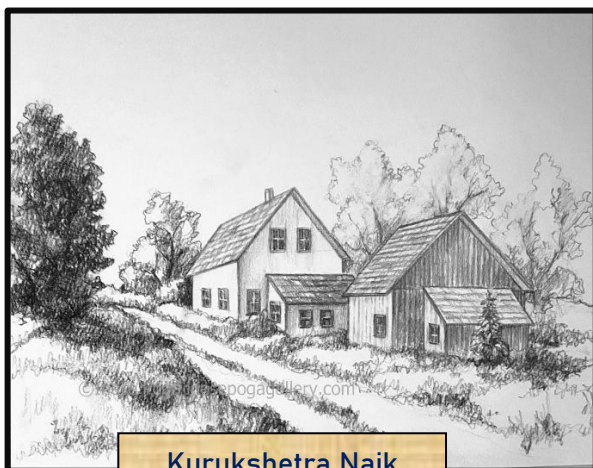
Art is not just about colors on a canvas or lines on a page; it's about expressing the depths of our imagination, emotions, and perspectives. In this section, we celebrate creativity in its myriad forms – from traditional paintings to digital art, from sculpture to photography, and everything in between.

Through the strokes of our brushes, the clicks of our cameras, and the chiseling of our sculptures, we aim to captivate, inspire, and provoke thought. Each piece featured here tells a story, reflects a moment, or expresses an idea unique to its creator.

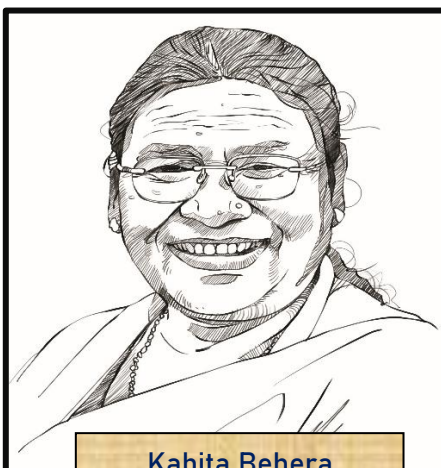
Art has the power to transcend boundaries, ignite conversations, and evoke profound emotions. So, immerse yourself in the world of creativity, let your imagination roam free, and join us on a journey through the boundless realms of artistic expression.

We invite you to explore, appreciate, and engage with the works showcased in this section. Let the colors, shapes, and textures speak to you, and may they inspire you to discover your own artistic voice.

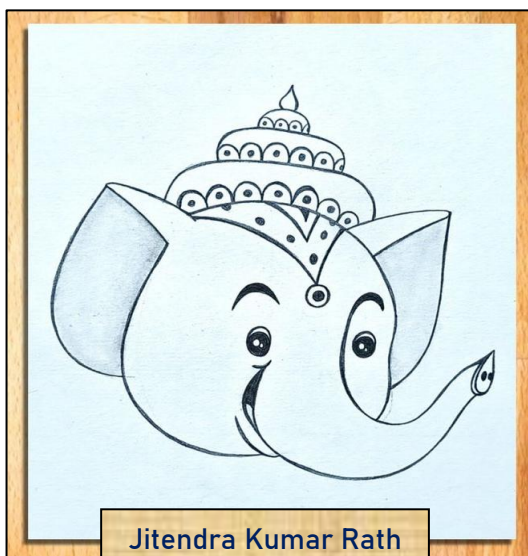
Enjoy the journey!



Kurukshetra Naik
2nd Sem Dip. EE



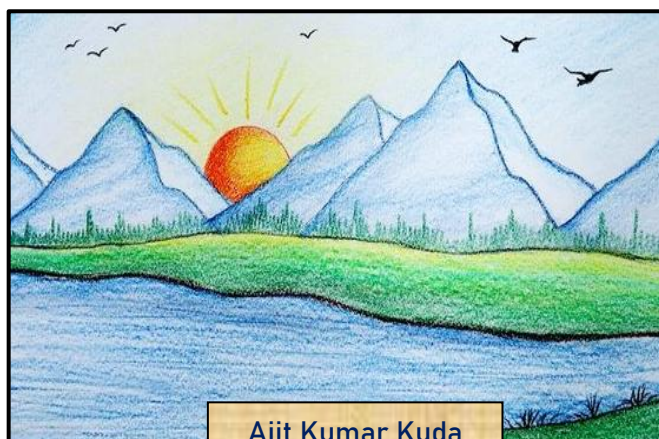
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POEMS

1. The Silent Forest
2. The Mountain's Story
3. Classroom Moments
4. The Tapestry of Society
5. A Love That Grows
6. In Your Eyes

SHORT STORIES

1. The Forgotten Melody
2. The Path to Purpose
3. The Last Exam
4. The Unexpected Friendship
5. The Lost Key

The Silent Forest

The forest stands, both old and wise,
Its towering trees reach for the skies.
Beneath the canopy, shadows play,
Where sunlight flickers, fades away.

The birds above in chorus sing,
A tune of joy that morning brings.
The earth below, so soft and green,
Is where the whispers of the woods are seen.

The breeze it carries scents so pure,
Of pine and earth, so calm, so sure.
Each step you take, the ground will guide,
Through paths where secrets softly hide.

The forest speaks in murmurs deep,
Its ancient tales, the earth will keep.
In silence, time moves slow and still,
While nature breathes, and hearts are filled.

Rajendra Rout
6th Sem Dip. EE

The Mountain's Story

The mountain looms in silent grace,
A timeless watch upon its place.
Through storms and sun, through night and day,
It stands unmoved in nature's sway.

Its peaks are crowned with snow and mist,
A secret world by clouds kissed.
The rivers rise from its deep heart,
And from its slopes, the wilds depart.

Beneath its stone, the earth does hum,
A tale of ages yet to come.
In quiet strength, it holds the sky,
A witness to the years go by.

The mountain speaks not in words loud,
But in the wind, in the sky's shroud.
Its silent presence tells a truth,
That time moves slow, yet stays aloof.

Kiriti Prasad Mohapatra
6th Sem Dip. EE

Classroom Moments

In classrooms filled with eager
minds,
We seek the answers, seek the signs.
The professor speaks, the pages turn,
As we strive, as we learn.
The chalkboard filled with facts and
clues,
We chase the knowledge, paid in
dues.
The lessons taught, the questions
asked,
Are keys that open every task.
But more than grades, more than
tests,
It's the moments that leave us
blessed—
The friendships, the laughter, the
times we share,
These are the memories we'll always
wear.

Trilochan Kandi
4th Sem Dip. EE

The Tapestry of Society

In the hustle, in the crowd,
Voices echo, soft and loud.
We build our world, brick by brick,
A tapestry both thin and thick.

In every hand, there's work to do,
In every heart, a dream so true.
We walk together, side by side,
In hope, in pain, we coincide.

Some dream of peace, while others fight,
Some seek the truth, some chase the
light.

But in this web, we all belong,
A harmony in rights and wrong.

We teach, we learn, we rise, we fall,
In society, we answer the call.
Though flaws are many, strong are we,
Together shaping what will be.

Tapash Maharana
4th Sem Dip. EE

A Love That Grows

Love is a seed, so small, so true,
It blooms and blossoms, red and blue.
In hearts it grows, both wild and free,
A timeless bond, a mystery.

Through days of joy and nights of
pain,
Love keeps its course, through sun
and rain.
It builds its roots, so deep, so strong,
A melody, a lasting song.

In every touch, in every glance,
Love is the rhythm, love is the dance.
It whispers softly in the breeze,
And lifts our souls with gentle ease.

Narayan Badajena
2nd Sem Dip. EE

In Your Eyes

In your eyes, I see the sky,
A place where dreams and stars will fly.
In every gaze, a world we share,
A love that's endless, beyond compare.

Your laughter is my favourite sound,
A melody that's always found.
In every smile, in every touch,
You make my heart feel oh, so much.

Together we are, and always will,
In love's embrace, time stands still.
For in your eyes, I find my home,
A love so pure, we're never alone.

Shishira Pujahari
4th Sem Dip. EE

The Forgotten Melody

Every morning, Mia would walk through the park, past the same old bench under the giant oak tree. It had become her ritual, a brief escape before the rush of the day. But one chilly autumn morning, as she passed by, she heard something she hadn't before—a soft melody, as if the wind itself was playing a tune.

She stopped, looking around, but saw no one. The music lingered in the air, gentle yet haunting. It seemed to come from the old bench, though no one sat there. Curious, Mia stepped closer. There, nestled against the bench, was an old violin case. She bent down, her heart racing, and opened it. Inside was a weathered violin, its wood scratched and worn but still beautiful. She didn't know much about music, but she could feel that this violin held a story.

Mia picked it up cautiously, her fingers brushing over the strings. As she did, a wave of memories flooded her mind—images of a boy she used to know, someone she hadn't thought about in years. His name was Ethan. They had met in high school, both passionate about music, and spent countless afternoons playing together in that very park. But life had pulled them in different directions. Mia had gone to college in another city, and Ethan had stayed behind, his dreams of being a musician slowly fading.

The violin felt familiar in her hands, and for a moment, it was as if time had reversed. She closed her eyes and began to play, her fingers moving over the strings without thought. The melody was one they had written together years ago, one that had never been finished.

As the final note faded into the air, Mia opened her eyes. Standing in front of her, with a shy smile, was Ethan. His hair was longer now, his eyes a little older, but his smile was the same.

"I never thought you'd come back," he said softly.

Mia smiled, holding up the violin. "I never stopped listening," she replied.

And in that moment, with the autumn leaves swirling around them, they picked up where they had left off, the music bridging the gap between time and distance, love and loss.

Ashwin Pujahari
4th Sem Dip. EE

The Path to Purpose

Sam had always drifted through life, letting the days pass without much thought about where they were taking him. He had a job he didn't love, a routine that felt comfortable, but something was missing. Every evening, he sat in his small apartment, staring at the same four walls, wondering if this was all there was to life.

One rainy afternoon, as Sam walked home from work, he passed by a small bookstore. A sign in the window caught his eye: "Live with Purpose—Find Your Path." Intrigued, he stepped inside. The air smelled of old pages and coffee. At the counter, an elderly man smiled at him warmly.

"You seem lost," the man said gently. "Looking for something?"

Sam hesitated, then shrugged. "Maybe... a purpose."

The man nodded, understanding in his eyes. "A life without purpose is like a ship without a sail. You can keep drifting, but you'll never reach your destination."

Sam wasn't sure what the man meant, but it stuck with him. Over the next few days, he couldn't shake the thought of finding a deeper meaning in his life. He started asking himself questions: What truly makes me happy? What am I passionate about? Slowly, he began to explore the things that had always interested him—helping others, teaching, creating art.

As Sam focused on these passions, he started making small changes in his life—volunteering in his community, taking up painting again, and even starting a blog to share his thoughts. The more he engaged with his purpose, the more fulfilled he felt. His days no longer seemed like a blur; they were full of intention and meaning.

Years later, Sam found himself living a life he had once only dreamed of. He had turned his passions into a career, built strong relationships, and discovered a profound sense of fulfillment. He knew now that life wasn't just about getting by—it was about living with purpose, with the courage to follow your heart and create a life that felt true to who you were meant to be.

Ejikel Raita
4th Sem Dip. EE

The Last Exam

Lina sat at her desk, her textbooks spread out before her, but her mind wandered. The final exam was just days away, and the pressure of the semester weighed heavily on her. The bright spring morning outside beckoned her, but she knew the importance of this moment—the last hurdle before summer break.

She had always been a diligent student, but this semester had been harder than most. Her schedule was packed with assignments, projects, and part-time work. But it wasn't just the workload that had her distracted—it was the fear of not measuring up, of not living up to her own expectations.

Her phone buzzed, snapping her back to reality. It was a message from her best friend, Maya: "Let's take a break and grab some coffee. You need it!"

Lina hesitated. She had so much to do. But she knew Maya was right. She needed to step away, even if just for a little while. After all, student life wasn't only about studying—it was about balance, about taking care of yourself along the way.

Lina met Maya at their favorite café, and they spent the next hour laughing, talking about everything but exams. Maya reminded her of all the challenges she'd already overcome, the late nights, the difficult subjects, and yet, Lina had always pulled through.

"Why do you put so much pressure on yourself?" Maya asked, a smile on her face. "You're doing great."

Lina smiled back, feeling the weight lift a little. "I guess I forget sometimes that it's not all about the grades."

As the sun dipped lower in the sky, Lina returned to her studies with renewed energy. She still had a lot of work to do, but now she saw the bigger picture. Student life wasn't just about passing exams or completing assignments—it was about growing, learning from mistakes, making memories with friends, and becoming the person you were meant to be.

The next day, she walked into the exam hall with confidence. No matter the outcome, she knew she had given her best. And that, in the end, was what truly mattered.

Jugesh Durga
2nd Sem Dip. EE

The Unexpected Friendship

It was the first day of college, and Sarah felt both excited and nervous. The campus was buzzing with new faces, unfamiliar places, and endless possibilities. She walked into her first lecture, a large auditorium filled with students, and found a seat near the back.

As the professor began speaking, Sarah tried her best to focus, but the sea of strangers around her made her feel small. She hated feeling out of place, and the thought of making new friends seemed daunting.

Just as Sarah was about to zone out, she felt a tap on her shoulder. Turning around, she saw a girl with bright, friendly eyes and a warm smile.

“Hey, you look a little lost,” the girl said, her voice soft but kind. “I’m Emma. It’s my first day too. Want to grab coffee after class?”

Sarah, taken off guard by the offer, hesitated for a moment. She had always been shy, never quite sure how to approach new people. But something about Emma’s genuine kindness made Sarah feel comfortable, so she nodded.

After class, they headed to the campus café. Over steaming cups of coffee, they shared stories about their high school lives, their fears about college, and their hopes for the future. Sarah found herself laughing more than she had in months, feeling a connection she hadn’t expected.

As the days turned into weeks, Sarah and Emma became inseparable. They studied together, went for late-night walks around the campus, and spent hours talking about everything under the sun. Sarah began to realize that college wasn’t just about grades or fitting in—it was about the relationships you formed along the way, the people who made you feel seen and understood.

One afternoon, as they sat on a bench by the lake, Emma turned to Sarah with a smile.

“You know, I’m really glad we met,” Emma said. “I think we were meant to be friends.”

Sarah smiled, feeling a warmth in her heart. “Me too,” she replied. “I never thought I’d find someone like you here.”

In that moment, Sarah understood that sometimes, the best friendships come when you least expect them, and they’re worth more than anything else you can find in the halls of a classroom.

Kaberi Mallick
2nd Sem Dip. EE

The Lost Key

One rainy afternoon, Mark sat at his desk in his small apartment, staring at his computer screen. He had been working tirelessly on a project for weeks, and the deadline was fast approaching. Yet, no matter how hard he tried, his mind kept drifting to the old, worn-out key sitting in the drawer of his desk.

The key had belonged to his grandmother, who had passed away a few months earlier. It was a small, ornate brass key—one he had always seen hanging on a chain around her neck, a key she had told him was to a box hidden somewhere in her house. But she never told him where the box was, and now, after her passing, the key had no purpose except to remind him of her absence.

Mark had kept the key close ever since, unsure of what to do with it, unsure if he should even search for the box. But that afternoon, as the rain tapped against the windows, something inside him urged him to take action.

He stood up, walked to the drawer, and took the key in his hand. It felt cold, familiar, and somehow comforting. With a deep breath, he decided to go to his grandmother's old house, the place he had visited countless times as a child, but hadn't stepped foot in since her passing.

When Mark arrived, the house was just as he remembered—quiet, with the scent of old books and dust hanging in the air. He made his way through the rooms, his fingers brushing against the familiar walls, until he found himself standing in front of the attic door, which had always been locked. He knew, without a doubt, that this was where the box must be hidden.

With trembling hands, Mark inserted the key into the lock. The door creaked open, revealing an attic filled with forgotten memories—boxes of old photographs, antique furniture, and trinkets from his grandmother's life. And there, in the far corner, was a small wooden chest, dust-covered but unmistakably the one his grandmother had spoken of.

Mark knelt down, his heart racing. He opened the chest, and inside was a stack of letters, tied with a red ribbon. They were addressed to him.

As he carefully untied the ribbon and read the first letter, he realized that his grandmother had left behind not just physical treasures, but words of love, wisdom, and guidance for him to hold onto. She had known that one day, he would find the key to her heart and her memories, and it was now up to him to cherish them.

Tears filled his eyes as he read each letter, feeling closer to his grandmother than ever before. The key, which had once been a symbol of loss, had become a symbol of connection—a reminder that the people we love are never truly gone, as long as we carry their memories in our hearts.

Asish Behera
2nd Sem Dip. EE