

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

# ELEKTOR

S V COLLEGE OF ENGINEERING

## CONTENTS

ARTICLES  
CURRENT EEE  
MEGA MINDS  
E-NEWS  
IGNITE YOURSELF

## EDITORIAL BOARD

Dr. K. SUDHEER  
Mr. P. VINOD KUMAR

## DESIGN DEPARTMENT

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JYOTHIPRAKASH

## 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 concern.

## Mission of the Department

- ◆ To prepare the learners professionally deft and intellectually adept in the field of Electrical and Electronics Engineering with an excellent infrastructure, core values and qualified & 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 education with a focus on MoUs with premier institutes and industries.

## About the Department

The Electrical & Electronics Engineering department was started with UG programme in 2007 with an intake of 60. The department has well talented, qualified, experienced & dynamic faculty along with skilled technical supporting staff who spearhead the process of achieving the vision of the department. The department has well equipped labs & infrastructure. It is continuously striving to impart quality education and competitive spirit among students for academic excellence.

## Strengths of the Department

1. In every semester Department of EEE conducts minimum of two workshops and there guest lecturers in the recent 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 academic 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

“The mind is not a vessel to be filled, but a fire to be kindled.” Said Plutarch.

I congratulate the staff and students of all faculties who used various mediums of expression to present their ideas. As long as our ideas are expressed and thoughts kindled we can be sure of learning, as everything begins with an idea. I appreciate every student who shared the joy of participation in co-curricular and extracurricular activities along with their commitment to curriculum. That little extra we do, is the icing on the cake.

Do more than care – help  
Do more than dream – work.  
Do more than forgive – forget  
Do more than be fair – be kind  
Do more than believe – practice  
‘Do more than belong – participate

Just as our mother earth gives us more and more, ELEKTOR will enable our learners to give and get a little more of learning.

Happy Reading!

**Dr. N. Sudhakar Reddy, Principal**

## Message from HOD

It gives me immense pleasure to pen a few words as prologue to the technical magazine ELEKTOR of the EEE department. This issue is designed to present the write-ups regarding topics related to electrical engineering, self development and the scientists introduction etc which makes the issue resourceful and informative. I congratulate all the contributors all the contributors and also the editorials board for bringing out such a nice issue.

Happy Reading.

**Dr. K. Sudheer, HoD, Dept. of EEE**

## Message from Faculty Advisor

It gives us great pleasure to bring the technical magazine Blaze, the department magazine of EEE. The name and fame of an institute depends on the caliber and achievements of the students and teachers. The role of a teacher is to be a facilitator in nurturing the skills and talents of students. This magazine is a platform to exhibit the literary skills and innovative ideas of teachers and students. We would like to place on record our gratitude and heartfelt thanks to all those who have contributed to make this effort a success. Last but not the least we are thankful to all the authors who have sent their articles. We truly hope that the pages that follow will make an interesting read.

**P.Vinod Kumar, Associate Professor, EEE**

## **HYPERLOOP - ULTRA-FAST SOLAR-POWERED TRAIN**

Tesla Motors, has just announced his plans for a brand new eco-friendly vehicle called "Hyperloop" that could bring people from LA to San-Francisco in just 30 minutes.

The next-gen transit system, which would help passengers travel at a speed twice as fast as that of a plane, and 3 to 4 times faster than a bullet train.

But what is really impressive is that the entire system will be powered by solar energy.



## **SOLAR ROAD PANELS**

Solar Road Panel is a device that generates electricity by making use of solar energy. The Panel is made of solar cells and glass.

Solar Roadways made each solar panel weatherproof, featuring a number of layers, including a transparent road surface layer, an electronics layer with LEDs and solar cells, and a base plate layer used to convey electricity to buildings connected to the roadway.

Probably the biggest advantage of these road panels is that they are self-heating, meaning that neither snow nor ice will gather on their top.



## **GREEN CAR POWERED BY WIND AND SOLAR POWER**

Being impressed by the shapes of nature, designer Cristian Polaco decided to come up with a rather unusual concept of an eco-friendly vehicle. AERO is the result of his imagination. The car represents three-wheeled electric vehicle that has space for two people, the driver and "co-pilot".

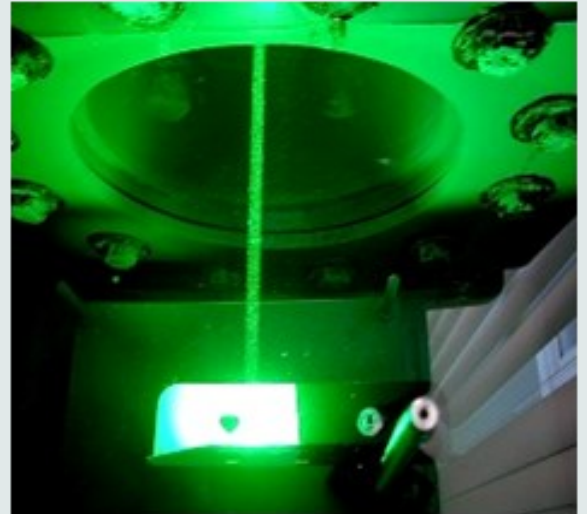


The green vehicle has its body made of compressed polymers that considerably reduce the weight of the car and which can be easily recycled. Each of the two front wheels of AERO has its own electric motor that is linked to the car's steering wheel via a wireless system. The onboard batteries can be recharged using the power of wind and sun, plus one can plug the car into a 120V source.

## **TECHNOLOGY THAT TURNS LASERS INTO SOUND**

Scientists managed to turn light into sound using their latest invention - a brand new laser technology. A team of researchers at the Naval Research Laboratory developed a technology able to increase and improve underwater acoustic applications. The technology allows compressing laser pulses. It is worth

mentioning that different colors of a laser pass through air and water at different speeds. However, in the water the concentration effects prove to be stronger. It is possible for a well-tuned laser to pass several hundreds of meters through the air and then rapidly compress after entering the water, which would help a jet to send messages un-



derwater, reports Live Science. If the colors of a laser are arranged in a particular way, the laser pulse would compress in time while passing through the water, which focuses the light. To be able to transform light into sound, researchers compress a laser pulse so it would ionize a small quantity of water. After giving charge to the molecules of water, the ionized water soaks up the laser energy and then heats up. Finally scientists witness a small explosion of steam that produces a pulse of sound having 220 decibels. It is worth mentioning that this latest invention could be used to improve the use of underwater acoustics for both Naval and commercial purposes such as undersea communications, navigation and acoustic imaging.

## **BRIDGE HARNESSES WIND ENERGY FROM PASSING CARS**

The design of this interesting concept was developed by Tiago Barros and Jorge Pereira. The two thought about creating a bridge that would exploit wind energy, which will be amplified by the vehicles that would pass under it. The length of the Cross-Wind Bridge is 40

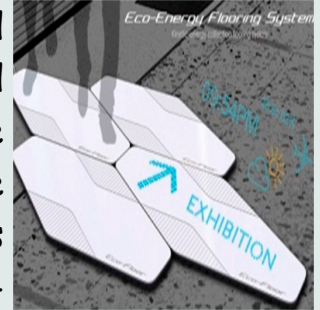


meters. It has a system of 2188 built-in rotating panels that rotate as the wind blows to produce electricity. The latter powers the lighting on the bridge in the evening. It is expected that the vehicles passing under the bridge will boost the speed of the wind by 20 percent, thus increasing the rotation speed of the panels. Both pedestrians and bikers will be able to use the bridge. It would be worth noting that 35 percent of the punctured casing that forms the bridge cladding is created from recycled steel that is taken from auto industry.

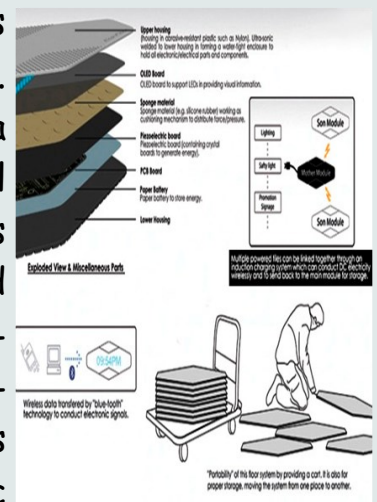
## **PADS USE PAPER BATTERY TO GENERATE POWER WHEN SOMEONE WALKS OVER THEM**

An interesting eco-friendly idea was proposed by designer Stephen Chan Wing Tak.

He is the author of the Eco-Energy Flooring System pads that feature a paper battery system used to collect energy that is generated when people walk and run over the piezoelectric blocks. To put it simple: the system is composed of blocks that are mounted on the floor and when someone steps on these blocks, energy is produced. Afterwards the collected power is used to light up LEDs.



Each pad is made of six layers, with the upper one being water resistant and covered with ultrasonic welding to make it humidity-proof. The next layer features an OLED board that can have all sorts of symbols, letters, numbers that can light up. Then there's a sponge material that dispenses the force and pressure. The follow-up level includes the piezoelectric board featuring crystal boards to produce power. Below there's the paper battery and the last layer is the one that touches the ground. The system is easy to transport and



## Design and Modeling of Metamorphic Dual-Junction InGaP/GaAs Solar Cells on Si Substrate for Concentrated Photovoltaic Application

### **Abstract:**

We have investigated the concentrated photovoltaic performance of metamorphic monolithic InGaP/GaAs dual-junction (2-J) solar cells on Si substrate under AM1.5d spectrum using finite-element analysis. The current-matching condition between each subcell was realized for threading dislocation density varying from  $10^5$  to  $10^7$  cm<sup>-2</sup>, emanating from the mismatch between GaAs and Si substrate. Through comprehensive cell design and by mitigating the losses due to shadowing effect and series resistance, we present an optimal cell design for harnessing the maximum potential of 2-J InGaP/GaAs cell integrated on Si substrate for concentrated photovoltaics. The optimization of front grid spacing and sheet resistance of the window layer were the key design parameters taken into consideration for extending the peak performance toward higher concentrations. Finally, we present an optimized 2-J InGaP/GaAs cell design on Si, which exhibited a theoretical conversion efficiency of 33.11% at 600 suns at a realistic TDD of  $10^6$  cm<sup>-2</sup>, indicating a promising future for integrating III-V cell technology on Si for low-cost concentrated photovoltaic.

## An Enhanced SVM Method to Drive Matrix Converters for Zero Common-Mode Voltage

### **Abstract:**

An enhanced space vector modulation (SVM) method to drive matrix converters (MCs) with zero common-mode voltage by using the rotat-

ing vectors, which are not used in the traditional SVM for MCs. The reference output voltage vector is generated by a combination of the closer rotating vectors in order to minimize the output distortion. Explicit equations are used to develop the switching patterns so that the proposed SVM

method can achieve full control of the output voltage vector and input current phase angle with good performance of the input/output current waveforms. Together with the theoretical analysis, the experimental results are provided to validate the feasibility of the proposed method.

## Flexible Control Strategy for Grid-Connected Inverter Under Unbalanced Grid Faults Without PLL

### **Abstract:**

Power oscillation and current quality are the important performance targets for the grid-connected inverter under unbalanced grid faults. First, the inherent reason for the current harmonic and power oscillation of the inverter is discussed with a quantitative analysis. Second, a new control strategy is proposed to achieve the coordinate control of power and current quality without the need for a phase-locked loop (PLL) or voltage/current positive/negative sequence extraction calculation. Finally, the experimental tests are conducted under unbalanced grid faults, and the results verify the effectiveness of the propose method.

## Analysis of a Switched Impedance Transformer-Type Nonsuperconducting Fault Current Limiter

### **Abstract:**

A non superconducting fault current limiter (NSFCL) topology and control strategy. The switched impedance transformer-type NSFCL topology is optimized to protect against short transients and to work in conjunction with other fuses or circuit breakers, hence has the merits of being simple, low cost, and compact. A prototype has been designed and built for a three-phase 600-VRMS,L-L system. It has been tested in a ULcertified high-power test lab with 5-A normal current and 100-kA potential fault current.

### Power Loss Prediction and Precise Modeling of Magnetic Powder Components in DC-DC Power Converter Application

#### **Abstract:**

In power electronics applications, magnetic components are often subjected to non sinusoidal waveforms, variable frequencies, and dc bias conditions. These operating conditions generate different losses in the core compared to sinusoidal losses provided by manufacturers. In the conception and design stage, lack of precise losses diagnosis has unacceptable effects on system's efficiency, reliability, and power consumption. Since virtual prototyping is used to predict and improve system's behavior before realization, losses and behavior prediction of components is possible. Circuit simulators and their compatible components models are required. This topic is summarized by proposing nonlinear dynamic model of powdered material magnetic core for use in circuit simulators. It includes the material's nonlinear hysteresis behavior with accurate winding and core modeling. The magnetic component model is implemented in circuit simulation software "Simplorer" using VHDL-AMS modeling language. Waveforms and losses of a powder core inductor in a buck converter application are simulated and compared to measured ones.

The model is validated for different ripple currents, different loads, and a wide frequency range. DC bias is taken into account in both continuous and discontinuous conduction modes.

### Hybrid Control of DC-DC Series Resonant Converters: The Direct Piecewise Affine Approach

#### **Abstract:**

The control and stabilization of resonant converters are essential problems in power electronics. The conventional controller design and stability analysis for these converters are based on the linearized averaged model. Nevertheless, the state variables in resonant converters have large ac variations and the validity of the linearized average model is violated. Hence, using large signal and nonaveraged models are necessary for controller design and stability analysis. In this topic, a new hybrid controller is presented that is applicable to dc-dc series resonant converters and use neither averaging nor small signal approximation. The dc-dc resonant converters are inherently switched affine systems with constrained switching law. The proposed controller is based on the switched behavior of the converter and the concept of piecewise affine methodology. Moreover, it has switched inner and proportional-integral (PI) outer control loops and does not require a modulator. The large signal and closed loop stability analysis of the resonant converters is presented by a theorem. The minimum phase attribute of the control system is investigated by zero dynamic stability analysis. The proposed controller has less complexity in comparison to other suggested controllers and can be implemented using simple analog circuits. The simulation and experimental results show the effectiveness of the proposed method.

# Mega Minds

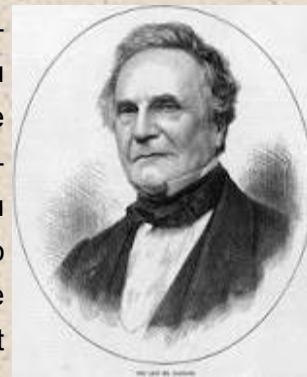
## C. V. Raman (1888-1970)

One of the most prominent Indian scientists in history, C.V. Raman was the first Indian person to win the Nobel Prize in science for his illustrious 1930 discovery, now commonly known as the “Raman Effect”. It is immensely surprising that Raman used equipment worth merely Rs.200 to make this discovery. The Raman Effect is now examined with the help of equipment worth almost millions of rupees. The ‘Raman Effect’ is considered very significant in analyzing the molecular structure of chemical compounds. After a decade of its discovery, the structure of about 2000 compounds had been studied. Thanks to the invention of the laser, the ‘Raman Effect’ has proved to be a very useful tool for scientists.



## Charles Babbage (1791 – 1871)

Do you ever wonder who you have to thank for the powerful desktop or laptop you are now using for practically everything you do? You might say all thanks should be given to the computer companies of today but in fact, you have Charles Babbage to thank. The name might not be familiar to you just yet but read on because pretty soon, “Charles Babbage” will be on your mind every time you use your computer. Charles Babbage was born on Dec. 26, 1791 in England. He was a polymath and became a mathematician, mechanical engineer, inventor, and philosopher. He had a lot of contributions to different scientific fields but his most famous work is probably coming up with the idea of a programmable computing device.



## Charles-Augustin de Coulomb (1736-1806)

Charles-Augustin de Coulomb was an eminent French physicist. He formulated the Coulomb’s law, which deals with the electrostatic interaction between electrically charged particles. The coulomb, SI unit of electric charge, was named after him. He also developed the inverse square law of attraction and repulsion of unlike and like magnetic poles. Coulomb extensively worked on friction of machinery, the elasticity of metal and silk fibres and windmills. The coulomb, SI unit of electric charge, was named after him.



## Joseph Henry ( 1797 – 1878 )

Joseph Henry was at the forefront of the great electromagnetic advances of the 1830s. He built the world’s most powerful electromagnets and made practical breakthroughs that allowed Samuel Morse to invent the telegraph. Henry also discovered mutual induction, in which a changing current (and hence changing magnetic field) in one wire induces a voltage in any wires that are nearby. The unit of electrical inductance is named the *henry* in his honor, with the symbol *H*. For most of the second half of the 1800s he was America’s most renowned scientist.



**DHEERAJ  
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## Nanowires give 'solar fuel cell' efficiency a tenfold boost

**Source:** Eindhoven University of Technology

**Summary:** Researchers have developed a very promising prototype of a new solar cell. The material gallium phosphide enables their solar cell to produce the clean fuel hydrogen gas from liquid water. Processing the gallium phosphide in the form of very small nanowires is novel and helps to boost the yield by a factor of ten. And does so using ten thousand times less precious material.

## Powerful, efficient ceramic fuel cells could enable in-home production of electricity from natural gas

**Source:** Colorado School of Mines

**Summary:** The development of affordable and efficient ceramic fuel cells that could be used to power homes is the culmination of five years worth of work, investigators say. The research would enable more efficient use of natural gas for power generation through the use of fuel cells that convert the chemical energy of a fuel source into electrical energy close to where it is used, the authors of a new study explain.

## Evaporation-powered motor and light

**Source:** Department of Energy, Office of Science

**Summary:** Rotary engine harnesses energy from evaporation to drive a miniature car. Electron microscope image shows the evaporation-powered "artificial muscle" made from bacterial spores on a polymer component. Could water evaporating provide power? Biological systems are known to convert energy generated from the evaporation of water confined within nanoscale compartments into muscle-like mechanical work in response to changes in environmental humidity. Recently, scientists designed shape-changing engineered composites of bacterial spores and a polymer that used an evaporation-driven process to power locomotion and generate electricity.

## Dive of the RoboBee

**Source:** Harvard University

**Summary:** For the first time, researchers have demonstrated a flying, swimming, insect-like robot -- paving the way for future dual aerial aquatic robotic vehicles. The Harvard RoboBee, designed in Wood's lab, is a microrobot, smaller than a paperclip, that flies and hovers like an insect, flapping its tiny, nearly invisible wings 120 times per second.

## New design brings world's first solar battery to performance milestone

**Source:** Ohio State University

**Summary:** After debuting the world's first solar air battery last fall, researchers have now reached a new milestone. They report that their patent-pending design -- which combines a solar cell and a battery into a single device -- now achieves a 20 percent energy savings over traditional lithium-iodine batteries. The square piece of solar cell (center) is red, because the researchers are using a red dye to tune the wavelength of light it absorbs and converts to electrons.

## Eco-friendly battery and solar cell all-in-one

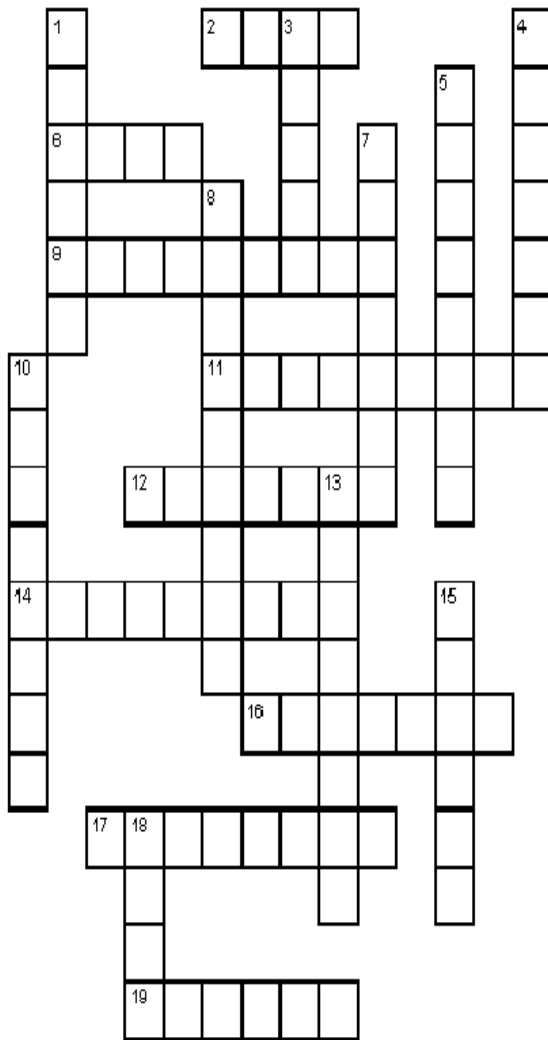
**Source:** Department of Energy, Office of Science

**Summary:** In solar flow batteries, the proposed charging process links harvesting solar energy and storing it as chemical energy via the electrolyte. Scientists built a solar flow battery that uses an eco-friendly, compatible solvent and needs a lower applied voltage to recharge the battery. More efficient, eco-friendly electricity generation with a "solar flow battery" combines a redox flow battery and a dye-sensitized solar cell, using compatible, water-based

JYOTHIPRAKASH  
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# IGNITE YOURSELF



## Across:

2. A safety device that break a circuit when too much current is flowing.
6. The unit that current is measured in (for short).
9. A material that doesn't conduct electricity well.
11. A material that conducts electricity will.
12. The flow of electrons through a material is called electric \_\_\_\_\_.
14. An electric discharge from the sky to the ground during a storm.
16. A voltage supply used in flashlights and many toys.
17. The charge on a proton.
19. A device that will open or close a circuit.

## Down:

1. Kind of electricity resulting from a build up of charged particles.
3. A type of circuit where current by passes most resistance and large, dangerous currents flow.
4. A switch that open a circuit when too much current is flowing.
5. A device that resists the flow of electricity in a circuit.
7. A path through which electric current flows.
8. Electricity is the movement of \_\_\_\_\_ through a conductor.
10. A circuit with more than one path through which electrons can flow.
13. The charge on an electron.
15. A circuit with only one path through which electrons flow.
18. The unit that resistance is measured in.

**BANDHAVYA  
17BF1A0239**

