JUNE - MAY 2023-24

PMC TECH
INSPIRE TO INNOVATE

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

2023-24

EETA- MAGAZINE

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ER. PERUMAL MANIMEKALAI POLYTECHNIC COLLEGE, HOSUR

VISION AND MISSION

VISION OF THE INSTITUTE

PMC TECH POLYTECHNIC COLLEGE SHALL EMERGE AS A PREMIER INSTITUTE FOR VALUED ADDED TECHNICAL EDUCATION COUPLED WITH INNOVATION, INCUBATION, ETHICS AND PROFESSIONAL VALUES

MISSION OF THE INSTITUTE

1. TO FOSTER THE PROFESSIONAL COMPETENCE THROUGH EXCELLENCE IN TEACHING AND LEARNING.
2. TO NURTURE OVERALL DEVELOPMENT OF STUDENTS BY PROVIDING QUALITY EDUCATION & TRAINING.
3. TO PROVIDE INNOVATIVE ENVIRONMENT TO LEARN, INNOVATE AND CREATE NEW IDEAS FOR THE BETTERMENT OF ONESELF AND SOCIETY.

VISION OF THE DEPARTMENT

TO PRODUCE DYNAMIC, COMPETENT AND INNOVATIVE ELECTRICAL AND ELECTRONICS ENGINEERING DIPLOMA HOLDERS TO CATER THE NEED OF THE INDUSTRY.

MISSION OF THE DEPARTMENT

TO PROMOTE EXCELLENCE IN TEACHING AND LABORATORY PRACTICES

TO HAVE GOOD AMBIENCE AND INFRASTRUCTURE FOR ELECTRICAL AND ELECTRONICS ENGINEERING STUDENTS SUITABLE FOR PROFESSIONAL CAREER AND HIGHER STUDIES

TO INCULCATE ETHICS, LEADERSHIP QUALITIES AND PROFESSIONAL OUTLOOK TO DEVELOP THE OVERALL PERSONALITY OF THE STUDENTS.

TO PROVIDE OPPORTUNITIES FOR LIFELONG SKILL DEVELOPMENT AND LEARNING FOR INDUSTRY AND SOCIAL NEEDS.

From the Chairman

It is the matter of pride to know the release of annual magazine “EETA” of Electrical and Electronics Engineering Department. The name and fame of an institute depends on the competence and achievements of the students and the faculty. In addition to the numerous achievements of the year is yet another mile stone in their curricular. I hope this magazine will bring out creative talents of the students of the institute. I congratulate the Principal, HoD, Staffs and Students for publishing “EETA Magazine”. My best wishes for the success of the effort of the department.

Mr. P KUMAR
Chairman
Pmc Tech Group of Institutions, Hosur

From the Secretary

I am happy that Electrical and Electronics Engineering Department of our Er. Perumal manimekalai Polytechnic College is releasing annual magazine “EETA”. Apart from achieving excellence in academics and sharpening technical skills it is important for students to develop leadership skills and capacity to innovate for social causes to make them resourceful and employable. I extend my best wishes to the team to make this magazine “EETA” a memorable one.

Smt. P Mallar
Secretary
Pmc Tech Group of Institutions, Hosur

From the Director

I feel extremely amusement to observe that of Electrical and Electronics Engineering Department is bringing out annual magazine “EETA” with the dedicate and committed efforts of faculty and students of the department. This magazine is the reflection of the students, involved in various activities. I congratulate the HoD, the faculty members and the students of electrical and electronics engineering department for their ingenuity and enthusiasm for this magazine and wish them all success.

Prof. N Sudhakaran
Director
Pmc Tech Group of Institutions, Hosur

From the Principal

It is always a pleasure to be a part of a team which strives to bring out the talents of students and staff. Electrical and Electronics department has always been striving to keep itself ahead of the competition. The essential purpose of a magazine is to inform, engage, inspire and entertain a diverse readership including alumni, parents, students, faculty, staff and other friends of the college by telling powerful stories that present a compelling, timely and honest portrait of the college and its extended family. This Magazine has made an earnest attempt in this direction and brought out certain aspects to the eyes of the public so that they may understand and know the EEE department even better.

Er. N Balasubramaniam
Principal
Pmc Tech Polytechnic College, Hosur

From the HOD

I feel privileged in presenting the magazine “EETA” of our department. This magazine is intended to bring out the hidden literary talents among the students and the faculty and also to inculcate leadership skills among them. I am sure it will be a source of inspiration for the budding poets and writers among the students and will direct their creativity to new dimensions of mature expression. I extend my sincere thanks to the editorial team for their constant effort and support in bringing out the magazine in the present form. I acknowledge my gratitude to our principal for their continuous support to prepare these issues of magazine. Last but not least; I am thankful to all the authors who have sent their articles

Er. N Anand
Head of the Department
Electrical and Electronics Engineering

ABOUT THE DEPARTMENT

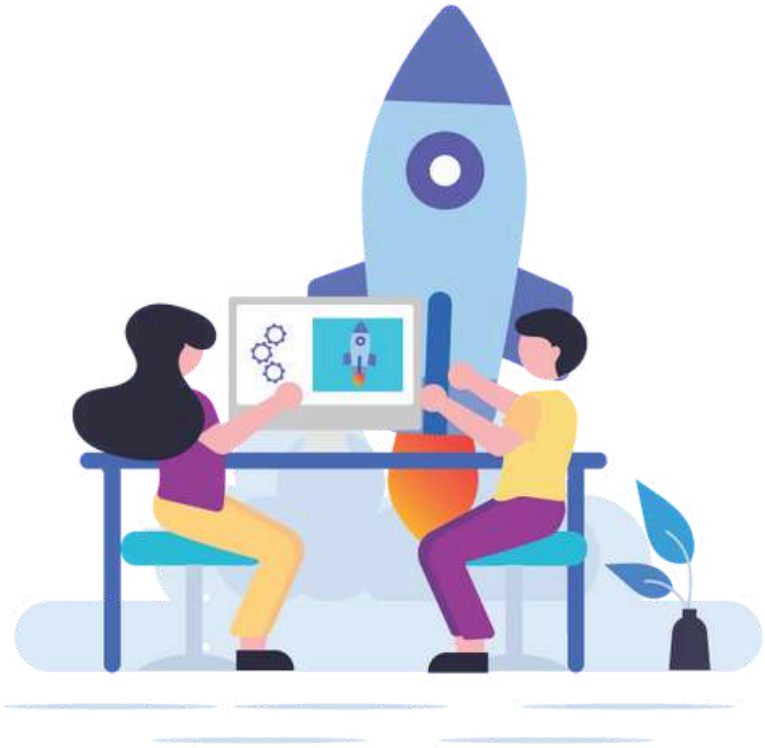
OUR DEPARTMENT WAS STARTED IN 2002 AND HAS EVOLVED INTO EXCITING HIGH TECHNOLOGY DISCIPLINE COVERING A WIDE RANGE OF ENGINEERING ACTIVITIES.
WE HAVE ACHIEVED STATE RANK HOLDERS IN BOARD EXAMINATIONS AND GIVEN EXCELLENT PLACEMENT OPPORTUNITY FOR OUR STUDENTS. LAST YEAR OUT OF 66 STUDENTS, 20 STUDENTS ACHIEVED FIRST CLASS WITH DISTINCTION AND 35 STUDENTS WITH FIRST CLASS. IN THAT 51 STUDENTS PLACED IN VARIOUS COMPANIES LIKE WEG INDIA, INEL, TENNECO, TVS SERVICES, NISSAN ETC AND 13 STUDENTS OPTIONED HIGHER STUDIES.
WE HAVE OVER 10 LABORATORIES WITH ADVANCED EQUIPMENT AND FACILITIES FOR SUPPORTING OUR TEACHING AND RESEARCH. IT IS ENVISIONED TO STRENGTHEN THE QUALITY OF ITS FACULTY, RESEARCH AND TEACHING FACILITIES, AS WELL AS STUDENT’S ACADEMIC PERFORMANCE.

ACHIEVEMENT

THE DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING APPLIED NBA ACCREDITATION FROM NATIONAL BOARD OF ACCREDITATION,NEW DELHI IN THE YEAR 2022.

Editorial Board

Content



TECHNICAL ARTICLES

IoT Is Everywhere — How IoT affect our daily life

It isn't news that the Internet of Things (IoT) is revolutionizing our lives – IoT transformation is Everywhere. IoT is now portable, wearable, and implantable, creating a ubiquitous and connected universe, and transforming physical objects that surround us into an ecosystem of information that is rapidly changing the way we live.

To answer the question, How IoT will change the world? , the answer is, IoT technology has already changed when and where work is done, in almost every industry. Businesses are transitioning to the Internet of Everything (IoE), an unprecedented network connection that encompasses machines, individuals, processes and data that can have a huge impact in our daily lives. The impact of IoT on society is indeed huge.

Well, looking for IoT examples in real life, Here are some examples of IoT in real life, automated temperature control by thermostats, devices such as Amazon Echo, Google Home, Wearables monitoring heart rates, home security systems, and smart lighting devices which response to voice commands.

Let's explore how IoT affects our daily life and a few significant areas that have been transformed through IoT at the intersection of people, data and intelligent machines.

How can IoT improve our lives?

Automotive

Driverless cars had previously been a figment of our imagination. However, with IoT shaking up the automotive industry like never before, digital transformation has made its way into the automotive space. By facilitating human-to-human, machine-to-machine, and human-to-machine interactions, IoT seeks to expedite processes and enrich people's lives.

Connected vehicles are now equipped with the ability to pick up information from the surroundings, providing the driver with diagnostic information that can quickly be acted upon.

IoT has enabled smart cars with built-in sensors that aid in efficient parking, provide data that facilitates better car maintenance, and can help drivers predict and avoid collisions.

Connected cars send data to manufacturers in real-time, sharing insights to develop more accurate predictive maintenance models – the speed of data allows them to respond quickly to any issues found. Take the case of assisted and autonomous driving, which is changing the driver's role from 'driving' to 'supervising' and is also better suited to increase car and road safety. The automated system, which is provided by Advanced Driver Assistance Systems (ADAS) is specifically designed with best-in-class technology that alerts drivers on potential problems and takes control over the vehicle to help significantly reduce collisions and road accidents.

Far beyond relying on human memory and extensive tracking, connected cars come with the advantage of enabling quick communication between manufacturers and drivers on issues and reminders for service and maintenance.

Telematics also has immense applications in the automotive industry. Family notification of vehicle collision, automated emergency calling and vehicle diagnostics and maintenance notifications are all classic examples.

Connected cars are equipped with technology that can trace and record driver habits and behaviour and transfer useful data to insurance companies for analysis. This makes for safer and more economical driving.

In terms of entertainment and user experience, connected cars are an extension for providing Infotainment (information and entertainment) seamlessly, without extensive changes in the communication channels that consumers generally use. This adds a sense of personalization to the entire driving experience.

NANDISH KUMAR S, II YR EEE

Solar Energy: The Key to Sustainable

Solar energy is the future. We have known this for a while now, but it's time we start to understand what that means and how that can impact our lives. Renewable energy is more environmentally sound and cost-effective than it's ever been. In addition, solar energy has proven to stimulate the economy because of its multipurpose nature, and there are companies out there that specialize in helping you with your solar projects. In simple words, solar energy is sustainable, and sustainable energy is the key to a greener future.

The Future of the Energy Sector

The future of energy is renewable. The sooner governments and businesses realize this, the better off we'll all be.

To understand why renewable energy the future is, it helps to look at its past. We've been using fossil fuels for much longer than we've been using renewable sources like wind and solar sustainable energy.

But now that more people realize how detrimental these traditional sources can be for our environment, many are looking for an alternative that's less damaging to human health and more sustainable over time-something we can pass on to future generations and utilize ourselves now.

Solar sustainable energy is key in ensuring sustainability remains a top priority for us now and into the future; without it, there would be nothing standing between us and complete environmental destruction!

Well-Known Benefits of Solar Energy

Solar sustainable energy can be used in many different ways. It is a renewable resource you can use to power your home, car, or business. It also will not deplete our natural resources like other forms of traditional energy do. Here are some of the most common features of Solar sustainable energy:

1. It is Cost-Effective Solar sustainable energy is a viable alternative to fossil fuels and can be a great investment for the future. Moreover, it's more cost-effective than ever, especially when solar panels can last for decades without needing any maintenance or replacement.

The average lifespan of an American home is 25 years, so if you install solar today, your panels will likely still be producing power in 2049.

You should also know that there are tax credits available to help offset some of the initial costs of installing a solar power system. It's important to speak with an experienced professional about this option before deciding to install new equipment in your home or business space.

2. It's Also Environmentally Sound. What's more, solar energy is environmentally sound. It doesn't pollute the air or water, and it doesn't produce greenhouse gases. As a result, solar power plants don't cause global warming, acid rain or smog either. Solar sustainable energy also has no harmful effects on wildlife—therefore protecting animals and their habitat as well.

Solar sustainable energy plants are completely sustainable in that they never run out of resources; they only need sunlight and land space to function properly.

Because of this, solar energy has become one of the most widely used methods worldwide when it comes to producing electricity on a large scale (in addition to other forms such as wind energy).

3. Solar Energy Stimulates the Economy The solar industry has been proven to create jobs. In 2017, there were 260,077 total jobs within the solar industry, and it's predicted that this number will continue to grow.

Solar energy is a great investment for both small businesses and homes, especially because it can be easily scaled up or down based on financial needs. Solar sustainable energy is an excellent solution for climate change because it emits no greenhouse gases like other sources of power generation, such as coal or natural gas (and even nuclear power plants).

4) Solar Sustainable Energy is Multipurpose You'll find that solar energy is multipurpose. It can be used for heating, cooling, and electricity. It can power a wide variety of devices like your computer or television. Moreover, it can also power vehicles and equipment such as lawnmowers and tractors.

This versatility makes it the key to sustainability because it reduces your need for other sources of energy like fossil fuels like oil or natural gas, which cause pollution when they are burned in combustion engines that run on them.

ACHITHA A, II YEAR EEE

The Contribution Of Solar Energy To Sustainable Development

According to the United Nations, sustainable development is "development that meets the needs of the present without jeopardizing future generations' ability to meet their own needs."Sustainability is about meeting our needs and preserving nature so that we can continue to meet our needs in the future. This means we must ensure we're using resources responsibly and not depleting them faster than they can be replenished. We must also keep our population growth in check so that we do not exhaust our natural resources or create too much pollution. Sustainable development has become a buzzword in recent decades, but its principles were first introduced in the early 1970s by the Club of Rome.

In its report titled "The Limits to Growth: A Report for the Club of Rome's Project on The Predicament of Mankind" (1972), it warned that economic growth was unsustainable because it relied on non-renewable sources such as fossil fuels and would lead to environmental degradation and resource depletion unless changes were made immediately.

We all understand the importance of sustainable energy. The use of renewable energy sources is growing, and people are becoming increasingly aware of the devastating effects of climate change. We need to do our part to restore our planet and its inhabitants.

Sustainable development is about creating a future where we can live harmoniously with our environment. It means using resources in a way that will last for many generations, something that cannot be said about non-renewable resources such as fossil fuels. The use of solar energy has been on the rise in recent years, with more people turning to it as an alternative energy source.

Begin Your Sustainable Journey with Schneider Electric Solar energy is the future, and sustainability is the key to everything. There are so many ways to make this planet a better place, and it all starts with our decisions. If you're interested in learning more about sustainable energy or how solar power can help you save money on your utility bills, then get in touch with us. At Schneider Electric, we possess proven expertise in solar power conversion and efficient energy management. In addition, our best-in-class technology, such as solar inverters/ chargers for homes and other facilities, can help you save a fortune and reduce your carbon footprint.

How can we most effectively capture, convert and store this tremendous natural resource?

One of the first technologies that comes to mind when discussing solar energy is the growing use of solar cells, also known as photovoltaic cell, which convert sunlight directly into electricity. Solar cells are silent,

non-polluting and long-lived devices that typically convert 10 to 15 percent of the energy received into energy that can be used. There are at least two other ways to store solar energy for use later.

The sunlight can be stored in the heat capacity of a molten salt (the liquid form of an ionic compound like sodium chloride) at a high temperature. When electricity is needed later, heat is transferred from the molten salt to water, using a heat exchanger to generate steam to drive a turbine.

They are not the only way to get electricity from solar energy, though. Sunlight can also be intensely focused onto a small area, using concentrators such as an array of mirrors or lenses to heat water and create steam. High-pressure steam can be driven through a turbine to generate electricity.

A second method of harnessing and storing solar energy is to employ sunlight to produce a fuel. For example, a photo electrochemical cell uses solar energy to split water into hydrogen and oxygen gases, which can be stored as fuels. These gases are then recombined to generate electricity in a device known as a fuel cell. An attractive feature of this approach is that the by-product of the fuel cell reaction is simply water.

While many of the technologies described here are in use on a small scale today, we must continue to develop innovative methods of storing solar energy and promote sustainable energy policies that benefit generations to come.

MAGESH N, II YEAR EEE

Electrical Safety Rules for Industries in India

There are many rules under the Indian electrical standards and Indian Electricity Rule 1956. And if you run a business in India, you must have a thorough knowledge of the various legal obligations which are related to electrical safety.

But reading all the rules is a time-consuming and tedious process. So, here is a comprehensive list of the most important Indian electricity rules that you need to keep in mind to ensure safe business operations. Some of the points also cover the legalities associated with the rules. .

Indian Electricity Rules 1956 – statutory requirements

Let us check out the statutory rules for electrical safety in India:

- **Indian Electricity Rule – 29**

All electrical apparatus and supply lines should be of appropriate ratings.

- **Indian Electricity Rule – 30**

As per this rule, all wires, devices, accessories, and power supply lines should be kept in safe conditions.

They should also be able to supply energy while being free from any kind of danger.

Underground electrical lines should be well-protected and duly insulated.

Industries must also ensure that even if there is any kind of damage to the insulation – chemical, electrical, or mechanical, the line must remain secure under all conditions.

- **Indian Electricity Rule – 32**

Proper and appropriate identification is a must for a grounded and earthed neutral conductor. Also, the position of the circuit breakers and the switches must be ensured.

- **Indian Electricity Rule – 33**

It is mandatory to provide and maintain a suitable earth terminal at an accessible position, preferably near the start point of the supply line.

- **Indian Electricity Rule – 34**

Bare conductors are used in many places for different requirements. Industries should make sure that these bare conductors are inaccessible. It is best if they can be fitted with switches so that they can be turned off whenever required. This switch position should be easily accessible.

- **Indian Electricity Rule – 35**

All medium, high, and very high voltage installations must have a danger notice written in English or Hindi and the local language of the place. There should also be a skull and bone sign indicating danger in the installation area. The skull and bone sign should be made as per specifications in IS No. 2551.

- **Indian Electricity Rule – 36**

Any worker working on an electrical device or an electrical power line must use proper safety tools and devices like rubber shoes, gloves, ladders, helmets, seat belts, hand lamps, line testers, and so on. These tools protect against electrical or mechanical injury. Employers should make sure that these tools are well-maintained and in proper working conditions.
Along with the required safety tools, no person will work on live electrical supply lines or devices without proper authorization.

- **Indian Electricity Rule- 37**

Overhead cranes are very useful but should be used very carefully. Overhead cranes are mostly powered by some external source. There must be an appropriate cut-off switch to cut off voltage at once when required. Also, the complete structure of overhead cranes must be grounded properly.

- **Indian Electricity Rule – 38**

Industries must refrain from using flexible cables for transformers, electric drills, generators, motors, welding stations, rectifiers, electric sprayers, and similar devices. However, if the flexible cables have strong insulation and adequate protection against mechanical damage, they can be used.

- **Indian Electricity Rule – 43**

Adequate arrangements must be available for combating electrical fires. Proper fire-fighting devices must be installed and maintained. Industries must ensure the availability of personal protective equipment and a first aid kit.

- **Indian Electricity Rule – 46**

Proper testing and inspection of all electrical installations by a licensed electrical inspector should be made mandatory at periodic intervals. The inspection should be scheduled at least every 5 years.

- **Indian Electricity Rule – 61A**

There must be an earth leakage protection device wherever necessary.

- **Indian Electricity Rule – 67**

Very high and high voltage installations often have many non-current-carrying parts. All these parts should be earthed effectively to a proper earthing system.

- **Indian Electricity Rule – 91**

Any overhead line in a public place or any part of the street must be protected with an appropriate device.

- **Indian Electricity Rule – 92**

The ground wire of a surge arrester should never pass through any steel or iron pipe. It is best conducted directly from the surge arrester to a separate earth electrode.

RAGUL GANDHI M, II YEAR EEE

Energy Efficient Lighting & How to Implement It

It has been estimated that lighting accounts for about 20% of the total power generation of the world. The quality and quantity of light not only affects our health, comfort, safety and productivity but also affects the economy. Many nations have been spending a huge amount of their electricity budget on lighting.

For achieving efficient use of electricity, nations have been taking a sustained switch to the energy efficient lighting which is the most cost effective and reliable method of energy-saving. A well-known technologies have been in use in the area of lighting to optimize the existing controls and lighting equipment for reducing the energy consumption with higher lighting quality. Let us discuss in detail about this concept.

What is Energy Efficient Lighting?

When the energy usage of a product is reduced without affecting its output or final response or user comfort levels is referred as energy efficiency. An energy efficient product consumes less energy to perform the same function when compared to the same product with more energy consumption.

What is the Need for Energy Efficient Lighting?

Lighting is the basic requirement of any facility and it impacts the day-to-day activities of the people. This accounts a considerable amount of total energy consumption in domestic, commercial and industrial installations.

In industries, energy consumption for lighting constitutes only a small component of the total energy consumed, which is nearly 2-5 percent of total energy consumption. It accounts for 50 to 90 per cent in the domestic sector and it may go up to 20-40 percent in case of commercial /building sectors, information technology complexes, and hotels. Due to the high energy consumption, traditional incandescent lamps and high discharge lamps have to be substituted with energy efficient lamps. Traditional lamps not only consume large amounts of electric power, but they use much of its consumed energy to produce heat rather than light (for instance 90% of consuming energy in case of incandescent lamps).

With the installation of energy efficient lighting, the amount of energy consumption eventually will get reduced and it results in lower electricity bills.

Hence the energy efficient lighting is necessary

- To reduce electricity consumption, thereby reduces the electricity bills
- To save electricity rather than wasting in terms of losses
- To lower greenhouse emissions because conventional lamps cause CO_2 emissions
- To achieve peak load reduction

MONISH S, III YEAR EEE

Six Challenges in Motor Design and Modelling for Electric Motors

In today's world, electric motors are essential for a sustainable and energy-efficient future. With the rapid growth of electric vehicles, renewable energy, and other applications, the demand for high-performance electric motors has never been higher.

However, the development of these motors presents a unique set of challenges.

Let's dig into six critical challenges in motor design and modeling for electric motors, how to overcome them, Carpenter Electrification's role in the industry, and tips on building and cooling an efficient electric motor

Challenges of Motor Design and How to Overcome Them

Before diving into the specific challenges, it's essential to understand that electric motor design is a complex and iterative process. Engineers must consider multiple factors and constraints to develop an optimized solution that meets the desired performance, cost, and reliability requirements.

Here are six challenges engineers often face in motor design and modeling, along with strategies to overcome them.

Increasing Complexity

As electric motors evolve, their design becomes more intricate, with higher power densities, tighter tolerances, and increased operating speeds. Engineers must optimize and balance multiple factors, such as weight, size, efficiency, and cost. Advanced simulation tools and computational methods, such as finite element analysis (FEA), can help engineers navigate this complexity and make informed design decisions.

Change Management and Adaptation to the New Approach

Adopting new design methodologies and technologies can be challenging for organizations. To ease the transition, companies must provide comprehensive training and foster a culture encouraging innovation and collaboration. By adopting agile methodologies and using modern tools for collaboration and project management, organizations can streamline their design processes and adapt to new ways of working.

Compliance and Automated Model Verification

Electric motor designs must comply with various industry standards and regulations. Automated model verification ensures that designs meet these requirements by validating them against predefined criteria. Implementing a rigorous verification process reduces the risk of non-compliance and helps maintain the quality of the final product.

Model-Based Testing and Testing Motors

Thorough testing ensures electric motors' performance, reliability, and safety. Motor simulations enable engineers to analyze and predict a motor's behavior without needing physical prototypes for real-world conditions. This approach can significantly reduce development time and costs while providing valuable insights into potential design improvements.

Conserving Energy

Energy conservation is a key concern in electric motor design. Engineers must optimize designs to minimize energy losses, such as those caused by magnetic losses or inefficiencies in power electronics. By using advanced materials and design techniques, engineers can improve energy efficiency and reduce waste.

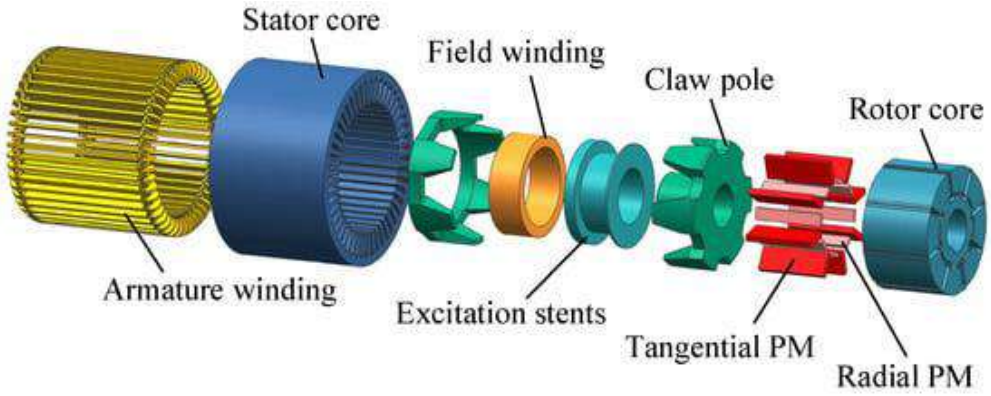
Gaining Higher Efficiency

Efficiency is crucial for electric motors, as it impacts their overall performance, operating costs, and environmental impact. To achieve higher efficiency, engineers must consider various factors, such as the choice of materials, design optimization, and advanced cooling techniques.

Tips on How to Build and Cool an Efficient Electric Motor

Creating an efficient electric motor requires a thorough understanding of the various designs, materials, and cooling methodologies influencing its performance. In this section, we will outline some practical tips and strategies engineers can use to develop efficient and high-performing electric motors, keeping thermal management in mind.

1. **Choose the optimal materials.** The choice of materials used in electric motor components, such as stators, rotors, insulation, and wiring, significantly impacts motor performance, efficiency, and reliability. High-quality materials with low losses, higher mechanical strength, and higher electrical



conductivity may allow for increased power density and torque in motor designs while also reducing energy losses. When space or weight constraints limit the motor size and design, using high-performance materials, such as those provided by Carpenter Electrification can decrease the motor size by 15-25%, resulting in a lighter and more efficient motor.

2. **Optimize the motor design** for maximum torque and power density. Engineers can use advanced simulation tools to tune design parameters in order to identify and eliminate potential design inefficiencies, producing a more compact and high-performing motor.

3. **Use advanced cooling techniques** like liquid or forced air to dissipate heat and maintain optimal operating temperatures. Effective cooling is crucial for maintaining electric motor performance, as it helps manage the heat generated during operation. Proper thermal management will maximize the motor's performance, reliability, and lifespan.

4. **Implement advanced control algorithms** to optimize motor performance under various operating conditions. These algorithms can dynamically adjust the motor's behavior to minimize energy consumption and optimize efficiency.

5. **Manage heat.** Managing heat is paramount in electric motor design because inadequate attention to heat management can lead to motor failure. Excessive heat can cause insulation breakdown, wiring damage, and other issues compromising motor performance and lifespan. Focusing on thermal management through optimized motor design, high-quality materials, and efficient cooling techniques results in electric motors that perform well under various conditions while maintaining reliability and durability.

MANIKANDAN K, I YEAR EEE

Powering the Future: Emerging Trends in Fault Detection and System Resilience

As the demand for electrical energy continues to rise, ensuring the safety, reliability, and efficiency of power systems is of paramount importance. Power system protection plays a critical role in safeguarding these systems from faults and abnormalities that can disrupt supply, cause equipment damage, and even pose risks to human life.

In this article, we will explore the emerging trends in power system protection and fault detection, highlighting advancements in technology and strategies that are shaping the future of electrical energy systems.

Importance of Power System Protection

Power system protection is essential for maintaining the integrity and stability of electrical networks. Its primary goal is to identify and isolate faults promptly, minimizing their impact and preventing cascading failures. Protection systems ensure the safety of personnel, equipment, and consumers, while also maximizing the availability and reliability of power supply.

Traditional Protection Schemes

Conventional protection methods have relied on devices such as relays, circuit breakers, and fuses. These devices are designed to detect abnormalities in current, voltage, and frequency, and initiate protective actions such as tripping circuit breakers to isolate faulty sections. While effective, these schemes often lack the flexibility and intelligence required to handle the complexities of modern power systems.

Advanced Protection Technologies

The advent of digital technologies has brought about significant advancements in power system protection. Digital relays, for instance, offer enhanced accuracy, programmability, and communication capabilities. Phasor Measurement Units (PMUs) and synchro-phasors provide synchronized measurements of voltage and current across the power system, enabling faster fault detection, dynamic system monitoring, and real-time control.

Wide-Area Monitoring Systems

Wide-area monitoring and protection systems have emerged as powerful tools for enhancing fault detection and system stability. By using synchronized measurements from multiple PMUs located across the network, these systems provide a comprehensive view of the power system's state and dynamics. They enable early fault detection, rapid system restoration, and enhanced situational awareness, thus improving overall system resilience.

Fault Location and Diagnosis

Accurate fault location and diagnosis are crucial for minimizing downtime and reducing maintenance costs. Travelling wave-based methods utilize the propagation characteristics of fault-induced waves to pinpoint fault locations accurately. Fault location algorithms leverage measurements from PMUs, digital relays, and other devices to estimate fault locations based on system impedance and network topology.

Adaptive Protection Schemes

Adaptive protection schemes offer the ability to dynamically adjust protection settings and strategies based on real-time system conditions and operational requirements. These schemes incorporate advanced algorithms and machine learning techniques to optimize fault detection, coordination, and system response. By adapting to changing network conditions, adaptive protection enhances reliability while minimizing unnecessary tripping and system disruptions.

Cybersecurity Challenges in Protection Systems

As power systems become increasingly digitized and interconnected, the risk of cyber-attacks on protection systems grows. Protecting these critical assets from malicious activities is imperative. Robust cybersecurity measures, including secure communication protocols, encryption, access controls, and intrusion detection systems, are essential to safeguard power systems from cyber threats.

Integration of Protection Systems with Automation and Control

Integration of protection systems with supervisory control and data acquisition (SCADA) systems and intelligent electronic devices (IEDs) enables enhanced monitoring, control, and coordination capabilities. IEDs often have multiple functions and can be programmable to adapt to different system requirements. They are designed to integrate with other devices and systems in the power grid, such as protective relays, meters, control systems, and communication networks. Some common examples of IEDs include digital relays, programmable logic controllers (PLCs), remote terminal units (RTUs), and substation automation systems.

Fault Analysis and System Performance Improvement

Thorough fault analysis and system performance evaluation provide valuable insights for improving power system protection, reliability, and efficiency. Advanced fault recording and analysis tools enable engineers to study fault events in detail, identify root causes, and implement preventive measures. By analysing fault data and system behaviour, engineers can optimize protection settings, enhance system planning, and minimize future fault occurrences.

DINESH H, I YEAR EEE

Root Cause Analysis of Electrocution & Electrical Fire

Nowadays, modern society is highly dependent on electrical power supply. To live & make our life comfortable, we use number of appliances/gadgets at our residence/office. Every day we get up with the news of electrocution or electrical fires in residential or commercial buildings or public location or distribution transformer or substation. This forces us to ponder over the reasons or causes of such accidents that lead to loss of lives as well as assets or properties. This article provides root cause analysis of different reasons of electrocution or fire hazards for all locations

Today's modern society is highly dependent on electrical power supply. To live & make our life comfortable, we use number of appliances or gadgets at our residence or office.

Electrocution, Electrical fire and Lightning kill 15,000 people a year. Also, 75,000 (approx.) people suffer because of these deaths as there is loss of property and assets, dreams of many people associated with deceased shatter.

Around 1 lakh people died due to electrocution in the last decade, as per NCRB data (please refer table 1). The news of electric shock or electric fire killing people gives pain and forces everyone to find the solution, but in a day or two we again forget and wait for another accident to happen. (Refer figure 1).

Table 1: NCRB Data of Deaths Due to Lightning Electrocution and SC Fire 2020-222

NCRB Death Data (Lightin, Electrocution & Fire Due to Short Circuit)						
Discription	**2020**	**2021**	**2022**	**% of Total (2020,21,22)**		
Total Death	374397	297530	430504	100	100	100
Lighting	2862	2880	2887	0.76	0.72	0.67
Electrocution	13446	12529	12918	3.59	3.15	3.00
Fire Due Elect SC	1943	1808	1567	0.52	0.45	0.36

There are too many tales that different parts of the country have to tell each day without fail (many cases are even not reported or recorded). Keeping the figure for the injured aside, the numbers for the electrocution deaths in the country tell a story of their own. According to the National Crime Records Bureau, around one lakh people lost their lives because of electrocution in the last decade alone. The annual average of fatalities rose to 12,500 per year or 30 fatalities every day.

Calling the 30 electrocution deaths per day in India 'accidents' is something that is not justified as it tends to insulate all stake holder from accountabilities.

Main Causes of Electrocution & Electrical Fire Hazard

Electrocution & Electrical Fires in an Electrical Installation may be broadly caused by:

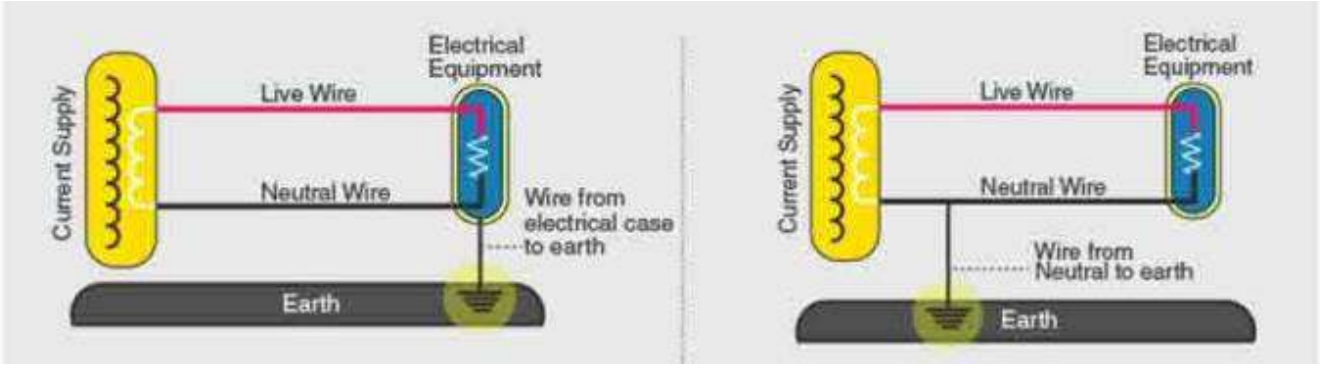
- Over currents (overloads and short circuits)
- Harmonics
- Earth fault
- Electric arcs in cables and loose Connections
- Failure of protection device or Wrong selection of protection device
- Wrong selection of cables or wires

- Mismatch of illumination fittings rating and lamps used
- Use of extension cord for heaters or any other heavy loads
- Use of outlived (outdated) or damaged equipment
- Over voltages (Lightning) & arcing ground
- Consumer has become prosumer
- Inadequate design for earthing or grounding
- Improper or No verification and testing (commissioning or periodical)

Role of Adequate Earthing or Grounding

Grounding or earthing means making a connection to the general mass of earth. The use of grounding is so widespread in an electric system that at practically every point in the system, from the generators to the consumers' equipment, earth connections are made.
There are two types grounding (Refer figure 2):

- Neutral Grounding
- General (Equipment) Grounding

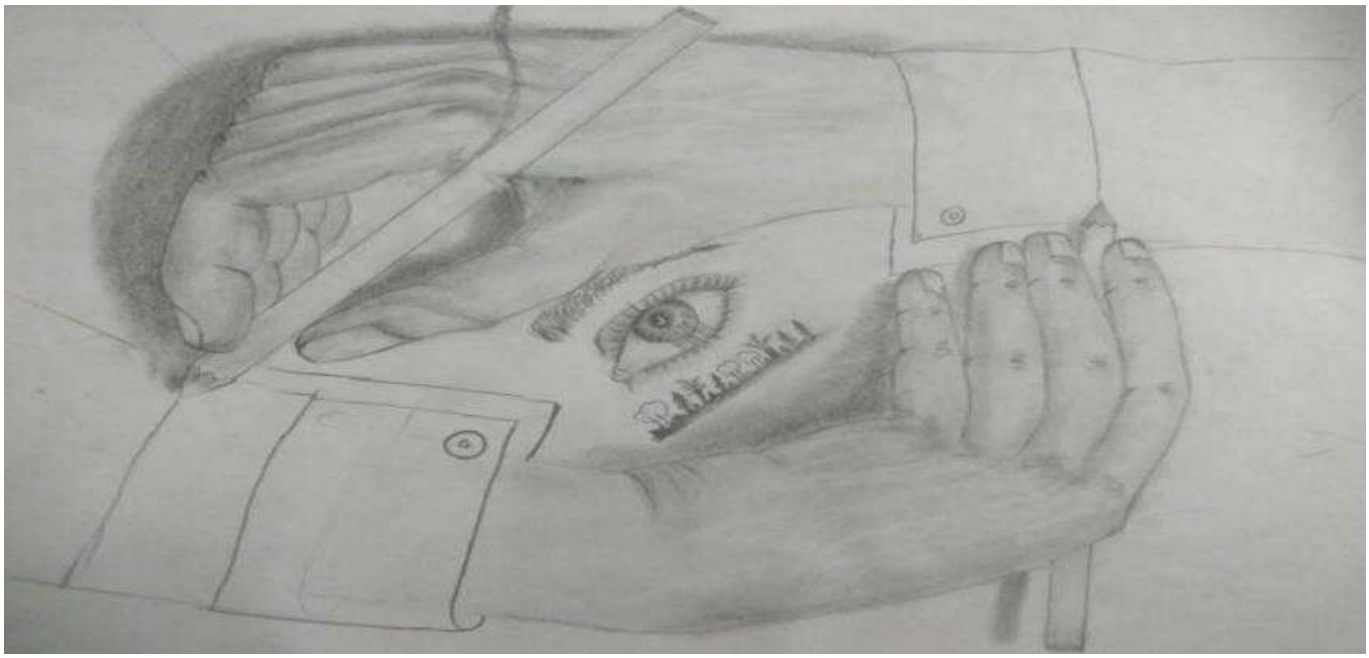


The objectives of General Grounding system include:

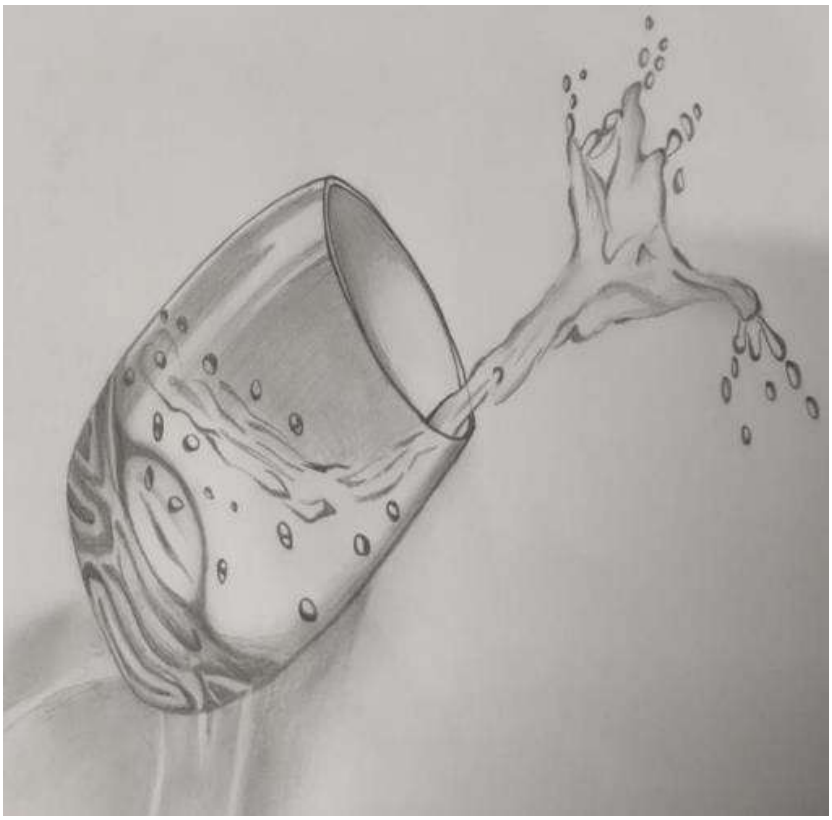
- To provide a low resistance return path for fault current, which further protects both working staff and equipment installed in the premises (Refer figure 3).
- To prevent dangerous GPR with respect to remote ground during fault condition.
- To provide a low resistance path for power system transients such as lightning and over voltages in the system.
- To provide uniform potential bonding /zone of conductive objects within substation to the grounding system to avoid development of any dangerous potential between objects (and earth).
- To prevent building up of electrostatic charge and discharge within the substation, which may result in sparks.
- To allow sufficient current to flow safely for satisfactory operation of protection system.

RAKSHITHA KV, I YEAR EEE

DRAWING



M Dinesh, II YEAR EEE



L theja, III YEAR EEE

Puzzle

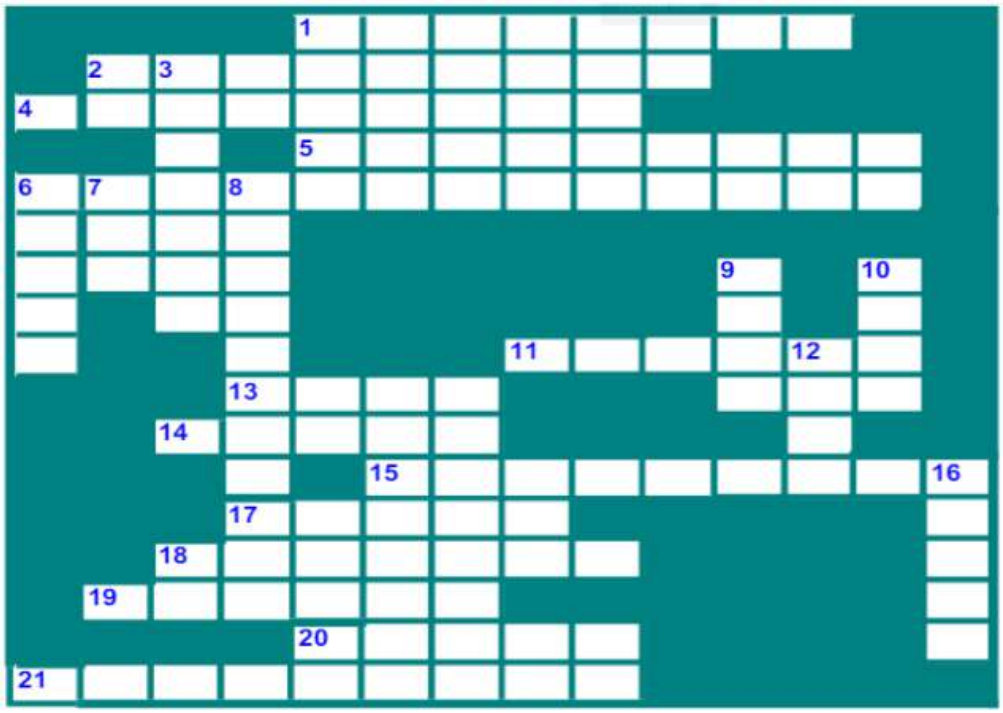
Five friends have their gardens next to one another, where they grow three kinds of crops: fruits (apple, pear, nut, cherry), vegetables (carrot, parsley, gourd, onion) and flowers (aster, rose, tulip, lily).

1. They grow 12 different varieties.
2. Everybody grows exactly 4 different varieties
3. Each variety is at least in one garden.
4. Only one variety is in 4 gardens.
5. Only in one garden are all 3 kinds of crops.
6. Only in one garden are all 4 varieties of one kind of crops.
7. Pear is only in the two border gardens.
8. Paul's garden is in the middle with no lily.
9. Aster grower doesn't grow vegetables.
10. Rose growers don't grow parsley.
11. Nuts grower has also gourd and parsley.
12. In the first garden are apples and cherries.
13. Only in two gardens are cherries.
14. Sam has onions and cherries.
15. Luke grows exactly two kinds of fruit.
16. Tulip is only in two gardens.
17. Apple is in a single garden.
18. Only in one garden next to Zick's is parsley.
19. Sam's garden is not on the border.
20. Hank grows neither vegetables nor asters.
21. Paul has exactly three kinds of vegetable.

Who has which garden and what is grown where?

Puzzle Solution:
Hank: pear apple cherry rose
Sam: cherry onion rose tulip
Paul: carrot gourd onion rose
Zick: aster rose tulip lily
Luke: pear nut gourd parsley

CROSSWORD



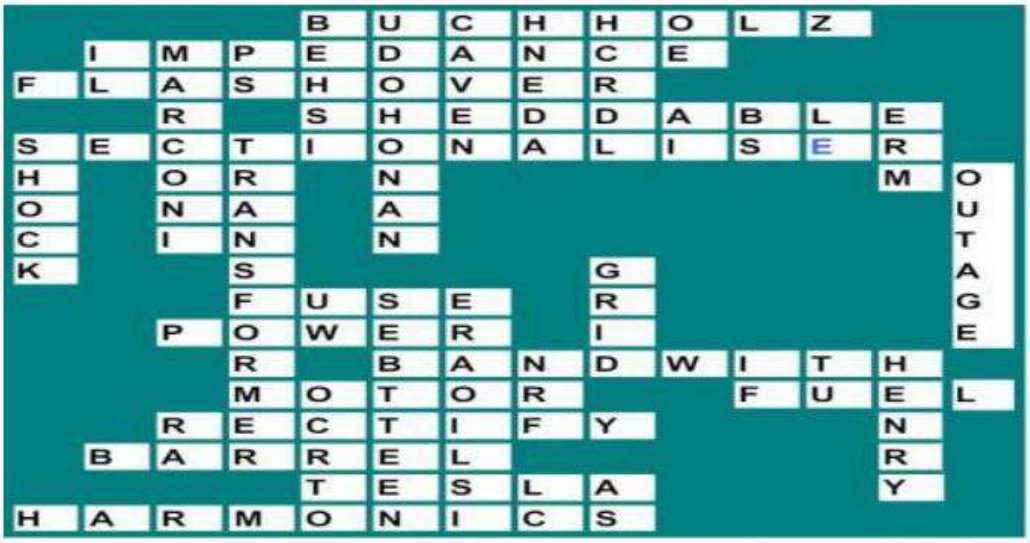
ACROSS

1 Another name of gas relay or sudden pressure relay (8)
2 A measure of total opposition to current (9)
4 An electrical concept associated with putting metals close to energized lines (9)
5 What loads are said to be if they can be disconnected during short periods of system distrubances (9)
6 A mechanical switching device to connect busbars of two sections (13)
11 The period during which a generating unit is out of service (6)
13 Used where the motor switching device is a contactor to provide short circuit protection (4)
14 The rate at which energy is transferred (5)
15 The range of frequencies that a signal contains or circuit can handle (8)
17 Has a function opposite to generator (5)
18 Convert AC to DC power (7)
19 A volumetric unit of measure of crude and petroleum products (6)
20 The Electrical genius best known for inventing Alternating current (5)
21 Sinosoidal Voltages or currents having frequencies that are whole multiples of the power frequency a which the supply system is designed to operate (9)

DOWN

3 He is associated with the discovery of radio (7)
6 Physiologically dangerous current (5)
7 A device designated to restart motors (3)
8 A type of equipment that is associated distribution of energy (11)
9 Designation for a type of transformer cooling (4)
10 Any substance that can be burnt to produce heat (4)
12 The layout of an electrical distribution network (4)
16 Measure of inductance (5)

Cross Word Solution



2024 PASSOUT BATCH