VOLUME - 22

JULY 2022 - DEC 2022

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

ELEKTOR

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CONTENTS

Vision of the Department

To prepare the learners globally competent, dynamic and multi talented young leaders with skill set & knowledge in Electrical and Electronics Engineering field with a focus on higher education, professional practice, research and technical consultancy competence ethical con- cern.

Mission of the Department

- To prepare the learners professionally deft and intellectually adept in the field of Electri- cal and Electronics Engineering with an excellent infrastructure, core values and quali- fied & experienced teaching faculty.
- To inculcate skill, knowledge and behavior to cater the dynamic requirements in the field of Electrical and Electronics Engineering.
- To motivate and prepare the learners for career guidance, placements and higher educa- tion with a focus on MoUs with premier institutes and industries.

Program Educational Objectives (PEOs)

PEO1: Solve challenging technological issues in the field of Electrical and Electronics Engi- neering for the betterment of the living standards of the society as valuable and productive engineers.

PEO2: Improve the efficiency and effectiveness of the existing methodologies by adapting out-of-the-box rationalized thinking.

PEO3: Function ethically and communicate professionally as a team member within multi- disciplinary teams.

PEO4: Continue the process of lifelong learning to cater the dynamically changing require- ments in the field of Electrical and Electronics Engineering.

Strengths of the Department

1. In every semester Department of EEE conducts minimum of two workshops and there guest lecturers in the re- cent trends in Electrical Engineering to bridge the gap between Academics & Industries, and the students will be guided to do their Major & Minor projects on the same topics.
2. Every faculty member of the department attends a minimum of one faculty development program in every aca- demic year. And most of the faculty members register for NPTEL online courses.
3. Department publishes a newsletter in every six months, which includes the activities that were done in the past two months; fortnight wall magazines based on recent advancements in the field of electrical engineering prepared by students

Message from Principal

"It is a moment of pride and joy to witness the Department of Electrical and Electronics Engineering bringing forth this technical magazine an excellent initiative to cultivate intellectual engagement and technical writing among students.

EEE is a dynamic discipline that continues to shape the future of sustainable energy, automation, smart technologies, and communication systems. I am confident that this magazine will serve as a mirror to the department's academic achievements, innovative thinking, and collaborative spirit.I appreciate the sincere efforts of the editorial team, faculty, and students for curating this publication. May continue to be a beacon of knowledge, inspiration, and academic excellence for years to come.

Happy Reading.

Dr. N. Sudhakar Reddy,
Principal

Message from HOD

It is with great pride and joy that I present this edition of the EEE Department's technical magazine. This publication symbolizes the innovative spirit, technical excellence, and collaborative effort that our department consistently nurtures. Electrical and Electronics Engineering is the backbone of modern technology—from power systems to robotics, automation to IoT. Through this magazine, our students have demonstrated not only academic brilliance but also a keen awareness of current trends and a passion to be future-ready.
I applaud every student who has contributed with creativity, research, and dedication. Let this magazine serve as both a milestone and a motivator for even greater achievements ahead. Best wishes to all our students - may you continue to question, innovate, and lead.

Happy Reading.

Dr. V. Lakshmi Devi, HOD, Dept. of EEE

Message from Faculty Advisor

It gives me immense pleasure to pen a few words for the Department Magazine of Electrical and Electronics Engineering. This magazine is a platform that showcases the talents, achievements, and innovative spirit of our students and faculty. This magazine reflects the creative and technical expressions of our young engineers. I am confident that the knowledge and insights shared here will inspire readers and help foster a culture of innovation and learning.

Dr. J. A. BASKAR, EEE

ARTICLES

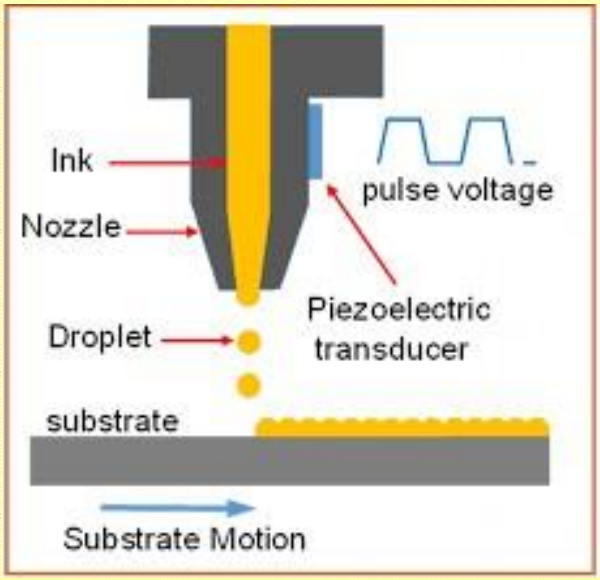
SOLAR-POWERED COLD STORAGE BOXES FOR VACCINES AND FOOD

Rural areas often lack electricity for cold storage. **Solar-powered refrigerators** and boxes are now being used in developing nations to store vaccines, food, and medicines safely. These units are portable, durable, and capable of maintaining temperatures below 4°C.

Solar refrigeration units are helping preserve vaccines and perishable goods in off-grid locations. These boxes use solar panels to charge thermal batteries, keeping contents cool for 3-5 days without sunlight. Organizations like UNICEF use them for vaccine transport in remote regions. Newer models include temperature monitoring and GPS tracking.

PRINTABLE SOLAR CELLS USING INKJET TECHNOLOGY

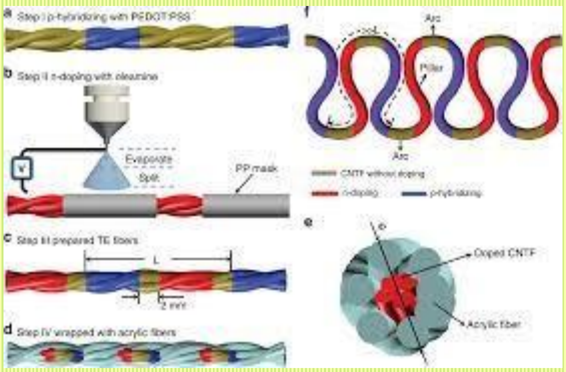
Printable solar cells use photovoltaic inks containing perovskite or organic compounds. They can be printed on flexible plastic sheets and installed on irregular surfaces like tents, backpacks, and emergency shelters. Though less efficient than silicon cells, they are cheap, lightweight, and ideal for temporary or mobile energy needs. Researchers are working to improve stability and lifespan to bring these products to market.



Engineers have created **solar panels that can be printed like newspapers** using conductive ink. These low-cost, lightweight cells can be used on tents, backpacks, or emergency shelters, providing instant electricity. This innovation democratizes energy by making it **cheap, flexible, and portable**.

THERMOELECTRIC FABRICS THAT TURN BODY HEAT INTO POWER:

Researchers have developed wearable thermoelectric JBfabrics that convert body heat into electricity. These fabrics contain semiconductor nanowires woven into synthetic fibers. As the body generates warmth, the temperature difference between the skin and outer air creates a voltage through the Seebeck effect. These materials can power low-energy wearables like fitness trackers, smartwatches,or health sensors without external batteries. Scientists at North Carolina State University created a fabric that generates up to 10 microwatts per square centimeter— enough to keep small devices operational continuously.



ELECTRICITY FROM RAINDROPS USING TRIBOELECTRIC NANOGENERATORS:

A new form of energy harvesting uses the motion and impact of raindrops to generate power. Using triboelectric nanogenerators (TENGs), these systems can convert mechanical energy from falling rain into electricity. Each droplet creates a tiny charge when it hits a specially designed surface made of layered polymers and graphene electrodes. Researchers in Hong Kong achieved over 140 volts from a single drop under ideal lab conditions. This technology can

complement solar panels during cloudy or rainy weather, especially in tropical regions.

HYDROGEN-POWERED TRAINS FOR EMISSION-FREE TRANSIT

Countries like Germany and Japan have deployed hydrogen-powered trains that emit only water vapor. These trains use fuel cells to combine hydrogen with oxygen from the air, generating electricity for traction motors. One hydrogen train can run up to 1,000 kilometers on a single tank and emits zero greenhouse gases. With charging stations being replaced by hydrogen refueling depots, these trains are now being introduced in routes where full electrification of tracks is not economically viable.

J.PRASAD (200BFA0256)

CURRENT EEE

Smart Windows with Electrochromic Technology:

Abstract:

Electrochromic windows dynamically adjust their transparency in response to an electric signal, allowing control over light and heat entering buildings. These smart windows use materials like tungsten oxide that change optical properties when voltage is applied. Ideal for energy-efficient buildings, they reduce cooling loads by 20–30% and enhance occupant comfort. Integrated with IoT, these windows can auto-adjust based on weather conditions and time of day. Research shows long-term durability and fast switching speeds, making them ideal for green architecture.

Energy Harvesting from Wi-Fi Signals Using Rectennas:

Abstract:

Recent advancements in rectifying antennas (rectennas) have enabled energy harvesting from ambient radio frequency (RF) signals such as Wi-Fi. These devices convert electromagnetic waves into direct current electricity, suitable for powering low-energy devices like IoT sensors and wearables. Researchers have developed flexible, ultra-thin rectennas using graphene and printed electronics that can be embedded into clothing or walls. Although power levels are low (~100 microwatts), future improvements aim to support self-powered smart systems.Self-Healing Batteries for Safer Energy Storage

Polymer-based electrolytes that can repair internal cracks and extend battery lifespan.

Abstract:

Self-healing battery materials are being engineered to address the issue of short circuits and degradation caused by repeated charging cycles. These batteries use polymer-based electrolytes that can repair internal cracks through reversible chemical bonds, significantly extending lifespan and reducing fire risk. Applications include consumer electronics, electric vehicles, and aerospace systems. Tests show up to 95% capacity retention after 500 cycles, opening possibilities for safer and longer-lasting battery technologies.

Hydrogel-Based Solar Panels for Humid Environments

Abstract:

Solar panels often face efficiency loss in hot climates due to overheating. A new hydrogel-based cooling layer, developed by researchers, extracts water from air and uses evaporation to cool panels naturally. This passive system reduces panel temperatures by up to 10°C, enhancing output by 15–20%. Made from polyacrylamide gel with hygroscopic salts, the system operates without electricity and is ideal for tropical or desert regions. This vapor cools the solar panel surface through evaporation, reducing overheating and maintaining optimal energy output. In some designs, the hydrogel also purifies the collected water, offering dual benefits of power generation and clean water production. This approach is particularly effective in tropical or coastal areas where conventional panels suffer from reduced efficiency due heat and moisture.

M.YOGESH (20BFA0256)

Graphene-Based Supercapacitors for Ultra-Fast Charging

Abstract:

Graphene supercapacitors are emerging as next-gen energy storage devices capable of ultra-fast charging and discharging. Their high surface area, excellent conductivity, and mechanical strength make them ideal for electric vehicles and portable electronics. Unlike traditional batteries, they can withstand millions of cycles without degradation, and recent lab models have achieved energy densities rivaling lithium-ion batteries hese supercapacitors can deliver high power density and long cycle life, making them ideal for applications requiring rapid bursts of energy, such as electric vehicles, portable electronics, and renewable energy systems. .

Wireless Charging Roads Using Embedded Inductive Coils:

Abstract:

Roads with embedded inductive coils can charge electric vehicles on the move using magnetic resonance. This innovation, pioneered in South Korea and Sweden, reduces the need for large onboard batteries. Dynamic charging improves EV efficiency, extends driving range, and could eliminate charging stations entirely in the future smart cities. These roads contain inductive coils embedded beneath the surface, which create a magnetic field when powered. A corresponding receiver coil installed in the vehicle captures this energy and converts it into electricity to charge the battery wirelessly.

Energy Harvesting from Human Motion Using Triboelectric Generators:

Abstract:

Triboelectric nanogenerators (TENGs) convert human movements into electricity using contact electrification and electrostatic induction. Embedded in shoes or clothing, they can power fitness bands, medical sensors, or emergency lights. Some designs even charge small batteries during walking or running.Triboelectric nanogenerators (TENGs) operate based on the triboelectric effect, where certain materials become electrically charged after frictional contact. Lightweight, flexible, and wearable, TENGs can be integrated into clothing, shoes, or accessories to power small electronics, sensors, or health-monitoring devices without batteries. This sustainable approach to energy harvesting has promising applications in wearable technology, biomedical devices, and the Internet of Things (IoT), enabling self-powered systems driven by human activity.

Smart Windows with Adjustable Transparency and Solar Power:

Abstract:

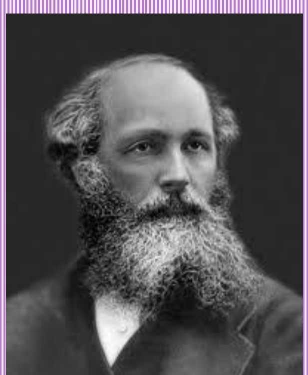
Electrochromic smart windows can switch between clear and tinted modes while generating solar power. These windows use nano-coated layers to change transparency with a small voltage, improving indoor comfort and reducing HVAC loads. These windows use electrochromic or thermochromic materials to adjust their transparency in response to light, heat, or electrical signals—allowing them to regulate indoor lighting and temperature. Integrated photovoltaic layers or transparent solar cells enable the windows to generate electricity from sunlight, powering building systems or storing energy for later use. This dual-functionality helps reduce energy consumption for lighting, heating, and cooling, making smart windows a key component in sustainable and energy-efficient architecture.

S.SANDHYA (20BFA0225)

Joseph Henry (1797–1878):

Henry discovered **electromagnetic self-induction** and improved the design of electromagnets. The unit of inductance, the **henry**, is named in his honor.

James Clerk Maxwell (1831–1879):



Scottish physicist James Clerk Maxwell formulated a set of four equations that describe how electric and magnetic fields interact and propagate as waves. His work unified the theories of electricity, magnetism, and optics, forming the foundation for classical electromagnetism. Albert Einstein famously credited Maxwell's theories as the foundation for his own breakthroughs in relativity. His set of equations, known as **Maxwell's equations**, unified electricity, magnetism, and light into a single theoretical framework, showing that light is an electromagnetic wave. This groundbreaking work laid the foundation for much of modern physics and electrical engineering, influencing technologies from radio to optics.

Mária Telkes (1900–1995) :

Dr. Mária Telkes was a Hungarian-American scientist known as the "Sun Queen" for her pioneering work in solar thermal storage and heating systems. She developed one of the first solar-powered homes and contributed to solar distillers used in World War II. Telkes' inventions laid the groundwork for modern solar thermal technologies used in clean energy solutions today.

Claude Shannon (1916–2001)

Claude Shannon was an American mathematician and electrical engineer who established the foundations of digital circuits and communication theory. His 1948 paper *"A Mathematical Theory of Communication"* introduced the concept of binary code and data compression, forming the bedrock of modern telecommunications, computing, and internet technologies.Shannon's work revolutionized telecommunications, computer science, and coding theory, enabling the development of modern digital systems such as the internet, mobile phones, and data encryption.

G.HIMA PRIYA(20BFA0216)

Smart Materials That Generate Electricity from Stress

Source: Massachusetts Institute of Technology (MIT)
Summary: Scientists have engineered a new class of *piezoelectric metamaterials* capable of converting mechanical stress—such as vibrations or pressure—into usable electrical energy. These materials are embedded with nano-scale conductive filaments that align under stress, generating voltage via deformation. This development opens possibilities for **self-powered sensors**, wearable electronics, and autonomous monitoring systems in industrial environments, significantly reducing the need for external power sources.

Graphene-Based Supercapacitors for Ultra-Fast Charging

Source: University of Manchester
Summary: Researchers have developed **graphene-integrated supercapacitors** that can charge up to 100 times faster than conventional lithium-ion batteries.
Utilizing the high surface area and conductivity of graphene, these devices store energy in electric fields rather than chemical reactions, enabling rapid charging/discharging cycles. This technology is particularly promising for **electric vehicles**, drones, and renewable energy storage, offering long life cycles with minimal energy loss.

AI-Controlled Smart Grids to Optimize Power Distribution

Source: Stanford University & National Grid UK
Summary: A new AI-powered grid system has been successfully tested that dynamically balances **supply and demand** in real-time across the electrical network. By incorporating machine learning models, the system can predict peak load patterns and redirect power from renewable sources (like solar and wind) before demand spikes. This helps reduce blackouts and energy waste while integrating decentralized power sources efficiently.

New Solar Paint Converts Any Surface into an Energy Generator

Source: RMIT University, Australia
Summary: Researchers have developed a solar paint that absorbs moisture from the air and uses sunlight to split water molecules, producing hydrogen fuel.
This innovative paint contains synthetic molybdenum-sulfide which acts as a catalyst for hydrogen production. When applied to surfaces like rooftops or walls, it can turn buildings into miniature hydrogen power plants—signaling a major shift toward decentralized clean energy systems.

Flexible Electronics Powered by Human Motion

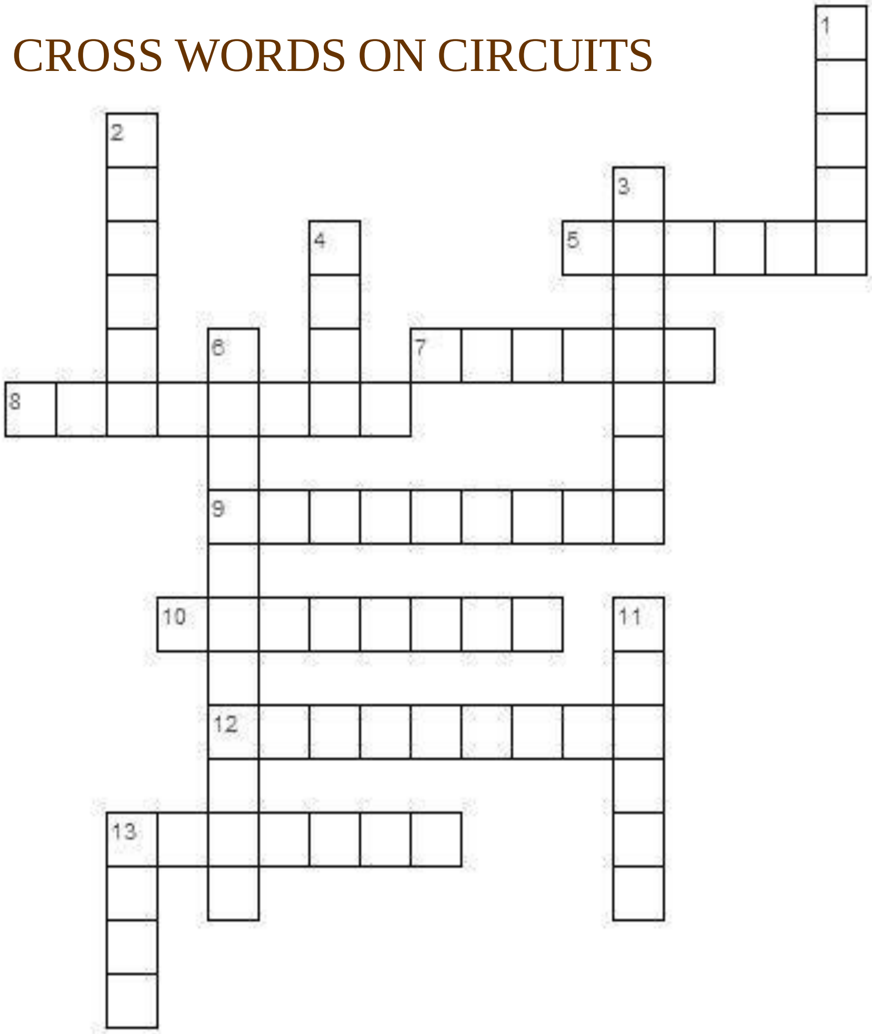
Source: Georgia Institute of Technology
Summary: A breakthrough in **triboelectric** nanogenerator (TENG) technology has enabled the creation of flexible electronic devices that can charge themselves using body movement. Embedded in clothing or skin patches, these materials convert friction into usable energy—powering sensors, LEDs, or even communication modules. This is a game-changer for **wearable tech and health monitoring**.

Carbon Nanotube Cables Stronger and More Conductive than Copper

Source: Rice University
Summary: New carbon nanotube cables are proving to be not only **ten times stronger** than copper but also **more efficient** at conducting electricity. Their lightweight, corrosion-resistant nature makes them ideal for aerospace applications and next-generation electric grids. These cables may soon replace traditional metallic conductors in high-performance and weight-sensitive environments.

B.DIVYA (20BFA0209)

CROSS WORDS ON CIRCUITS



Across

5 bulbs shining less
7 This controls everything
8 side by side circuits
9 Anything in a circuit
10 bulbs shining more
12 Beware of the teeth
13 There can be no power without this

Down

1 This should move things
2 No honey from this
3 Power flows around this
4 thin wire which breaks if power is too much
6 The name of the energy
11 components one after the other
13 Throws some light on the subject

A RAJA
20BFA0258