KAMARAJ

COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous institution - AFFILATED TO ANNA UNIVERSITY, CHENNAI)

Department of Electrical and Electronics Engineering

E-SHOTS-21st EDITION

June 2022 to December 2022

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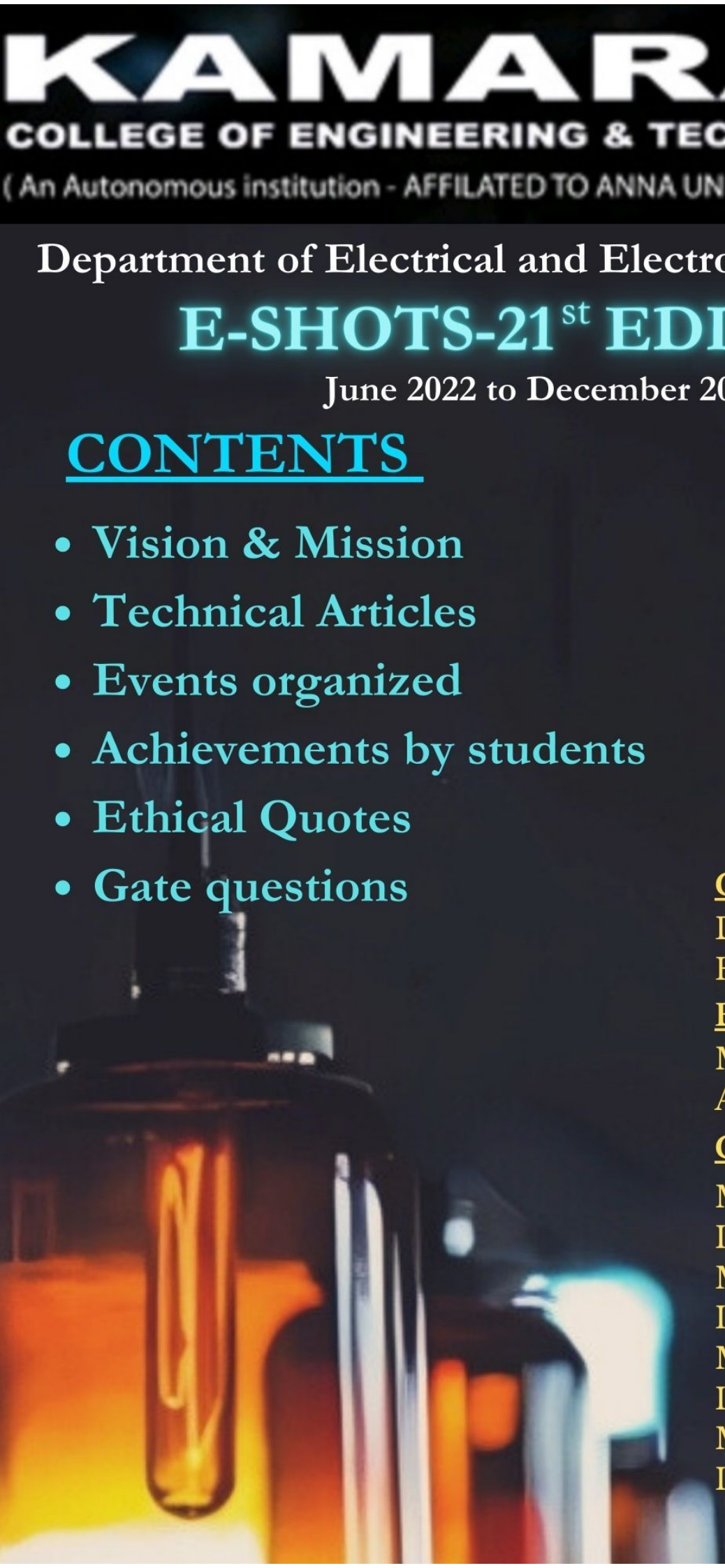

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VISION OF THE DEPARTMENT:

To make the Department of Electrical and Electronics Engineering of this Institution the unique of its kind in the field of Research and Development activities in this part of the world.

MISSION OF THE DEPARTMENT:

Department of Electrical and Electronics Engineering is committed to impart highly innovative and technical knowledge in the field of Electrical and Electronics Engineering to the urban and unreachable rural student folks through Total Quality Education.

ENERGY STORAGE:

Energy storage is the capture of energy produced at one time for use at a later time to reduce imbalances between energy demand and energy production. A device that stores energy is generally called an accumulator or battery. Energy comes in multiple forms including radiation, chemical, gravitational potential, electrical potential, electricity, elevated temperature, latent heat and kinetic. Energy storage involves converting energy from forms that are difficult to store to more conveniently or economically storable forms.

Some technologies provide short-term energy storage, while others can endure for much longer. Bulk energy storage is currently dominated by hydroelectric dams, both conventional as well as pumped. Grid energy storage is a collection of methods used for energy storage on a large scale within an electrical power grid.

Common examples of energy storage are the rechargeable battery, which stores chemical energy readily convertible to electricity to operate a mobile phone; the hydroelectric dam, which stores energy in a reservoir as gravitational potential energy; and ice storage tanks, which store ice frozen by cheaper energy at night to meet peak daytime demand for cooling. Fossil fuels such as coal and gasoline store ancient energy derived from sunlight by organisms that later died, became buried and over time were then converted into these fuels. Food (which is made by the same process as fossil fuels) is a form of energy stored in chemical form.

HISTORY:

In the 20th century grid, electrical power was largely generated by burning fossil fuel. When less power was required, less fuel was burned.[2] Hydropower, a

mechanical energy storage method, is the most widely adopted mechanical energy storage, and has been in use for centuries. Large hydropower dams have been energy storage sites for more than one hundred years. Concerns with air pollution, energy imports, and global warming have spawned the growth of renewable energy such as solar and wind power. Wind power is uncontrolled and may be generating at a time when no additional power is needed. Solar power varies with cloud cover and at best is only available during daylight hours, while demand often peaks after sunset (see duck curve). Interest in storing power from these intermittent sources grows as the renewable energy industry begins to generate a larger fraction of overall energy consumption.

Off grid electrical use was a niche market in the 20thcentury, but in the 21stcentury, it has expanded. Portable devices are in use all over the world. Solar panels are now common in the rural settings worldwide. Access to electricity is now a question of economics and financial viability, and not solely on technical aspects. Electric vehicles are gradually replacing combustion-engine vehicles. However, powering long-distance transportation without burning fuel remains in development.

METHODS:

The following list includes a variety of types of energy storage:

- Fossil fuel storage
- **Mechanical**
  - Spring
  - Compressed air energy storage (CAES)
  - Fireless locomotive
  - Flywheel energy storage
  - Solid mass gravitational
  - Hydraulic accumulator
  - Pumped-storage hydroelectricity (pumped hydroelectric storage, PHS, or pumped storage hydropower, PSH)
  - Thermal Expansion
- **Electrical, electromagnetic**
  - Capacitor
  - Super capacitor
  - Superconducting magnetic energy storage (SMES, also superconducting storage coil)
- **Biological**
  - Glycogen
  - Starch
- **Electrochemical (Battery Energy Storage System, BESS)**
  - Flow battery
  - Rechargeable battery
  - Ultra Battery
- **Thermal**
  - Brick storage heater

- Cryogenic energy storage, Liquid air energy storage (LAES)
- Liquid nitrogen engine
- Eutectic system
- Ice storage air conditioning
- Molten salt storage
- Phase-change material
- Seasonal thermal energy storage
- Solar pond
- Steam accumulator
- Thermal energy storage (general)

- **Chemical**
  - Bio fuels
  - Hydrated salts
  - Hydrogen storage
  - Hydrogen peroxide
  - Power to gas

Super capacitor

One of a fleet of electric capabuses powered by super capacitors, at a quick-charge station-bus stop, in service during Expo 2010 Shanghai China. Charging rails can be seen suspended over the bus.

Super capacitors, also called electric double-layer capacitors (EDLC) or ultra capacitors, are a family of electrochemical capacitors that do not have conventional solid dielectrics. Capacitance is determined by two storage principles, double-layer capacitance and pseudo capacitance.

Super capacitors bridge the gap between conventional capacitors and rechargeable batteries. They store the most energy per unit volume or mass (energy density) among capacitors. They support up to 10,000 farads/1.2 Volt,[50] up to 10,000 times that of electrolytic capacitors, but deliver or accept less than half as much power per unit time (power density).

While super capacitors have specific energy and energy densities that are approximately 10% of batteries, their power density is generally 10 to 100 times greater. This results in much shorter charge/discharge cycles. Also, they tolerate many more charge-discharge cycles than batteries.

Super capacitors have many applications, including: Low supply current for memory backup in static random-access memory (SRAM)

Power for cars, buses, trains, cranes and elevators, including energy recovery from braking, short-term energy storage and burst-mode power delivery.

-G.Amrutha Sri- III EEE

MAXIMUM POWER POINT TRACKING (MPPT) IN SOLAR PHOTOVOLTAIC SYSTEMS

INTRODUCTION:

The Maximum Power Point Tracking (MPPT) in solar photovoltaic (PV) systems marked a significant advancement in optimizing energy harvesting from solar

panels. MPPT technology enables solar PV systems to operate at their peak efficiency by dynamically adjusting the operating conditions to match the changing environmental factors and load conditions. MPPT algorithms continuously monitor the voltage and current output of the solar panels and track the maximum power point, which is the point on the current-voltage (I-V) curve where the panel produces the most power. By dynamically adjusting the operating point, MPPT ensures that the solar panels deliver the maximum available power to the load or battery, improving overall system efficiency and energy output. MPPT stands for "Maximum Power Point Tracking."It's a technique used in photovoltaic (solar) systems to optimize the efficiency of solar panels by continuously adjusting the voltage and current to ensure they operate at their maximum power output. This helps to extract the most energy from the sunlight and increase the overall efficiency of the solar power system.

SOLAR PHOTOVOLTAIC:

Solar photovoltaic (PV) technology is a renewable energy technology that directly converts sunlight into electricity. Solar PV systems use semiconductor materials, usually silicon-based solar cells, to capture photons from sunlight. When photons strike the solar cells, they excite electrons, creating a flow of electric current. There are different types of solar cells, including monocrystalline, polycrystalline, and thin-film cells. Each type has its own characteristics in terms of efficiency, cost, and appearance. A typical solar PV system consists of solar panels (made up of multiple solar cells), an inverter (to convert DC to AC), mounting structures, wiring, and sometimes battery storage. Solar cell efficiency refers to the amount of sunlight converted into electricity. Advances in technology have led to improved efficiencies, allowing more power to be generated from a given area of solar panels.

Figure: Solar Panel

WORKING OF MPPT:

The working of MPPT includes the following steps: Solar photovoltaic (PV) panels are the primary components that convert sunlight into electricity. Each panel consists of multiple solar cells made of semiconductor materials like silicon. The MPPT controller is an electronic device that optimizes the power output of the solar

panels. It continuously tracks the Maximum Power Point (MPP) of the panels by adjusting the voltage and current they operate at. The MPPT controller measures the output voltage and current of the solar panels in real-time. It uses these measurements to determine the power output of the panels. The Implementation algorithms of MPPT controller uses algorithms such as Incremental Perturb and Observe (P&O) or Hill Climbing to find the MPP. These algorithms make small adjustments to the operating voltage of the panels and monitor the resulting power output. Based on the algorithm's feedback, the MPPT controller adjusts the operating voltage of the panels either up or down. It continues this process iteratively to find the voltage that maximizes power output. By dynamically adjusting the operating voltage, the MPPT controller ensures that the solar panels are operating at their maximum efficiency and producing the highest amount of power they can deliver under the given sunlight conditions. The DC power generated by the solar panels is converted into AC power using an Inverter. The AC power from the inverter can be used to power appliances within the building. Many MPPT controllers and solar PV systems come with monitoring and control capabilities. This allows you to remotely monitor the performance of your solar system and adjust settings as needed.

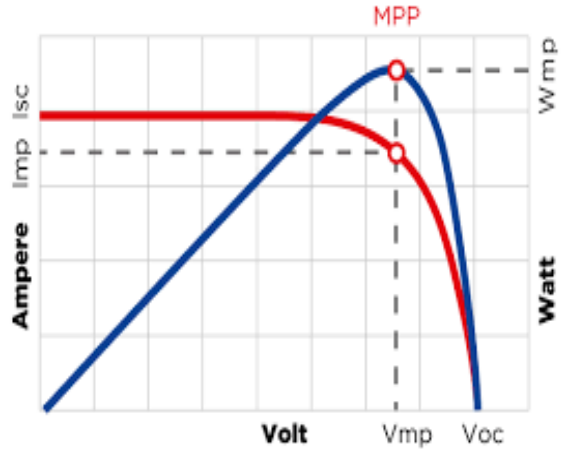

Figure: PV and IV characteristic curve

TYPES OF MPPT METHODS:

There are several types of MPPT methods commonly used in solar PV systems:

1. Perturb and Observe (P&O):This method periodically adjusts the voltage slightly and observes the change in power output. If the power increases, the adjustment continues in that direction until the power starts to decrease. P&O can be simple but may oscillate around the maximum power point in rapidly changing conditions.

2. Incremental Conductance (IncCond): Similar to P&O, this method compares the incremental change in power with respect to the incremental change in voltage. It adjusts the voltage direction based on this comparison to approach the maximum power point.

3. Fractional Open-Circuit Voltage (FOCV): FOCV estimates the open-circuit voltage of the solar panel and calculates the maximum power point based on this

estimation. It adjusts the operating voltage to reach this point.

4. Constant Voltage (CV): In this method, the solar panel operates at a fixed voltage, and the current is adjusted based on the changing sunlight conditions. This approach is less common and may not be as efficient as other MPPT methods.

5. Model Predictive Control (MPC): MPC uses a mathematical model of the solar panel's behavior and predicts future power outputs for different voltage settings. It then selects the voltage that maximizes the predicted power output.

Each MPPT method has its advantages and limitations, and the choice of method depends on factors such as system complexity, cost, and environmental conditions. Overall, MPPT plays a crucial role in enhancing the efficiency and performance of solar PV systems, making them more reliable and cost-effective sources of renewable energy.

ADVANTAGES:

The advantages of Maximum Power Point Tracking (MPPT) in solar photovoltaic (PV) systems include: Increased Energy Harvesting, Optimized System Performance, Adaptation to Changing Conditions, Enhanced Battery Charging, Reduced System Costs, Compatibility with Various Panel Configurations, Real-Time Monitoring and Control, Support for Multiple Power Sources, Improved ROI and Payback Period, Environmental Benefits.

DISADVANTAGES:

The disadvantages includes the following: Complexity and Cost, Maintenance Requirements, Efficiency at Low Irradiance Levels, Software and Firmware Updates, Compatibility and Integration, Potential for Over-Engineering, Limited Performance Gain with Uniform Irradiance, Learning Curve, Energy Efficiency vs. Cost Trade-off, Potential Electromagnetic Interference (EMI)

It's important to note that the disadvantages of MPPT technology should be weighed against the benefits and the specific requirements of each solar PV installation. In many cases, the advantages of MPPT can outweigh the drawbacks, leading to improved energy production, system efficiency, and overall performance.

APPLICATIONS:

Maximum Power Point Tracking (MPPT) is widely used in various applications within solar photovoltaic (PV) systems to optimize energy harvesting and improve overall system efficiency. Some key applications of MPPT in solar PV include:

Grid-Connected Solar Power Plants: MPPT technology is used in large-scale grid-connected solar power plants to maximize energy production and feed electricity into the grid efficiently.

Off-Grid and Hybrid Systems: MPPT is essential in off-grid and hybrid solar PV systems, where energy storage (batteries) is involved.

Residential Solar Installation: It ensures that the system generates maximum power even under varying weather conditions and shading.

Commercial and Industrial Rooftop Installations: By using MPPT, these installations can capitalize on available roof space to produce more energy and potentially reduce electricity costs.

Solar-Powered Electric Vehicle Charging Stations: MPPT can be used in solar PV systems that power electric vehicle (EV) charging stations. It maximizes energy generation from solar panels to recharge EVs, contributing to sustainable transportation.

Solar-Powered Mobile and Portable Devices: MPPT is employed in solar-powered mobile charging stations, portable chargers, and outdoor equipment to optimize energy conversion from solar panels and provide efficient charging.

Overall, the applications of MPPT in solar PV systems span a wide range of scenarios, from large-scale power generation to smaller, decentralized setups, all aimed at enhancing energy production, utilization, and sustainability.

CONCLUSION:

Maximum Power Point Tracking (MPPT) technology has emerged as a crucial innovation in the field of solar photovoltaic (PV) systems. Its ability to dynamically optimize the energy output of solar panels by continuously tracking and adjusting to the maximum power point offers significant benefits across a wide range of applications.

-S.Nishitha-III EEE

EVENTS ORGANIZED:

- **Mr.K.Ganesan**,organized Industrial guest lecture titled "Energy audit and green audit" and the resource person Er.Sundar, Environpro Consultancy on 18-07-2022.
- **Mr.S.Jegan**, organized online alumni guest lecture titled "Job opportunities in Renewable Energy field " and the resource person **Mr. Megan Prasanth,** O & M, Solar division, Pioneer Wincon, Madurai on 06-08-2022.
- **Mr.S.Jegan**, organized alumni guest lecture titled "Job opportunities in other countries" and the resource person **Mr.M.Mahendran**, Chief Electronics Engineer [R&D], Iqnexus, New Zealand on 14-09-2022.

- **Mrs.J.UmaMaheswari** & **Mr.R.Ganesan organized** Hands on training on "NI my RIO tool kit" and the resource persons from faculty members EEE & EIE for students from various departments on 03-11-2022 & 04-11-2022.
- **Mr.S.Jegan,** organized ISTE sponsored alumni mock interview for students and the resource person **Ms.Sorna Pon princess**, Infosys, Chennai on 03-09-2022.
- **Mr.S.Jegan,** organized ISTE event titled Prototype validation convering e-waste into product for students and the resource person **Mr.R.Ganesan,AP /EEE,** KCETon 27-08-2022.
- **Mr.S.Jegan,** organized ISTE event titled Tech talk event (Solution for a problem) for students on 21-09-2022.

CO-CURRICULAR ACTIVITIES:

- **K. P. Shree Nachiyaar** has won third prize in Women Badminton Doubles tournament at VHNSN College on 18.09.2022.
- **S.Darsan** has won first prize in Circuitrix at Bharath Niketan Engineering College, Theni on 11.11.2022.
- **M.Ajay** has won first prize in Circuitrix held at Bharath Niketan Engineering College, Theni on 11.11.2022.
- **N.Kalaimani** has won second prize in ADMADSHOW held at Bharath Niketan Engineering College, Theni on 11.11.2022.
- **K.Bharathi** has won second prize in ADMADSHOW at Bharath Niketan Engineering College, Theni on 11.11.2022.
- **R.Shalini** has won second prize in ADMADSHOW at Bharath Niketan Engineering College, Theni on 11.11.2022.
- **M.Subha Shri** has won second prize in ADMADSHOW at Bharath Niketan Engineering College, Theni on 11.11.2022.
- **N.Caroline Reshma** has won second Prize in ADMADSHOW at Bharath Niketan Engineering College, Theni on 11.11.2022.
- **A.Janani Priya** has won second Prize in ADMADSHOW at Bharath Niketan Engineering College, Theni on 11.11.2022.
- **K.P.Shree Nachiaar** has won third prize in Techno Storm at Bharath Niketan Engineering College, Theni on 11.11.2022.
- **B.Senthil Velan** has won first prize in Circuitrix at Bharath Niketan Engineering College, Theni on 11.11.2022.
- A.Abdul Malik has won first prize in Circuitrix at Bharath Niketan

Engineering College, Theni on 11.11.2022.

- **A.Manoj** has won first prize in Circuitrix at Bharath Niketan Engineering College, Theni on 11.11.2022.
- **D.Gobi Krishna** has won second prize in Circuitrix at Bharath Niketan Engineering College, Theni on 11.11.2022.
- **G.Vetrivel** has won second prize in Circuitrix at Bharath Niketan Engineering College, Theni on 11.11.2022.
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- **N.Caroline Reshma** has won first prize in Inquisative at Bharath Niketan Engineering College, Theni on 11.11.2022.
- **Amruthasri. G** has participated CATC CUM GP RDC TRG-1 at NTA, Idayapatti on 10.08.2022 – 17.08.2022.
- **B.Sridhar** has participated Internship at Kalasalingam university on 27.06.2022-07.07.2022.
- **K.Devakalidass** has participated AKAM-ANU-YATRA 2022 at Mepco schlenk Engineering college on 05.08.2022-06.08.2022.
- **K.Devakalidass** has participated Internship at Kalasalingam university on 27.06.2022-07.07.2022.
- **M.Rohit Raju** has participated AKAM-ANU-YATRA 2022 at Mepco schlenk Engineering college on 05.08.2022-06.08.2022.
- **B.Sridhar** has participated AKAM-ANU-YATRA 2022 at Mepco schlenk Engineering college on 05.08.2022-06.08.2022.

- **Anavartha Raj. M** has participated Java basics- Programming course in Skill Rack on 25.07.2022.
- **Puruchothaman.K** has participated C-Programming Course in Skill Rack on 29.07.2022.
- **Mohamed Luqmaan.P** has participated Simulation of Power Converters using Matlab - Simulink Course in Indian Society for Technical Education-(ISTE)-Faculty Chapter on 01.08.2022-02.08.2022.
- **Vishal.M.S** has participated IDEATHON'22at Kalasalingam University on 01.09.2022-02.09.2022.
- **Ram Kumar.K** has participated IDEATHON'22at Kalasalingam University on 01.09.2022-02.09.2022.
- **Nishitha.S** has participated IDEATHON'22at Kalasalingam University on 01.09.2022-02.09.2022.
- **Thirupathi.P** has participated IDEATHON'22at Kalasalingam University on 01.09.2022-02.09.2022.
- **Amrutha Sri.G** has participated IDEATHON'22at Kalasalingam University on 01.09.2022-02.09.2022.
- **Kowsika.K** has participated IDEATHON'22at Kalasalingam University on 01.09.2022-02.09.2022.
- **Santhiya Bharthi.K** has participated IDEATHON'22at Kalasalingam University on 01.09.2022-02.09.2022.
- **Keertthana.G** has participated IDEATHON'22at Kalasalingam University on 01.09.2022-02.09.2022.
- **Vijay.K** has participated in Paper Presentation in National Level Symposium BIO-BEGINZ 2K22at P.S.R. Engineering College on 27.09.2022
- **Gobinath.M** has participated in Paper Presentation in National Level Symposium BIO-BEGINZ 2K22at P.S.R. Engineering College on 27.09.2022
- .**Nishitha.S** has participated in Up skilling Boot camp-AECCADD Centre, Virudhunagar on 22.09.2022

ETHICAL QUOTES:

"Anything that won't sell, I don't want to invent. Its sale is proof of utility, and utility is success." "A genius is often merely a talented person who has done all of his or her homework." "When I have finally decided that a result is worth getting, I go ahead on it and make trial after trial until it comes."-Thomas alva Edison.

GATE QUESTIONS:

1. The most commonly used relay, for the protection of an alternator against loss of excitation, is

a) offset Mho relay.

b) over current relay.

c) differential relay.

d) Buchholz relay.

Ans: Option a

2. In a biased differential relay the bias is defined as a ratio of

a) Number of turns of restraining and operating coil

b) Operating coil current and restraining coil current

c) Fault current and operating coil current

d) Fault current and restraining coil current

Ans: Option b