

Facilitator Guidebook

ELECTRICAL SAFETY SUPERVISOR



Facilitator Guide Book

Electrical Safety Supervisor

Sector:- Cross Sectoral

**Sub-Sector:- Hydrocarbon, Iron & steel, Mining, Power,
Automotive, Construction, Chemicals &
Petrochemicals, and others.**

Occupation:- Electrical Safety Management

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The Facilitator Guidebook for **Electrical Safety Supervisor, SSD/Q1301**, developed by the **Safety Skill Development Foundation (SSDF)**, reflects our commitment to industry requirement for the job role, best practices in the profession, quality training requirement, regulatory compliances, workplace safety, health and sustainable practices. This guide is enriched with insights from **Subject Matter Experts (SMEs), trainers, and industry professionals**, ensuring its relevance to real-world applications.

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Our gratitude also goes to trainers, assessors, industry experts, government bodies, and sector skill councils for their contributions toward advancing occupational safety across industries, including Hydrocarbon, Iron & Steel, Mining, Power, Automotive, Construction, Chemicals & Petrochemicals, and more.

The qualification is aligned with **NSQF** and this guide supports the **Skill India** initiative and is dedicated to trainers committed to excellence in skill development. SSDF welcomes feedback for continuous improvement.

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About this Guide Book

The increasing focus on electrical safety across various industries is driving a surge in the demand for qualified Electrical Safety Supervisor. This heightened need is resulting in a greater requirement for trained professionals in the field. As a result, there is an escalating necessity for trainers to prepare individuals with the essential skills to become competent Electrical Safety Supervisor.

This Facilitator Guide is designed for providing skill training and /or upgrading the knowledge level of the Trainees to take up the job of an “Trainer” in the Cross Sectoral Sector.

This Facilitator Guide is designed based on the Qualification Pack (QP) under the National Skill Qualification framework (NSQF) and it comprises of the following National Occupational Standards (NOS)/topics and additional topics.

- 1. Introduction to Occupational Safety, Health, and Environment (OSHE).**
- 2. Electrical Hazard Identification, Risk Assessment, and Hazard Control**
- 3. Electrical Machines & Power Systems.**
- 4. Electrical Switchgear and Protective Devices**
- 5. Statutes & Legislative: Safety, Health & Electricity**
- 6. Plan & Organize Electrical Emergency Protocols**
- 7. Employability Skills (60 Hours)**
























The guidebook provides detailed insights on how facilitators can engage with participants, assess their training requirements, and convey essential concepts pertaining to Occupational Safety Health & Environment Management System (**OSHEMS**). It guarantees that facilitators address all necessary subjects effectively, achieving the training goals within the allotted time.

At the start of each unit, key learning objectives for each National Occupational Standard (NOS) are presented, assisting facilitators in navigating the training process. Additionally, the symbols utilized in this guidebook are clarified to enhance facilitators' comprehension of the materials. This guide will support trainers in developing competent professionals to effectively contribute in creating and maintaining safe electrical systems and workplaces and hence meet the rising demand of qualified Electrical Safety Supervisors in the industry.

This guidebook serves as an extensive resource for trainers, ensuring they are adequately prepared to conduct effective safety audit training.

Symbols Used

Symbols Used

					
Steps	Time	Tips	Notes	Objectives	Do
					
Ask	Explain	Elaborate	Field Visit	Practical	Lab
					
Demonstrate	Exercise	Team Activity	Facilitation Notes	Learning Outcomes	Say
					
Resources	Activity	Summary	Role Play	Example	

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1. Unit 1 Introduction

1.1. Key Learning Outcomes

At the end of this module, the trainees will be able to:

- Describe Hydrocarbon, Iron & steel, Mining, Power, Automotive, Construction, Chemicals & Petrochemicals
- List the roles and responsibilities of Electrical Safety Supervisor

1.2. Unit 1.1: Overview of the Industry

1.2.1. Unit Objectives

At the end of this unit, students will be able to:

1. Describe about the Hydrocarbon sector in India
2. Describe about the Iron & Steel sector in India
3. Describe about the Mining sector in India
4. Describe about the Power sector in India
5. Describe about the Automotive sector in India
6. Describe about the Construction sector in India
7. Describe about the Chemicals & Petrochemicals in India
8. Describe how each sub-sector contributes to skill development
9. Compare the job potential of all sub-sectors

1.2.2. Resources to be used

- Available objects such as Projection screen, whiteboard, projection screen, laptop, speaker, notebook, pen, participant handbook, etc
- Flip chart
- Attendance sheet
- Activities (role plays and games)

1.2.3. Ask

- Ask the participants to share their expectations from the program
- Ask them to tell what they know about the Hydrocarbon sector, Iron & Steel sector, Mining sector, Power sector, Automotive sector, Construction sector, Chemicals & Petrochemicals
- What is the 'Make-in-India' initiative?

1.2.4. Do

- Introduce yourself to the participants.
- Give an overview of the program to the participants - duration of the program, objective etc.
- Give an overview of the Hydrocarbon sector, Iron & Steel sector, Mining sector, Power sector, Automotive sector, Construction sector, Chemicals & Petrochemicals sector in India.

1.2.5. Explain

List the major segments in the Hydrocarbon sector, Iron & Steel sector, Mining sector, Power sector, Automotive sector, Construction sector, Chemicals & Petrochemicals sector

1.2.6. Tips

- Go slow with information flow with participants.
- Observe each participant's body language.
- Keep a positive and supportive approach towards the candidates

1.2.7. Activity: Team Spot

- Separate the class in 2 different teams.
- Each team will be assigned with 3 different sector topics
- Ask them to present the given topics team after team, and state examples individually to explain

1.2.8. Notes for Facilitation

- Revise the important points discussed in this unit.
- Clear the doubts of the students, if any. Encourage them to ask questions.
- Discuss the question with the class and answer their queries satisfactorily.
- Help participants identify how to apply the skills taught in the course to their work
- Praise participants and the group on improving their performance and developing new skills.
- Encourage participants to move through the initial difficulties of learning new skills, by focusing on steps in their progress and the importance of what they are learning to do.

1.2.9. Summary

- **Hydrocarbon:** The hydrocarbon sector involves the extraction, refinement, and distribution of oil and natural gas. This sector plays a crucial role in energy production and the global economy, providing fuel and raw materials for various industries.
- **Iron & Steel:** The iron and steel sector is fundamental to industrial development. It focuses on producing metal alloys used in manufacturing, construction, and infrastructure. This sector is key to building economies and supporting technological advancements.
- **Mining:** The mining industry is concerned with extracting valuable minerals and materials from the earth. It provides essential raw materials for industries like construction, energy production, and manufacturing.
- **Power:** The power sector includes the generation, transmission, and distribution of electricity. This sector is vital to economic development and daily life, powering homes, businesses, and industries through a variety of sources such as coal, natural gas, renewables, and nuclear energy.
- **Automotive:** The automotive sector involves the design, production, and distribution of motor vehicles, including cars, trucks, and motorcycles. It is a significant driver of technological innovation and economic activity globally.
- **Construction:** The construction sector is involved in the building and infrastructure development of residential, commercial, and industrial projects. It supports urbanization and economic development by creating critical infrastructure such as roads, bridges, and buildings.
- **Chemicals & Petrochemicals:** This sector deals with the production of chemicals, fertilizers, and petrochemical products derived from petroleum. It plays a crucial role in manufacturing various goods such as plastics, pharmaceuticals, and industrial chemicals.

1.2.10. Exercise

1. Which of following is the most common cause of accidents in hydrocarbon sector?
 - A. Equipment Failure
 - B. Human Error
 - C. Natural Disasters
 - D. Fire
2. Routine inspections and maintenance are crucial for preventing accidents in oil and gas pipeline.(T/F)
3. Which of the following is major hazard in steel industry?
 - A. Noise Pollution
 - B. High Temperature
 - C. Exposure to Hazardous Substance
 - D. All the above
4. Proper PPE is essential for Workers handling molten metal.(T/F)

5. What is most common cause of fatalities in underground mines?
- Rock Falls
 - Explosion
 - Flooding
 - Electrical Hazards

1.3. Unit 1.2: Roles and Responsibilities of a Electrical Safety Supervisor

1.3.1. Unit Objectives

At the end of this unit, students will be able to:

- Identify roles and responsibilities of Electrical Safety Supervisor
- Identify essential skills of Electrical Safety Supervisor

1.3.2. Resources to be used

- Available objects such as Projection screen, whiteboard, projection screen, laptop, speaker, notebook, pen, participant handbook, etc
- Flip chart
- Attendance sheet
- Activities (role plays and games)

1.3.3. Ask

- Ask the participants to share their expectations from the program

1.3.4. Do

- Give a brief introduction on the job description of Electrical Safety Supervisor outlining their personal attributes to the participants
- Provide the participants with a List of Roles and Responsibilities of Electrical Safety Supervisor
- Talk about the skills and knowledge which are essential to become a Electrical Safety Supervisor

1.3.5. Explain

Describe about the roles and responsibility of Electrical Safety Supervisor

1.3.6. Tips

- Go slow with information flow with participants.
- Observe each participant's body language.
- Keep a positive and supportive approach towards the candidates

1.3.7. Activity: Team Spot

- Separate the class in 2 different teams.
- Each team will be assigned with topics - Roles and responsibilities of Electrical Safety Supervisor
- Ask them to present the given topics team after team, and state examples individually to explain

1.3.8. Notes for Facilitation

- Revise the important points discussed in this unit.
- Clear the doubts of the students, if any. Encourage them to ask questions.
- Discuss the question with the class and answer their queries satisfactorily.
- Help participants identify how to apply the skills taught in the course to their work
- Praise participants and the group on improving their performance and developing new skills.
- Encourage participants to move through the initial difficulties of learning new skills, by focusing on steps in their progress and the importance of what they are learning to do.

1.3.9. Summary

- **Developing and Implementing Safety Procedures:** The Safety Executive is responsible for creating, updating, and enforcing safety protocols, standard operating procedures (SOPs), and best practices to prevent accidents, injuries, and environmental harm.
- **Conducting Inspections and Risk Assessments:** Regular inspections are carried out to identify potential hazards in the workplace. The Safety Executive analyses these risks, recommends corrective actions, and monitors their implementation.
- **Incident Reporting and Analysis:** In case of accidents or incidents, the Safety Executive ensures proper documentation, reporting, and root cause analysis to prevent future occurrences.
- **Training and Awareness:** The Safety Executive coordinates safety training programs for staff to ensure they understand the proper safety protocols and are equipped to handle emergencies.
- **Compliance Monitoring:** Ensuring compliance with local, regional, and international safety regulations is a key responsibility. The Safety Executive must stay updated on laws and standards governing workplace safety and environmental protection.
- **Resource Planning:** The Safety Executive evaluates and manages resources, including safety equipment, training materials, and personal protective equipment (PPE), ensuring that staff have what they need to work safely.
- **Collaboration with Departments:** The role requires coordination with various departments (HR, operations, maintenance) to implement safety measures, bridge gaps, and improve overall safety culture within the organization.
- **Reporting and Documentation:** The Safety Executive is tasked with preparing detailed reports on inspections, incidents, corrective actions, and the overall safety performance of the organization. These reports are submitted to management and regulatory bodies.

1.3.10. Exercise

1. What is one of the primary responsibilities of an Electrical Safety Supervisor?
 - a) Oversee daily electrical equipment repairs
 - b) Ensure compliance with electrical safety regulations
 - c) Handle customer complaints related to electrical issues
 - d) Manage accounting for electrical equipment purchases
2. In case of an electrical emergency, the Electrical Safety Supervisor is responsible for _____.
 - a) Directing emergency services and evacuating the area
 - b) Fixing the electrical equipment immediately
 - c) Continuing operations without interruption
 - d) Taking a break
3. True or False: Electrical Safety Supervisors should not be involved in planning emergency procedures, as it is the responsibility of the fire safety team.
4. True or False: An Electrical Safety Supervisor must regularly inspect electrical equipment to ensure it is properly maintained and safe to use.
5. An Electrical Safety Supervisor should conduct regular _____ assessments to identify potential electrical hazards.
6. The Electrical Safety Supervisor is responsible for ensuring that all workers have access to and use proper _____ while working with electrical systems.

2. Unit 2 NOS 1: SSD/VSQ/N0106: Introduction to Occupational Safety, Health, and Environment (OSHE)

2.1. Key Learning Outcomes

At the end of this module, the trainees will be able to

- Understand health & safety requirements, financial losses of an organization because of an accident.
- Understand safety policy formulation and health & safety objectives.
- Identify hazards at the workplace.
- Understand different classes of fire, evacuations, fire drills, use of PPEs.
- Onboard and manage contractors to comply with statutory requirements in occupational OSHE

2.2. Unit 2.1: Health & Safety at workplace

2.2.1. Unit Objectives

At the end of this unit, students will be able to:

- Understand the concept of Health, Safety and Environment management at the workplace, its importance and the moral, financial and legal reasons for health and safety at the workplace.
- Understand “Accident Cost- Iceberg” theory of direct and indirect cost incurred from an incident.
- Understand the employer responsibilities in providing safe working conditions and the employee rights & responsibilities at a workplace, safety culture, its indicators and role of International Labour Organisation in health & safety.
- Understand safety Policy, the general statement of intent in a safety policy, its aim, objectives and “SMART” concept of goal setting

2.2.2. Resources

- Whiteboard, erasable marker, board cleaner, projection screen, laptop, speaker, notebook, pen, participant handbook, etc
- Flip chart
- Participant Manual
- Projection screen and PowerPoint presentations.
- Activities (role plays)

2.2.3. Say

- What is Health, Safety and Environment management
- Why Safety?
- Describe “Accident Cost- Iceberg” theory
- What are employer’s responsibilities
- What is safety Policy

2.2.4. Explain

- Describe Health, Safety and Environment management and its component
- Describe Accident Cost- Iceberg” theory
- Describe Employer’s responsibilities
- Describe employee rights & responsibilities at a workplace

- Describe safety culture & its indicators
- Describe role of International Labour Organisation in health & safety
- Describe safety Policy

2.2.5. Activity

Health & Safety at the Workplace

- Distribute the Iceberg Diagram to each participant or group.
- Ask participant to break down the costs of an accident into direct and indirect costs based on the Iceberg Theory.
- Direct costs: Medical expenses, workers' compensation, repairs, etc.
- Indirect costs: Lost productivity, training costs for replacements, damage to reputation, legal fees, etc.

2.2.6. Role-Playing Exercise:

- Divide the class into pairs. One person will take on the role of the employer and the other the employee.
- Provide the pairs with a scenario in which a safety issue arises in the workplace (e.g., unsafe working conditions, a worker's right to stop unsafe work).
- Ask them to role-play the interaction where the employer explains their responsibilities and the employee asserts their rights and responsibilities.
- After the role-play, ask the class to reflect on what was discussed and highlight any key learning points.

2.2.7. Notes for Facilitation

- Summarize the important points and terms explained in the session.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer questions, as needed, providing concrete and brief answers.
- Tell participants to complete the questions at the end of the unit.
- Ensure that every participant answers all the questions.

2.2.8. Summary

1. Health, Safety, and Environment (HSE) Management:

- HSE management focuses on maintaining a safe and healthy workplace by preventing accidents and promoting environmental sustainability.
- Importance: Ensures the well-being of employees, compliance with regulations, and minimizes financial loss from accidents.

Reasons for Safety:

A. Moral: Duty to protect workers from harm.

B. Financial: Avoiding costs related to accidents (e.g., medical expenses, compensation, lost productivity).

C. Legal: Compliance with safety laws to avoid fines and legal issues.

2. Accident Cost – Iceberg Theory:

- Direct Costs: Visible costs like medical bills, compensation, and equipment repair.
- Indirect Costs: Hidden costs like loss of productivity, legal fees, and damage to company reputation.

3. Employer Responsibilities:

- Ensure safe working conditions, provide necessary training, and equip workers with protective gear.
- Maintain safety policies and perform regular safety audits.

4. Employee Rights & Responsibilities:

- Rights: Right to work in a safe environment and report hazards without fear of retaliation.
- Responsibilities: Follow safety procedures, use protective equipment, and report unsafe conditions.

5. Safety Culture:

- A strong safety culture encourages active participation from both employers and employees to promote a safe working environment.
- Indicators: Open communication, adherence to safety procedures, and continuous safety training.

6. Role of International Labour Organisation (ILO):

Sets global standards and guidelines for workplace safety and health to protect workers worldwide.

7. Safety Policy and SMART Goals:

- Safety Policy: A statement outlining the company's commitment to health and safety, including aims and objectives.
- SMART Goals: Specific, Measurable, Achievable, Relevant, and Time-bound goals set to improve workplace safety (e.g., reducing accidents by a certain percentage in a specific time frame).

2.2.9. Exercise

1. What are the three primary reasons for implementing health and safety at the workplace?

- Moral, Environmental, Legal
- Financial, Moral, Legal
- Legal, Technological, Environmental
- Financial, Technological, Moral

2. The "Accident Cost - Iceberg" theory highlights which of the following?

- The hidden and visible costs of accidents
- The physical and emotional impact of accidents
- The visible impact of training
- The role of environment in accidents

3. What is the role of the International Labour Organisation (ILO) in workplace safety?

- Provides financial support for safety training
- Sets global safety standards and promotes safety culture
- Implements emergency evacuation plans
- Supplies equipment to reduce accidents

4. Every employer is required to provide a _____ work environment to ensure the health and safety of all employees.

5. It is important for employees to report any _____ immediately to their supervisor to prevent accidents

6. It is the employer's responsibility to ensure a safe working environment for all employees. (T/F)

7. Employees should immediately report any unsafe conditions or hazards to their supervisor. (T/F)

2.3. Unit 2.2 Types and Scope of Safety Audit

2.3.1. Unit Objectives

At the end of this unit, students will be able to

- Understand concept of safety audit, audit objective, types, requirement for safety audit at workplace, audit for a task, program, activity, project and machinery
- Understand the scope of internal and external audit, reasons and advantages, responsibility of auditor.
- Understand first party, second party and third party audits, scope of the compliance audit, program audit and management system audit.

2.3.2. Resources

- Whiteboard, erasable marker, board cleaner, projection screen, laptop, speaker, notebook, pen, participant handbook, etc
- Flip chart
- Participant Manual
- Projection screen and PowerPoint presentations.
- Activities (role plays)

2.3.3. Say

- Understand the difference between various types of safety audits (e.g., general, specific, compliance) and their respective scopes.
- Describe & familiarize oneself with various methodologies used in safety audits, such as checklists, inspections, interviews, and observations.
- Understand the scope of internal and external audit, reasons & advantages.
- Understand first-party, second-party and third-party audits.
- Understand the scope of the compliance audit, program audit & management system audit.
- Understand the scope of audit for a task, program, activity, project & machinery.

2.3.4. Explain

- Understand the difference between various types of safety audits (e.g., general, specific, compliance) and their respective scopes.
- Describe & familiarize oneself with various methodologies used in safety audits, such as checklists, inspections, interviews, and observations.
- Understand the scope of internal and external audit, reasons & advantages.
- Understand first-party, second-party and third-party audits.
- Understand the scope of the compliance audit, program audit & management system audit.
- Understand the scope of audit for a task, program, activity, project & machinery.

2.3.5. Activity

Types and Scope of Safety Audit

Objective: To enhance students' comprehension of the various types of safety audits and their relevance across different settings.

Activity Setup:

- Organize the class into small groups consisting of 3-4 students each.
- Assign a distinct type of safety audit to each group (e.g., Compliance Audit, Risk Assessment Audit, Environmental Audit, Process Safety Audit, etc.).

Instructions:

Research: Each group will perform a concise research task on their designated type of safety audit, focusing on:

The definition and objectives of the audit type.

The scope of the audit, including the areas or processes typically involved.

Examples of contexts in which this audit is utilized (e.g., manufacturing facilities, construction sites, chemical processing plants).

Scope Mapping: Groups are to develop a mind map or flow chart that outlines the primary areas encompassed by their assigned audit type, such as equipment, personnel, environmental factors, and legal compliance.

Presentation: Each group will present their research findings, emphasizing the audit type, its scope, and practical applications in real-world scenarios.

Discussion: Following the presentations, facilitate a class discussion on the significance of understanding the scope of various safety audits. Explore how these audits contribute to risk reduction and the promotion of workplace safety.

Conclusion: Recap the main types of safety audits and highlight that each audit fulfils a distinct role tailored to the specific safety requirements of an organization or industry.

2.3.6. Notes for Facilitation

- Summarize the important points and terms explained in the session.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer questions, as needed, providing concrete and brief answers.
- Tell participants to complete the questions at the end of the unit.
- Ensure that every participant answers all the questions.

2.3.7. Summary

- **Internal Audits** :Internal audits assess compliance, effectiveness, and risk management processes.
- **External Audits**: Conducted by external firms to ensure accuracy and transparency. Assess compliance with legal regulations, standards, and accounting practices.
- **Regulatory Audits**: Regulatory audits ensure compliance with industry-specific laws and regulations
- **1st Party Audits** : Internal audits conducted by an organization on its own processes to assess compliance and performance.
- **2nd Party Audits** : Audits conducted by customers or clients to evaluate their suppliers' processes, systems, or compliance with contracts.
- **3rd Party Audit** : Independent audits performed by external, neutral organizations to verify compliance with standards or regulations.
- **Compliance Audits**: Compliance audits assess adherence to internal policies and external regulations.
- **Program Audits**: Evaluation of specific programs to assess efficiency, effectiveness, and compliance with set objectives and regulations
- **Management System Audits** : Assessing an organization’s management systems to ensure compliance with standards, effectiveness, and continuous improvement.
- **Incident Investigation Audits**: Conducted to investigate specific accidents or incidents and identify root causes.
- **Risk Assessment Audits**: Evaluate an organization's risk management processes and identify potential hazards.
- **Safety Culture Audits**: Assess the organization's safety culture and identify areas for improvement.

Key Areas included in Safety Audits:

- Hazard Identification:
- Compliance Assessment:
- Risk Management:
- Safety Training and Education:
- Emergency Preparedness:
- Safety Culture:
- Incident Investigation:
- Safety Management Systems:

2.4. Unit 2.3: Hierarchy & Process Safety

2.4.1. Unit Objectives

At the end of this unit, students will be able to

- Understand the role of management in an organization.
- Understand fundamentals of process safety
- Understand the role of occupier, controller of premise
- Understand Contractor Safety Management System
- Understand permit to work system and role of safety committee

2.4.2. Resources

- Whiteboard, erasable marker, board cleaner, projection screen, laptop, speaker, notebook, pen, participant handbook, etc
- Flip chart
- Participant Manual

- Projection screen and PowerPoint presentations.
- Activities (role plays)

2.4.3. Say

- Describe role of management in an organization.
- Describe fundamental concept of process safety
- Describe the role of occupier, controller of premise
- Describe process of Contractor Safety Management System
- Describe permit to work system and role of safety committee

2.4.4. Explain

- Describe role of management in an organization.
- Describe fundamental concept of process safety
- Describe the role of occupier, controller of premise
- Describe process of Contractor Safety Management System
- Describe permit to work system and role of safety committee

2.4.5. Role-Play Exercise:

Divide the students into small groups and assign each group a scenario related to contractor safety management. Each group will take on one of the following roles:

Safety Manager overseeing contractors.

- Contractor working on-site.
- Safety Committee member conducting a review meeting.
- Occupier ensuring compliance with safety rules.

Scenarios could include:

- A contractor requesting a work permit for a high-risk activity (e.g., working at height or with hazardous chemicals).
- A contractor not following proper safety procedures, and the safety manager steps in to correct the situation.
- A safety committee conducting a regular review meeting to assess contractor compliance and discuss safety concerns.

Instructions:

- Role-players must act out the scenario and interact according to their assigned role. Focus on communication, safety checks, and the importance of reporting incidents.
- After the role-play, each group will explain their actions to the class and discuss the outcomes of their scenario, such as identifying gaps in contractor safety or reviewing safety permits.

2.4.6. Notes for Facilitation

- Summarize the important points and terms explained in the session.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer questions, as needed, providing concrete and brief answers.
- Tell participants to complete the questions at the end of the unit.
- Ensure that every participant answers all the questions.

2.4.7. Summary

1.Role of Management in an Organization:

Management is responsible for establishing and promoting a culture of safety within the organization. They ensure that safety policies are developed, implemented, and adhered to, and that appropriate resources (financial, human, and technical) are allocated to maintain workplace safety. Management also oversees safety training programs, safety audits, and emergency preparedness plans. Their role includes ensuring compliance with legal safety requirements and continuous improvement of safety systems.

2.Fundamental Concept of Process Safety:

Process safety involves the identification, analysis, and management of hazards associated with industrial processes to prevent accidents, injuries, and environmental harm. It focuses on the integrity of process systems and aims to prevent catastrophic incidents such as fires, explosions, and toxic releases. Fundamental concepts include risk assessments, hazard identification, safety barriers, and ensuring the proper design, operation, and maintenance of equipment.

3.Role of Occupier and Controller of Premises:

Occupier: The occupier is the person or entity responsible for the operation of a premises. They are accountable for ensuring safety standards are met and maintained within the workplace. This includes managing safety policies, risk assessments, and compliance with regulatory requirements.

Controller of Premises: The controller of premises is responsible for controlling access to and usage of the workplace. They ensure that the premises are maintained in a safe condition and that safety procedures are followed by employees and contractors alike.

4.Process of Contractor Safety Management System:

Contractor safety management is a system that ensures contractors follow safety standards while working on-site. It involves the selection of contractors based on their safety performance, assessing risks, and ensuring that contractors adhere to workplace safety protocols. This system includes issuing work permits, ensuring contractor training, conducting safety audits, and regular safety meetings. Communication between the contractor, safety managers, and employees is crucial to ensure a safe work environment.

5.Permit to Work System and Role of Safety Committee:

The permit to work system is a formal procedure used to control high-risk activities and ensure that safety measures are followed. It is a written authorization that allows specific tasks to be carried out, outlining safety measures, precautions, and necessary safety checks before the work begins.

The Safety Committee plays a crucial role in overseeing the safety programs within an organization. They ensure the enforcement of safety standards, conduct safety inspections, review accident reports, and promote safety awareness. The committee acts as a communication bridge between management, employees, and contractors, helping to create a safe and compliant working environment.

2.4.8. Exercise

1. What does QRA stand for in process safety?

- a) Quantitative Risk Analysis
- b) Quality Resource Assessment
- c) Quick Risk Assessment
- d) Qualified Risk Analysis

2. What is the purpose of a work permit system for contractors?

- a) To ensure contractors' work aligns with production goals
- b) To confirm contractors understand and adhere to safety protocols
- c) To manage financial transactions with contractors
- d) To improve efficiency in contractor management

3. What is the role of a safety committee in an organization?

- a) Organize employee recreational activities
- b) Monitor and improve workplace safety systems
- c) Conduct financial audits
- d) Approve equipment purchases

4. The role of management in an organization includes overseeing operations, ensuring the safety of employees, and maintaining _____ compliance.

5. The safety supervisor is responsible for ensuring that employees are following the organization's safety protocols and _____ safety rules.

6. LOPA (Layer of Protection Analysis) is a risk management technique that evaluates the layers of safeguards needed to prevent a _____ event

7. SIL (Safety Integrity Level) is used to determine how often safety equipment should fail.

8. FERA (Fire and Explosion Risk Assessment) focuses on evaluating the likelihood of electrical failures in a workplace.

9. The occupier of a premises is responsible for ensuring all health and safety measures are adhered to on-site.

2.5. Unit 2.4: PDCA Cycle & Safety training

2.5.1. Unit Objectives

At the end of this unit, students will be able to

- Understand the requirement of Plan-Do-Check-Act (PDCA) Cycle in safety management system
- Understand the need of training, the contents of induction training & competent persons at the workplace
- Understand “Toolbox talk” and “Induction training”.
- Understand Concept of gas testing using – LEL sensor, O2 sensor, H2S sensor, Co-Sensor

2.5.2. Resources

- Whiteboard, erasable marker, board cleaner, projection screen, laptop, speaker, notebook, pen, participant handbook, etc
- Flip chart
- Participant Manual
- Projection screen and PowerPoint presentations.
- Activities (role plays)

2.5.3. Say

- What do you understand by Plan-Do-Check-Act (PDCA) Cycle in safety management system?
- Why training is necessary?
- What should be included in “Toolbox talk”

2.5.4. Explain

- Describe Plan-Do-Check-Act (PDCA) Cycle in safety management system and its stage
- Describe different kind of training and competency
- Describe about Toolbox talk
- Describe Concept of gas testing

2.5.5. Activity

Divide the class into small groups and give each group a scenario related to workplace safety (e.g., handling chemical spills, machinery maintenance, or a fire drill).

Task:

In their groups, students must apply the PDCA cycle to the scenario, focusing on the Plan and Do stages. Each group will:

Identify key safety objectives (Plan stage).

Create a simple plan to address the safety issue (e.g., implementing PPE or specific safety protocols).

Discuss how they would implement the plan (Do stage).

After 10 minutes, each group will present their plan and actions.

Class Discussion:

Discuss the Check and Act stages. What methods can be used to evaluate if the plan worked, and what corrective actions can be taken if the plan was unsuccessful?

2.5.6. Role-Playing Exercise:

Split students into pairs. One person will take the role of a trainer, and the other will be the trainee.

The trainer will conduct a short Toolbox Talk on a safety topic (e.g., fire safety, lifting techniques) or deliver a portion of an Induction Training.

After 5 minutes, swap roles.

Class Feedback:

After each role-play, allow the class to provide feedback on the effectiveness of the training and suggest improvements (e.g., clarity, engagement, essential information).

2.5.7. Notes for Facilitation

- Summarize the important points and terms explained in the session.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer questions, as needed, providing concrete and brief answers.
- Tell participants to complete the questions at the end of the unit.
- Ensure that every participant answers all the questions.

2.5.8. Summary

1. PDCA Cycle (Plan-Do-Check-Act)

The PDCA Cycle (Plan-Do-Check-Act) serves as a structured method for enhancing safety management.

- Plan: Recognize safety concerns, establish goals, and create a strategic action plan.
- Do: Execute the safety measures and initiatives as outlined in the plan within the workplace.
- Check: Evaluate the effectiveness of the implemented actions and review overall performance.
- Act: Implement corrective measures to enhance safety protocols and standardize effective practices.

Grasping and utilizing the PDCA cycle is essential for fostering ongoing improvements in safety.

2. Training and Competence at the Workplace:

Induction Training: Introduces new employees to safety policies, procedures, hazard identification, and emergency response protocols.

Toolbox Talk: Short, focused safety discussions that reinforce specific safety topics to employees on the job.

Competence at the workplace refers to skills, knowledge, and abilities needed to perform tasks efficiently, contributing to organizational success

3. Gas Testing:

Learning how to use gas testing equipment (LEL sensor, O2 sensor, H2S sensor, CO sensor) is crucial in workplaces where hazardous gases may be present.

- LEL Sensor: Detects lower explosive limits to prevent fire or explosions.
- O2 Sensor: Measures oxygen levels to ensure sufficient oxygen is available for safe work conditions.
- H2S Sensor: Detects hydrogen sulphide, a toxic gas.
- CO Sensor: Monitors carbon monoxide levels to prevent poisoning.

2.5.9. Exercise

1. What does the “Plan” stage in the PDCA cycle focus on?

- a) Implementation of safety measures
- b) Planning safety objectives and goals
- c) Monitoring the effectiveness of actions
- d) Revising and improving processes

2. What is the primary purpose of a “Toolbox talk”?

- a) To distribute safety gear
- b) To discuss job-specific hazards and safety measures
- c) To provide formal safety training

d) To conduct drills for emergency evacuation

3. In the Plan stage of the PDCA cycle, the focus is on identifying and analysing _____ related to workplace safety.

4. The Do stage in the PDCA cycle involves _____ the safety plan, which includes implementing necessary controls.

5. The PDCA cycle is an essential tool for continuously improving safety management systems.

6. The 'Do' stage of the PDCA cycle involves checking the effectiveness of the safety measures.

7. Toolbox talks are informal discussions aimed at increasing awareness of specific safety risks at the workplace.

8. Induction training is only required for new employees and not for existing employees

3. Unit 3 NOS 2: SSD/VSQ/N1302: Electrical Hazard Identification, Risk Assessment, and Hazard Control

3.1. Key Learning Outcomes

- Identify hazards & categories the electrical hazards.
- Implement hierarchy of control in risk assessment adopted electrical safety methodologies
- Identify residual or hidden risks in energized machines and powerlines.
- Analyse risks associated with electrical hazards & fires

3.2. Unit 3.1: Electrical Hazard

3.2.1. Unit Objectives

At the end of this unit, students will be able to:

- Grasp and define specific terms and expressions related to electric safety.
- Identify electrical hazards that include electrical shock, arc flash and fire hazards during maintenance activities.
- Understand the risk assessment methodology and apply it for evaluating electrical safety in various situations.
- Hierarchy of control refers to ranking electrical safety in terms of elimination, substitution, engineering controls, administrative controls, and personal protective equipment.

3.2.2. Resources

- Whiteboard, erasable marker, board cleaner, projection screen, laptop, speaker, notebook, pen, participant handbook, etc
- Flip chart
- Participant Manual
- Projection screen and PowerPoint presentations.
- Activities (role plays)

3.2.3. Say

- Describe basic definitions of specific terms and expressions related to electric safety.
- Describe about electrical hazards that include electrical shock, arc flash and fire hazards during maintenance activities.
- Describe risk assessment methodology and apply it for evaluating electrical safety in various situations.
- Describe about Hierarchy of control

3.2.4. Explain

- Describe basic definitions of specific terms and expressions related to electric safety.
- Describe about electrical hazards that include electrical shock, arc flash and fire hazards during maintenance activities.
- Describe risk assessment methodology and apply it for evaluating electrical safety in various situations.
- Describe about Hierarchy of control

3.2.5. Activity

Distribute scenario cards to each group. Each card should describe a different electrical maintenance activity (e.g., inspecting circuits, repairing equipment, working with live wires).

Ask each group to read their scenario and:

Identify the electrical hazards involved.

Analyse the risks associated with the activity (e.g., shock, burns, fire).

Present their findings to the class.

Scenario Examples:

Scenario 1: A technician is working on a circuit board while it is still connected to a live power source.

Scenario 2: An electrician is using an old, frayed extension cord to power equipment.

Scenario 3: A worker is cleaning electrical panels with water near exposed wires.

Participant will be able to identify electrical hazards and assess the risks associated with common electrical maintenance tasks.

3.2.6. Notes for Facilitation

Summarize the important points and terms explained in the session.

- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer questions, as needed, providing concrete and brief answers.
- Tell participants to complete the questions at the end of the unit.
- Ensure that every participant answers all the questions

3.2.7. Summary

Identify Definitions in Electrical Safety:

One of the important things to be considered in electrical safety management is the fundamental concepts of electrical safety. It includes definitions of electrical hazard as a potential source of injury or damage, risk as the chance of harm being caused by an electrical hazard, and safety controls as measures for preventing or reducing risks associated with electrical hazards that must be well understood by electrical system users.

Discuss Electrical Hazard Categories and Risks Associated with Electrical Maintenance Operations:

Electrical hazards can be categorized into several types, including shock hazards (electric shock from direct or indirect contact with live components), arc flash (release of energy due to electrical faults), and fire hazards (caused by electrical malfunctions or overheating). Each category carries specific risks that need to be analysed carefully. Risks associated with electrical maintenance may include the fact that electrical activities are often done on live circuits, with defective equipment, or in dangerous settings. Risk assessment is therefore determined by considering the likelihood of such incidents occurring and the seriousness of their effects.

Explain Hierarchy of Control Significance to Electrical Safety Maintenance

Hierarchy of control refers to the elimination or minimizing exposure to the electric hazard through this system:

Elimination: Removing the hazard entirely, for example by de-energizing circuits.

Substitution: Replacing hazardous electrical systems or equipment with safer alternatives.

Engineering Controls: Physical safeguards that eliminate or control a hazard. Examples include insulation, circuit breakers.

Administrative Controls: Safe work procedures, training and regular inspections.

PPE: It refers to provision of safety gears for workers (for example, insulated gloves and helmets). In addition, a proper understanding of the hierarchy of control ensures that electrical hazards are handled properly and the worker is not at risk in case of electrical maintenance activities.

3.2.8. Exercise

1. Which of the following is NOT considered an electrical hazard?

- Electric shock
- Arc flash
- Heat stress

d) Fire caused by faulty wiring

2. Electrical hazards can lead to which of the following risks?

a) Fire and electrocution

b) Slips and falls

c) Chemical spills

d) Ergonomic injuries

3. Electrical hazards are only present when working with high-voltage systems. (T/F)

4. The hierarchy of controls starts with elimination, followed by substitution, engineering controls, administrative controls, and lastly PPE. (T/F)

5. Personal protective equipment (PPE) should always be the first option in the hierarchy of control to address electrical hazards. (T/F)

6. The _____ hazard arises when electrical current flows through a person's body, leading to serious injury or death.

7. The use of insulated tools and circuit breakers are examples of _____ controls in electrical safety.

3.3. Unit 3.2: Electrical Fires & Control

3.3.1. Unit Objectives

At the end of this unit, students will be able to:

- Learn the causes of electrical fires and how they start
- Learn control measures to prevent, contain, and extinguish electrical fires
- Learn the risks of electrical shock, burns, and mechanical injuries from tools and equipment
- Classify and assess the safety measures required when handling different electrical tools and machinery
- Learn how electrical hazards can compound with other workplace hazards
- Interpret safety strategies to mitigate multiple hazards at once in a workplace setting.

3.3.2. Resources

- Whiteboard, erasable marker, board cleaner, projection screen, laptop, speaker, notebook, pen, participant handbook, etc
- Flip chart
- Participant Manual
- Projection screen and PowerPoint presentations.
- Activities (role plays)

3.3.3. Say

- Describe about causes of electrical fires
- Describe about control measures to prevent, contain, and extinguish electrical fires
- Describe about risks of electrical shock, burns, and mechanical injuries from tools and equipment
- Describe about safety measures required when handling different electrical tools and machinery

3.3.4. Explain

- Describe about causes of electrical fires
- Describe about control measures to prevent, contain, and extinguish electrical fires
- Describe about risks of electrical shock, burns, and mechanical injuries from tools and equipment
- Describe about safety measures required when handling different electrical tools and machinery

3.3.5. Activity

Hand out a worksheet that lists common electrical tools, equipment, and machinery (e.g., circuit breakers, power tools, generators, electrical panels).

Ask participant to identify the potential hazards associated with each item, categorizing them into:

- Electrical shock hazards
- Fire hazards
- Mechanical hazards
- Overheating hazards

Participant should also identify control measures for each category (e.g., insulated tools for shock hazards, fire extinguishers for fire hazards).

3.3.6. Notes for Facilitation

- Summarize the important points and terms explained in the session.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer questions, as needed, providing concrete and brief answers.
- Tell participants to complete the questions at the end of the unit.
- Ensure that every participant answers all the questions

3.3.7. Summary

Electrical Fires Analysis and Controls

Electrical fires may be due to the wrong handling of electrical systems or components, lack of maintenance, and very old infrastructure. The control of these electrical fires must first identify all the potential risks then apply preventative measures including periodical check-ups, circuit breakers, and proper wiring insulation. Fire safety measures such as fire extinguishers (Class C for electrical fires), fire suppression systems, and emergency shutdown procedures must be available to minimize the impact of an electrical fire.

Hazard Categories Associated with Electrical Tools, Equipment, and Machinery

There are various types of hazards associated with electrical tools, equipment, and machinery, which include:

- **Electrical Shock Hazards:** Direct contact with live wires or faulty equipment.
- **Fire Hazards:** Overloading, short circuit, or an equipment malfunctioning.
- **Mechanical Hazard:** Moving electrical machinery parts causing physical injury to the person or persons.
- **Risk of overheating:** Electrical machines or equipment whose heat generation poses a risk for fire if not enough ventilation is obtained.

The important thing is realizing these hazards, using safety guidelines such as application of insulated tools for handling, a regular check in the maintenance program, and perfect grounding.

Interpret the Interaction of Electrical Hazards with Other Hazards

Electrical hazards typically coincide with many other workplace risks that make its management challenging. Examples include work at height that combines the fall risks of misplaced tools or incidental contact with the live cables alongside electrical equipment exposures at heights and confined spaces whereby the exposed wiring within the confine increases one's exposure to moisture, risking electrical fires and shocks.

Working in Excavations: Electrical hazards at excavations might be hurt underground cables, where electrocution or fire breakout is possible.

Lone Working: Workers performing their duties alone with electrical systems have time delays in reacting to accidents such as electrical fires or shock.

Slips & Trips: The presence of electrical cords or poor wiring can contribute to tripping and potential accidents at work locations.

3.3.8. Exercise

1. Which fire extinguisher class is suitable for electrical fires?

- Class A
- Class B
- Class C
- Class D

2. When working at height, what is a critical safety measure to prevent electrical hazards?

- Using insulated tools and equipment
- Wearing flame-resistant clothing
- Using automatic shutoff devices

d) Keeping the work area dry

3. Electrical fires are most effectively extinguished with water. (T/F)

4. One of the risks associated with electrical tools is the potential for electrical shock if the tools are not properly insulated. (T/F)

5. Class _____ fire extinguishers are designed for use on electrical fires.

6. When working in confined spaces, electrical hazards are compounded by the presence of _____ and _____ in the environment.

3.4. Unit 3.3: Understand reasons for electrical hazards leading to accidents

3.4.1. Unit Objectives

At the end of this unit, students will be able to:

- Understand and identify the various causes and contributing factors that lead to electrical hazards in a workplace setting
- Ability to identify and assess risks of electrical fires through the proper conduct of risk assessments
- Identify and appreciate the proper tooling and apparatus needed for proper handling of electrical systems

3.4.2. Resources

- Whiteboard, erasable marker, board cleaner, projection screen, laptop, speaker, notebook, pen, participant handbook, etc
- Flip chart
- Participant Manual
- Projection screen and PowerPoint presentations.
- Activities (role plays)

3.4.3. Say

- Describe about various causes and contributing factors that lead to electrical hazards in a workplace setting
- Describe about identify and assess risks of electrical fires through the proper conduct of risk assessments
- Describe about proper tooling and apparatus needed for proper handling of electrical systems

3.4.4. Explain

- Describe about various causes and contributing factors that lead to electrical hazards in a workplace setting
- Describe about identify and assess risks of electrical fires through the proper conduct of risk assessments
- Describe about proper tooling and apparatus needed for proper handling of electrical systems

3.4.5. Activity

- Provide each group with a scenario card that describes a specific electrical environment (e.g., a kitchen with faulty appliances, a workplace with overloaded circuits).
- Groups must carry out a risk assessment using the provided template. They need to identify potential electrical fire risks and propose preventative measures.
- Each group presents their findings to the class, discussing the identified risks and the proposed solutions.
- After the presentations, facilitate a class discussion on how these fire risks can be minimized through proper inspection, maintenance, and safety protocols.
- Participant will be evaluated based on their ability to identify electrical fire risks and recommend appropriate safety measures.

3.4.6. Notes for Facilitation

- Summarize the important points and terms explained in the session.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer questions, as needed, providing concrete and brief answers.
- Tell participants to complete the questions at the end of the unit.
- Ensure that every participant answers all the questions

3.4.7. Summary

Identify causes and reasons leading to electrical hazards

Summary Electrical hazard conditions or circumstances exist in a given condition that would potentially damage a human health and safety environment due to improper wiring, maintenance, or installations as well as overload in circuitry. Moreover, moisture, dust, or even high temperature, may become causes for the development of an electrical hazard. Some common electrical hazards are wires exposed to naked, damaged insulation, and faulty equipment, with resulting electric shocks, burns, electrocution, or fire. These causes must therefore be identified in time with appropriate measures to be put in place to minimize the chance of accidents.

Carry out risk assessment to identify risks associated with electrical fires

Summary: Electrical fires are a safety hazard in environments that use electrical systems and equipment. The risks posed by electrical fires include the combustion of flammable materials due to faulty wiring, overloaded circuits, malfunctioning electrical appliances, or equipment failure. A risk assessment is defined as the process of identifying the potential hazards and evaluating the chances of fire occurrence and the risks' severity. The condition of electrical wiring, the presence of fire extinguishers, and the proper grounding of electrical systems are factors to consider during a risk assessment. Regular risk assessments prevent electrical fires by ensuring that safety standards are met and that necessary precautions are taken to minimize risks.

Recognize tools & equipment for handling electrical systems.

Summary: To safely handle electrical systems, it is essential to recognize and use the correct tools and equipment. Electrical work requires specialized tools designed to ensure safety, accuracy, and efficiency. Common tools include insulated pliers, wire cutters, multimeters for testing voltage and current, and circuit testers to check for continuity. PPE, which includes rubber gloves, insulating mats, and safety goggles, is also necessary to protect the workers from electrical hazards. Selection and use of tools are critical in preventing accidents, improving work efficiency, and ensuring that electrical installations or repairs are made safely. It is, therefore, very important to know the specific function of each tool and use them according to their intended purpose.

3.4.8. Exercise

1. What is a common cause of electrical hazards?

- Faulty wiring
- Proper grounding
- Regular inspection
- Use of safety equipment

2. Electrical hazards may include _____, which can result from damaged equipment or exposed wires.

3. Which of the following is a key factor in assessing the risk of electrical fires?

- The colour of the wires
- The age of the electrical equipment

- c) The presence of fire extinguishers and safety systems
 - d) The size of the electrical system
4. A proper risk assessment for electrical fires includes checking the wiring for damage or wear.(T/F)
5. Which of the following tools is commonly used to test electrical circuits for continuity?
- a) Wire stripper
 - b) Multi meter
 - c) Insulated pliers
 - d) Screwdriver
6. ____ tools are used in electrical work to ensure that workers do not come into contact with live electrical parts.

4. Unit 4 NOS 3: SSD/VSQ/N1303: Electrical Machines & Power Systems

4.1. Key Learning Outcomes

- Identify the underlying electrical hazard in electrical machinery.
- Protect workforce from accidents.
- Learn best practices in electrical safety.
- Identify the underlying electrical hazard in electrical power system.

4.2. Unit 4.1 Electricity & effects on human body

4.2.1. Unit Objectives

At the end of this unit, students will be able to:

- Understand and identify the basic terminologies and concepts used in electrical engineering
- Understanding the differences between Alternating Current (AC) and Direct Current (DC)
- Understand and analyse the physiological effects of electricity on the human body.

4.2.2. Resources

- Whiteboard, erasable marker, board cleaner, projection screen, laptop, speaker, notebook, pen, participant handbook, etc
- Flip chart
- Participant Manual
- Projection screen and PowerPoint presentations.
- Activities (role plays)

4.2.3. Say

- Describe about basic terminologies and concepts used in electrical engineering
- Describe about Alternating Current (AC) and Direct Current (DC)
- Describe about physiological effects of electricity on the human body

4.2.4. Explain

- Describe about basic terminologies and concepts used in electrical engineering
- Describe about Alternating Current (AC) and Direct Current (DC)
- Describe about physiological effects of electricity on the human body

4.2.5. Activity

- Divide the class into small groups and give each group a set of flashcards with electrical terms and their corresponding definitions (mixed up).
- Each group must match the correct definition to the corresponding electrical term within a given time.
- After the activity, have each group present their matched terms and explain their understanding of each one.
- Use the whiteboard to clarify any misunderstandings and provide additional examples or explanations where necessary.
- Evaluate the students based on their ability to correctly identify and explain the electrical terms.

4.2.6. Notes for Facilitation

- Summarize the important points and terms explained in the session.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer questions, as needed, providing concrete and brief answers.
- Tell participants to complete the questions at the end of the unit.
- Ensure that every participant answers all the questions

4.2.7. Summary

Basic Terminologies in Electrical Engineering

In electrical engineering, the understanding of basic terminologies is a prerequisite to working effectively with electrical systems. The basic terms are current, which is the flow of electrical charge; voltage, the

potential difference that drives current; resistance, the opposition to current flow; power, the rate at which energy is consumed or generated; and circuit, a path through which current flows. The knowledge of the above terms should be well in the mind of every electrical person because it helps form a platform to solve any electrical problem from analysis. Perfect knowledge of these principles brings successful implementation of the said concepts in design, effective solving of problems and safety of any electrical system.

Differentiate Alternating Current and Direct Current

Alternating Current

Direct Current. AC has characteristics of a current that reverses direction periodically with a tendency that makes it better suited for wide distances as far as the transportation of power due to easy transformability into many different voltages. DC, however, is in a single direction; it is more commonly used in applications with low voltage such as batteries and electronic devices. The difference between AC and DC has to be understood in order to use the correct type of current for various electrical systems so that it is applied safely, efficiently, and functions well in any type of application.

Analyse the physiological effects of electricity on the human body

Electricity can cause serious physiological effects on the human body, depending on the factors of current magnitude, voltage, exposure duration, and the path of current flow. Even a small current can cause electrical shock, burns, and muscle contractions. Larger currents will cause more extreme effects, like heart arrhythmia, respiratory failure, or even death. The importance of understanding these effects is critical in ensuring electrical safety. This helps to identify hazards and implement measures of protection. The proper use of insulation, grounding, and the use of personal protective equipment can help to minimize the risk of electrical injury while ensuring a safe working condition about electrical systems.

4.2.8. Exercise

1. What is the main focus of an effluent treatment plant (ETP)?
 - A) Solid waste recycling
 - B) Purification of air
 - C) Treating wastewater before disposal
 - D) Managing hazardous chemicals
2. _____ pollution is caused by excessive emissions from vehicles, factories, and industrial activities that degrade air quality.
3. The process of _____ involves treating wastewater to remove contaminants before it is released into the environment.
4. True or False: Noise pollution primarily results from industrial activities and loud machinery, and can lead to hearing loss and stress.
5. True or False: The primary goal of the Environment Protection Act of 1986 is to promote industrial growth without considering environmental impacts.
6. True or False: The Central Pollution Control Board (CPCB) and State Pollution Control Boards (SPCB) are responsible for implementing and enforcing environmental regulations in India.

4.3. Unit 4.2 Electrical Conductor & Insulators

4.3.1. Unit Objectives

At the end of this unit, students will be able to:

- Understand the fundamental roles of electric conductors and insulators in electrical circuits
- Gain the ability to analyse and assess the wiring requirements specific to industrial environments
- Understand and interpret the principles of electrical induction and the importance of safety clearance in electrical installations.
- Analyse the principles of double insulation and how it is applied in electrical devices to enhance safety

4.3.2. Resources

- Whiteboard, erasable marker, board cleaner, projection screen, laptop, speaker, notebook, pen, participant handbook, etc
- Flip chart

- Participant Manual
- Projection screen and PowerPoint presentations.
- Activities (role plays)

4.3.3. Say

- Describe about fundamental roles of electric conductors and insulators in electrical circuits.
- Describe about ability to analyse and assess the wiring requirements specific to industrial environments
- Describe about principles of electrical induction and the importance of safety clearance in electrical installations.
- Describe about principles of double insulation and how it is applied in electrical devices

4.3.4. Explain

- Describe about fundamental roles of electric conductors and insulators in electrical circuits.
- Describe about ability to analyse and assess the wiring requirements specific to industrial environments
- Describe about principles of electrical induction and the importance of safety clearance in electrical installations.
- Describe about principles of double insulation and how it is applied in electrical devices

4.3.5. Activity

- Set up a simple circuit with a battery, light bulb, and wire. Explain how the circuit works when using a conductor (e.g., copper wire).
- Divide the participant into small groups and give them a selection of materials. Ask each group to test whether each material conducts electricity by connecting it to the circuit (using a multi meter or observing if the light bulb turns on).
- After testing all materials, have the students categorize the materials as conductors or insulators. Discuss the results, explaining why some materials allowed the current to flow while others did not.
- Emphasize how understanding the roles of conductors and insulators is vital in electrical systems to ensure proper functionality and safety.
- Evaluate students based on their ability to correctly identify materials as conductors or insulators and explain why each material behaves the way it does.

4.3.6. Notes for Facilitation

- Summarize the important points and terms explained in the session.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer questions, as needed, providing concrete and brief answers.
- Tell participants to complete the questions at the end of the unit.
- Ensure that every participant answers all the questions

4.3.7. Summary

Electric Conductors and Insulators: Importance and Function

- Electric conductors and insulators are basic materials in electrical engineering. They play crucial roles in the design, operation, and safety of electrical systems. They are necessary for anyone dealing with electrical circuits, devices, and power systems.
- Electric Conductors- Materials through which electric current easily passes with slight resistance. It is commonly provided by metals -copper and aluminium. Those materials contain moving free electrons through the structure and allow current motion. Copper in wiring because its excellent conductivity aluminium is often preferable in lines for transmission line because it saves weight and becomes less costly to produce.
- Insulators are materials that resist the flow of electric current. They are useful in preventing accidental electric shocks to electrical components and users. The insulating materials include rubber, plastic, glass, and ceramic. These are used for casing wires, cables, and other electrical equipment so that the path for the current's flow is not unintentional and therefore both the users and the equipment are saved. The roles

of conductors and insulators are complementary. Conduction allows the passage of current; insulation prevents safety through electrical leakage and accidental touch with live wires.

- Conductors are either copper or aluminium, while insulation is made up of plastic or rubber. Such a combination assures effective operation without compromising safety factors in electrical systems.

Analysis of Wiring Requirements in Industries

- Wiring requirements are the most important factors for ensuring safety and efficiency in electrical systems in industries. Industrial settings are characterized by large-scale operations with heavy machinery, control systems, lighting, and safety equipment, which require specific wiring solutions. Analysing and designing wiring systems in such environments ensures compliance with industry standards, safety regulations, and the ability to handle high electrical loads.
- Wiring in industrial applications is customized to match the power requirements of the equipment being used, and also to reduce the risk of electrical hazards. The correct wire gauge based on load calculations must be understood. The gauge refers to the thickness of the wire, and the correct gauge must be selected to prevent overheating and possible fire hazards. If the wire is too thin, it may overheat due to excessive current flow, while a wire that is too thick can be inefficient and unnecessarily costly.
- The choice of material is another important consideration. Copper and aluminium are commonly used materials in industrial wiring. Copper is preferred for its high conductivity and reliability, while aluminium is often used for long-distance power transmission due to its lightweight and cost-effective properties.
- Safety in industrial wiring is always on top of the list. Faulty or improper wiring can result in short circuits, overheating, fire, or electrocution. All these can be minimized through appropriate grounding, insulation, and circuit protection. Devices such as circuit breakers, fuses, and ground fault circuit interrupters (GFCIs) are used for protecting electrical systems from faults and overloads.
- National and international standards in wiring within industries must adhere to the National Electrical Code (NEC) and International Electrotechnical Commission (IEC) standards. These codes state the detailed specifications for conduit installation, wire sizing, and safety clearances in electrical systems so that the efficiency of the system is achieved without electrical hazards..
- **Electric Conductors and Insulators: Understanding Their Importance**
- Electric conductors and insulators are the most basic components in electrical engineering. They play very important roles in the design, operation, and safety of electrical systems. Understanding these materials and their functions is essential for anyone involved in electrical circuits, devices, and power systems.
- Electric Conductors are materials that let electrical current pass through with minimal resistance. The most common conductors are metals like copper and aluminium. These materials have free-moving electrons within their structure, which facilitates the flow of current. Copper is generally used for wiring due to its excellent conductivity. Aluminium is usually preferred for power transmission lines due to its lower weight and reduced cost.
- Insulators are material that opposes or resists electric current flow. Conductors are absolutely necessary for guarding electrical components, as well as users, against accidental electric shock. Insulators such as rubber, plastic, glass, and ceramic are often used to envelop wires, cables, and electrical apparatus to prevent them from flowing through unexpected paths and then protecting both users and the apparatus. The job of conductors and insulators are complementary. Conductors allow the flow of current, while insulators ensure safety by preventing electrical leakage and accidental contact with live wires.

Electrical Induction Interpreted Safety Clearance Concept

Electrical induction is a phenomenon wherein a change in the magnetic or electric field of one conductor causes a current or voltage in the nearby conductor. This principle plays a crucial role in the functionality of devices like transformers, motors, and generators. For instance, in a transformer, electrical induction is employed to increase or decrease the level of voltage within a circuit.

There are two major types of electrical induction:

- **Magnetic Induction:** A changing magnetic field induces a voltage in a conductor. This is the principle behind devices like transformers.
- **Electrostatic Induction:** A charge in one conductor induces a voltage in a nearby conductor. This often occurs in high-voltage environments or circuits.

Electric induction also finds its application in the design of motors and electromagnetic devices, wherein electrical energy converts into mechanical energy (or vice versa).

This concept is the minimum distance between electrical conductors or equipment that prevents arcing, electrical interference, and accidental contact. Safety clearance plays a crucial role in reducing electrical hazards, mainly in systems in which electrical induction occurs. An example of safety clearance is within high-voltage transmission lines, which ensures that an induced current from nearby conductive materials, like metal structures, does not lead to electrocution or destruction.

Double Insulation Principles and Their Applications

Double insulation is a safety principle meant to safeguard the user against electric shock. While systems dependent on grounding for safety, double insulation relies on two layers of insulating material that prevent the contact of the live electrical component with the human body. This design is mostly applied in handheld power tools and appliances where grounding is not possible or practicable.

The principle of double insulation is divided into two layers of insulation:

- The first layer consists of a thick layer of insulation so that there cannot be a physical contact between the electric components and living wires.
- The second layer again isolates the electric components from the user, hence in case that the first one fails the other one works because it was protected.

Handheld appliances such as electric drills, power saws, hairdryers, and toasters are applications of double insulation. Such devices are commonly used in environments where grounding is not possible or becomes difficult. Such locations include construction sites or wet areas. Users will be safe when double insulation is applied since internal wiring will expose or become damaged.

The International Electrotechnical Commission (IEC) standards have set norms on the basic selection of double-insulated devices material, how they should have been insulated-thick, as well as specific requirements for a certain construction. End. Double insulation is crucial for use in damp or wet environments where electrical safety is of top priority.

4.3.8. Exercise

1. Which of the following is an example of an electric conductor?
 - a) Rubber
 - b) Plastic
 - c) Copper
 - d) Wood
2. Copper is used as an insulator because it has high resistance to electrical current.(T/F)
3. The primary role of an insulator is to prevent _____ from flowing through electrical equipment.
4. What device is commonly used in industrial wiring to protect circuits from overloads?
 - a) Capacitor
 - b) Fuse
 - c) Transformer
 - d) Inductor

5. Which of the following is a result of improper safety clearance in electrical systems?
 - a) Reduced electrical efficiency
 - b) Risk of electrical arcing or short circuits
 - c) Increased power output
 - d) Reduced current flow
6. Safety clearance ensures the minimum distance between electrical conductors and _____ materials to avoid risks like electrocution.
7. Double insulation is used to ensure that electrical devices can operate without grounding(T/F)

4.4. Unit 4.3 Electrical load & losses

4.4.1. Unit Objectives

At the end of this unit, students will be able to:

- It would allow the students to recognize overloads and short circuits on a power line through their causes, characteristics, and indicators.
- Understand protection mechanisms used in power lines to safeguard against overloads and short circuits, focusing on protective devices
- Understand the operation and principles of different electrical machinery, such as motors (single-phase, three-phase, DC, synchronous, and servo motors), generators (DC and AC), and transformers (step-up, step-down, and instrument transformers)..
- Understand losses on AC and DC transmission lines with reference to resistance, reactance, impedance, and the causes of such energy loss.
- Understand methods to reduce losses and how to maximize an electric system's efficiency will be explored.

4.4.2. Resources

- Whiteboard, erasable marker, board cleaner, projection screen, laptop, speaker, notebook, pen, participant handbook, etc
- Flip chart
- Participant Manual
- Projection screen and PowerPoint presentations.
- Activities (role plays)

4.4.3. Say

- Describe about overloads and short circuits on a power line through their causes, characteristics, and indicators.
- Describe about protection mechanisms used in power lines
- Describe about operation and principles of different electrical machinery
- Describe about losses on AC and DC transmission lines and methods to reduce losses

4.4.4. Explain

- Describe about overloads and short circuits on a power line through their causes, characteristics, and indicators.
- Describe about protection mechanisms used in power lines
- Describe about operation and principles of different electrical machinery
- Describe about losses on AC and DC transmission lines and methods to reduce losses

4.4.5. Activity

- Divide the class into small groups and provide each group with a set of diagrams representing electrical power lines with different fault scenarios (overload, short circuit, normal operation).

- Ask each group to analyse the scenarios, identify the type of fault (overload or short circuit), and explain how these faults can occur in a power line.
- After the analysis, have the groups present their findings to the class, discussing the impact of each fault on the electrical system.
- Conclude with a class discussion on the safety measures and possible consequences of overloads and short circuits in power lines.

4.4.6. Notes for Facilitation

- Summarize the important points and terms explained in the session.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer questions, as needed, providing concrete and brief answers.
- Tell participants to complete the questions at the end of the unit.
- Ensure that every participant answers all the questions

4.4.7. Summary

Detect Overload and Short Circuit in Power Lines

Overloads and short circuits are very common electrical faults in power lines. An overload is when a circuit or power line carries more current than the circuit can handle, due to excessive demands on the system. Short circuits are a result of an unintended path for current, which is typically between live and ground wires; this results in over flow, which causes either fires or destroys equipment. To ensure the integrity as well as security of the system, such faults must be found. Typical signs of overloads include tripped circuit breakers or blown fuses. Short circuits typically indicate by the presence of sparks, smells, or complete loss of equipment operation. Understanding these causes and indicators prevents disastrous damage to the power lines as well as corresponding electrical systems.

Overload and Short Circuit Protection in Power Lines

Protections gadgets in power lines that can have prevented the loss due to overload and short circuit include: Primary components used to protect electrical system are fuses, circuit breakers, and relays. A fuse is an insurance device which melts up if the current becomes more than a certain value to break the circuit. However, when a circuit breaks either because of an overload or short circuit, it is reset once the problem concerned has been tackled. Relays track the electrical parameters of the system. If any abnormality develops, then the circuit gets tripped. Such equipment is crucial in order to save power lines from hazardous situations that could be caused by electrical fires, equipment damage, or downtime. Knowledge about how such protective mechanisms work would ensure reliability and safety in an electrical system.

Analyse Operation of Electrical Machinery

The operation of any electrical machinery becomes fundamental for knowledge of the energy transformation of the electrical energy applied through different kinds of applications. This is the process of changing electrical energy to mechanical motion by single-phase and three-phase Induction motors; however, three phases provide more efficiency for industrial use. Direct current motors and generators deliver a dc directly, thus applied in applications for smooth working and controlled variable speed. The ac generators provide an alternating current and are extensively used in power plants in which electricity needs to be sent a long distance. Synchronous motors are used with constant speed, and servo motors are used for precision control in robotics and automated systems. The step-up transformer increases the voltage level for efficient transmission over a long distance, while the step-down transformer reduces the voltage level for safe consumption. Instrument transformers monitor parameters of electric values to ensure very precise monitoring and protection of the system. Understanding how these machines function and how they find practical application in life is absolutely necessary for any person connected with electrical engineering. Instrument Transformers are part and parcel of modern power electrical systems.

Transmission Losses of AC and DC power lines should be identified

Transmission losses represent the loss of electrical energy as it travels over power lines, and understanding these losses will help improve efficiency of systems. In both AC and DC power lines, losses occur due to resistance, reactance, and impedance. Resistive losses are caused by the inherent resistance of the transmission lines, which results in energy being dissipated as heat. The reactance in AC lines is due to the inductance and capacitance of the power lines, which causes loss in power and voltage drop. To combine them, the resultant impedance is simply the combination of resistance and reactance. The efficiencies of the two systems are significantly reduced due to this. Even though in case of DC it suffers mainly through losses caused due to resistance only, in AC its sufferings double due to causes caused by the reactance part. Loss reduction in transmission, therefore, takes utmost importance towards the improvement in power delivery. To reduce losses, higher transmission voltages, larger conductors, or optimization of power factor are used.

4.4.8. Exercise

- Which of the following is a common indication of an overload in a power line?
 - Blown fuse or tripped circuit breaker
 - Sparkling wires
 - Voltage drops
 - Short-circuit damage
- What is the primary function of a circuit breaker in power lines?
 - To increase current
 - To interrupt the flow of current in case of overload or short circuit
 - To measure voltage
 - To store energy for later use
- Which of the following motors is commonly used in residential appliances like fans and air conditioners?
 - Single-phase induction motor
 - Three-phase induction motor
 - DC motor
 - Synchronous motor
- A _____ transformer is used to reduce the voltage for safe use in homes and buildings.
- Which of the following contributes most to transmission losses in AC power lines?
 - Voltage drops
 - Impedance
 - Inductive reactance
 - All of the above

5. Unit 5 NOS 4: SSD/VSQ/N1304: Electrical Switchgear and Protective Devices

5.1. Key Learning Outcomes

- Identify electrical switchgears, fuses, circuit breakers and protective devices for protection.
- Identify & learn Protective devices to protect workforce from accidents.
- Learn best practices in electrical safety, switch gears for human life protection.

5.2. Unit 5.1 : Electrical Power System

5.2.1. Unit Objectives

At the end of this unit, students will be able to:

- Identify the electrical power systems
- Understand how electricity is generated, transmitted, and distributed.

- Understand about harmonics, how they affect power lines and equipment, and how their effects can be mitigated to ensure efficient transmission of power.
- Understand how electrical current follows the path of least resistance in a circuit, applying Ohm's Law and analysing how circuit elements affect current flow and minimize energy loss.

5.2.2. Resources

- Whiteboard, erasable marker, board cleaner, projection screen, laptop, speaker, notebook, pen, participant handbook, etc
- Flip chart
- Participant Manual
- Projection screen and PowerPoint presentations.
- Activities (role plays)

5.2.3. Say

- Describe about electrical power systems
- Describe about how electricity is generated, transmitted, and distributed
- Describe about harmonics, how they affect power lines and equipment
- Describe about how electrical current follows the path of least resistance in a circuit

5.2.4. Explain

- Describe about electrical power systems
- Describe about how electricity is generated, transmitted, and distributed
- Describe about harmonics, how they affect power lines and equipment
- Describe about how electrical current follows the path of least resistance in a circuit

5.2.5. Activity

- Divide participant into small groups. Provide each group with a diagram showing components of a power system. Ask them to label and explain each part (generation, transmission lines, substations, distribution networks).
- Have groups present their diagrams to the class, explaining how electricity flows through each stage of the power system.
- Summarize the key elements of each power system and discuss their roles in providing electricity.

5.2.6. Notes for Facilitation

- Summarize the important points and terms explained in the session.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer questions, as needed, providing concrete and brief answers.
- Tell participants to complete the questions at the end of the unit.
- Ensure that every participant answers all the questions

5.2.7. Summary

Power Generation Systems

- **Thermal Power Plants:** Fossil fuels such as coal, natural gas, or oil are burnt in these plants to boil water, turning the water into steam that drives attached turbines connected to generators. Among the types of thermal power plants, the coal-fired plant is most common, but natural gas-based plants are on the rise owing to their increased efficiency and low emissions.
- **Hydroelectric Power Plants:** Hydroelectric power plants are those plants which generate electricity through the energy of flowing water. Dams are constructed to store water, and when released, the water flows through turbines and generates electricity.
- **Nuclear Power Plants:** In nuclear power plants, nuclear reactions-fission generate heat, which in turn is used to produce steam that drives the turbines and finally generates electricity. Nuclear power is very efficient but raises questions about safety, waste disposal, and radioactive materials.

- **Renewable Energy Resources:** Solar and wind power is increasingly being applied to generate electricity. Solar and wind energy directly convert sunlight or wind into kinetic energy. Electricity is generated due to the production of steam which drives turbines in geothermal power plants with heat from earth's interior.
- **Transmission Systems:** Transmission lines are overhead lines or underground cables that carry electricity from power stations to substations. Transmission lines are usually made of aluminium or copper to reduce resistance and loss of power.
- **Substations:** A substation is a facility in which the voltage is reduced to a level suitable for local distribution. Transformers are used to reduce the high voltage at such places to lower levels (33kV or 11kV), thus making it safe for distribution to homes and industries.
- **Transformers:** They are crucial parts of both transmission and distribution systems. The voltage is increased to higher levels to transmit the energy over long distances and decreased to safer levels for local distribution.
- **Switchgear:** These devices control and protect the transmission network, isolate faulty sections of the network, and prevent damage to equipment.
- **Distribution Lines:** These lines carry electricity from substations to homes, businesses, and other end-users. They are typically low-voltage lines that can be either underground or overhead, depending on the area.
- **Transformers:** At the distribution level, transformers further reduce the voltage to the standard level used by consumers (e.g., 120V or 240V in residential areas).
- **Meters:** These devices measure the amount of electricity consumed by a particular household or business. Consumers are billed based on their usage.
- **Switches and Fuses:** These devices ensure the safety of the distribution system by preventing overloads and short circuits.

Applying the Concept of Harmonics in Power Lines

Sources of Harmonics

Harmonics are primarily produced by nonlinear loads, which draw current in a non-sinusoidal manner. Some common sources of harmonics are:

Power Electronic Devices: Equipment like rectifiers, inverters, and variable speed drives (VSDs) produce harmonics because they convert alternating current (AC) to direct current (DC) and vice versa. Devices like computers, printers, and LED lights also contribute to harmonic distortion due to their internal switching mechanisms.

Inductive Loads: Some electrical equipment, like motors and transformers, also generate harmonic currents, especially if they are not very efficient or are designed poorly.

Arc Furnaces: In industries where electric arc furnaces are used for metal processing, there is usually a significant amount of harmonic distortion due to the erratic current drawn by the furnace.

Impact of Harmonics

Harmonics can cause several adverse effects on the power system:

Overheating: Harmonics cause additional heating in electrical equipment, such as transformers, cables, and motors, which can reduce their lifespan and efficiency.

Equipment Damage: Sensitive equipment like computers, communication devices, and medical equipment can malfunction or be damaged due to harmonic distortion.

Reduced Power Quality: The presence of harmonics can reduce the overall quality of electrical power, leading to voltage distortion, flickering lights, and interference with communication lines.

Increased Losses: Harmonics increase the losses in transmission and distribution systems, thus requiring more power to be generated to meet demand.

Mitigation of Harmonics

There are various methods used to mitigate the effects of harmonics in power systems:

Filters: Passive or active harmonic filters can be installed in the system to remove or reduce the harmonic components in the electrical signals.

Transformers: Special transformers can be used to reduce the harmonic content by isolating non-linear loads from the rest of the power system.

Load Management: By controlling the operation of non-linear loads and ensuring they are distributed across the network, the generation of harmonics can be minimized.

Power factor correction in a small number of circumstances, this process can even serve to reduce the amount of harmonic distortion, but often only in the most significant nonlinear-load systems.

Analysing the Path of Least Resistance in Electric Circuits

$$I=V/R$$

Understanding Resistance in Circuits

The material properties of the conductors, the length of the wires, and the cross-sectional area of the conductors cause resistance in a circuit. Resistance of a path is higher, meaning less current will pass through. Conversely, more current flows through a path that has very low resistance. This particularly applies to circuit design where engineers want to ensure the current flows through the desired path with minimum loss of energy and safety.

Practical Implications

Parallel Circuits: In a parallel circuit, multiple paths are available for current to flow. The current divides across the paths based on their respective resistances. The path with the lowest resistance will carry the most current, while the other paths will carry less.

Series Circuits: In a series circuit, the current is the same throughout the circuit, but the voltage drops depend on the resistance of each component. The more resistance in the circuit, the less voltage available to other components.

Design of Efficient Circuits: The resistance in circuits must be such that current is flowing through with minimal heating and energy losses. Suitable wire sizing, selection of suitable resistive elements, and proper use of materials that have low resistances (such as copper) are very much required.

Energy Losses and Efficiency

The dissipation of energy is in the form of heat when current flows through resistive components. Energy loss due to resistance is proportional to the square of the current and the resistance of the path, as expressed by the formula:

$$P=I^2R$$

This implies that reducing the resistance in a circuit or optimizing the path of least resistance helps in minimizing energy losses, improving the overall efficiency of the system.

5.2.8. Exercise

1. Which of the following is a primary component of a power generation system?

- a) Circuit breakers
- b) Transformers

c) Generators

d) Meters

2. Which of the following devices is used to step down voltage in a power distribution system?

a) Circuit breaker

b) Transformer

c) Meter

d) Capacitor

3. Harmonic distortion can cause overheating of electrical equipment. (T/F)

4. In a parallel circuit, the current is the same through all components. (T/F)

5. Harmonics are generated by _____ loads, which cause distortion in the current waveform.

6. In a circuit, current follows the _____ of least resistance, where most of the current flows.

5.3. Unit 5.2 :Earth Pit & Protective Devices

5.3.1. Unit Objectives

At the end of this unit, students will be able to:

- Understand how to build and design an earth pit based on the standards of IS 3043 to ground the earth properly.
- Understand the contribution of earth pits towards electrical safety as well as installation and maintenance.
- Understand the static electricity cause, effect, and control techniques.
- Understand how these devices prevent damage from over current, short circuits, and faults.
- Understand role of electrical safety system
- Understand how they protect systems from faults and ensure safety along with best practices in electrical safety to prevent damage and ensure reliability.

5.3.2. Resources

- Whiteboard, erasable marker, board cleaner, projection screen, laptop, speaker, notebook, pen, participant handbook, etc
- Flip chart
- Participant Manual
- Projection screen and PowerPoint presentations.
- Activities (role plays)

5.3.3. Say

- Describe about how to build and design an earth pit based on the standards of IS 3043 to ground the earth properly.
- Describe about earth pits
- Describe about how electrical safety devices prevent damage from over current, short circuits, and faults
- Describe about how electrical current follows the path of least resistance in a circuit

- Describe about role of electrical safety system
- Describe how to protect systems from faults and ensure safety

5.3.4. Explain

- Describe about how to build and design an earth pit based on the standards of IS 3043 to ground the earth properly.
- Describe about earth pits
- Describe about how electrical safety devices prevent damage from over current, short circuits, and faults
- Describe about how electrical current follows the path of least resistance in a circuit
- Describe about role of electrical safety system
- Describe how to protect systems from faults and ensure safety

5.3.5. Activity

Assign each group a different safety device (e.g., lightning arrester, surge protector, relay, recloser) and ask them to research the device's working principle and applications in electrical safety.

Each group should prepare a short presentation explaining their assigned device, including where it is used in electrical systems and its role in protecting circuits.

5.3.6. Notes for Facilitation

- Summarize the important points and terms explained in the session.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer questions, as needed, providing concrete and brief answers.
- Tell participants to complete the questions at the end of the unit.
- Ensure that every participant answers all the questions

5.3.7. Summary

Earthing Pit as per IS 3043 and Static Electricity

Earthing Pit Construction (IS 3043):

The earthing pit is an important safety measure that provides a safe path for fault currents to flow into the ground. IS 3043 gives guidelines for the construction of a low-resistance earthing pit. Some of the major constituents are:

- **Earth Electrode:** Copper, galvanized iron, or stainless steel, this electrode connects the electrical system to earth. It must be installed at a depth that allows minimal resistance in soil conditions.
- **Earthing Conductor:** A copper or aluminium conductor connecting the earth electrode to the electrical system.
- **Earth Pit:** Dig a pit 1.5-3 meters deep depending on soil conditions. The depth, diameter, and electrode placement determine grounding effectiveness.
- **Soil Resistance:** The soil conditions determine the efficiency of the earthing pit. Salt and charcoal can be used to reduce the resistance in soil.
- **Static Electricity:** Static electricity occurs due to the accumulation of electric charges resulting from friction between materials. It can cause discharges that can destroy equipment or be hazardous to people.

Grounding systems, including earthing pits, are critical in the dissipation of static electricity, thereby reducing the risks of electrical shock, equipment damage, and fires.

Protective Devices for Circuits, Equipment, and Personnel

- **Circuit Breakers:** Circuit breakers automatically interrupt the flow of electricity when an overload or short circuit occurs, protecting circuits from damage. Types include:
 - **MCBs:** Used in residential/commercial settings.
 - **MCCBs:** Used in industrial applications for higher current.
 - **ACBs:** Applied in high voltage systems.
 - **Fuses:** Fuses disconnect the circuit when excessive current flows, protecting circuits by melting a metal wire inside. They are inexpensive and reliable but require replacement after use.
 - **Overload Relays:** These are used in conjunction with circuit breakers to safeguard equipment, for example, motors against sustained overloads that do not operate the circuit breaker.
 - **Interrupting Devices:** Air blast circuit breakers and oil circuit breakers interrupt the current immediately when faults occur to prevent damage from overcurrent or short circuits.
 - **Residual Current Circuit Breakers (RCCB):** RCCBs protect people from electric shocks by detecting leakage currents between live and neutral wires. They trip when leakage is detected, preventing harm.

Analysis of Lightning Arresters, Surge Protectors, Fuses, Relays, Circuit Breakers, Reclosers, and Electrical Safety Devices

Lightning Arresters: These devices protect electrical equipment from lightning strikes by providing a low-resistance path for the electrical energy to safely flow into the ground.

Surge Protectors: Surge protectors protect sensitive equipment from voltage spikes. They use parts such as varistors to absorb excess voltage during surges caused by lightning or power grid disturbances.

Relays: Relays are switches that detect faults such as overcurrent or under-voltage, and automatically activate protection devices (e.g., circuit breakers) to disconnect faulty circuits.

Circuit Breakers and Reclosers: Circuit breakers cut electrical circuits in faults, while reclosers restore service automatically when the fault is temporary, for example, when a tree branch falls.

Electrical Safety Devices & Best Practices:

Grounding: Safe passage of fault currents is ensured, and the possibility of shock and fire is minimized.

Routine Maintenance: Electrical equipment must be checked regularly and cleaned properly to ensure correct functioning.

Installation: The device should be installed according to guidelines and codes for safety.

Personal Protective Equipment (PPE): Workers should wear PPE such as rubber gloves and insulated tools to avoid electrical accidents.

Arc Flash Protection: The use of arc-resistant clothing and arc flash protection devices helps prevent arc flash incidents in electrical systems.

In a nutshell, earthing pits (as per IS 3043) and protective devices are integral to ensuring the safety and efficiency of electrical systems by preventing faults, minimizing risks, and protecting both equipment and personnel.

5.3.8. Exercise

1. What is the primary purpose of an earthing pit in an electrical system?

- a) To store electrical current
- b) To provide a safe path for fault currents to flow into the ground
- c) To enhance electrical resistance
- d) To increase voltage

2. According to IS 3043, what is the typical depth range of an earthing pit?

- a) 0.5m to 1m
- b) 1.5m to 3m
- c) 3m to 5m
- d) 5m to 7m

3. What is the function of a lightning arrester?

- a) To protect equipment from overcurrent
- b) To absorb electrical surges caused by lightning strikes
- c) To measure the voltage levels
- d) To store electrical energy

4. True or False: A fuse is a one-time use device that must be replaced after operation.

5. True or False: Lightning arresters are typically installed at the base of electrical equipment to prevent lightning strikes.

6. Static electricity results from the transfer of ____ from one material to another.

7. Surge protectors absorb excess voltage and divert it away from sensitive ____.

5.4. Unit 5.3: Electrical Arching & Hotspots

5.4.1. Unit Objectives

At the end of this unit, students will be able to:

- Understand and identify the possible dangers of electrical arcing, including their causes, effects, and safety risks.
- Understand how to conduct a resistivity test for determining the optimal placement of an earth pit.
- Understand how to perform Lockout/Tagout (LOTO) procedures on electrical busbar systems to ensure that workers are safe during maintenance.
- Understand how to use thermographic techniques in identifying electrical hotspots in electrical systems.

5.4.2. Resources

- Whiteboard, erasable marker, board cleaner, projection screen, laptop, speaker, notebook, pen, participant handbook, etc
- Flip chart
- Participant Manual
- Projection screen and PowerPoint presentations.
- Activities (role plays)

5.4.3. Say

- Describe about dangers of electrical arcing
- Describe about how to conduct a resistivity test for determining the optimal placement of an earth pit.
- Describe about how to perform Lockout/Tagout (LOTO) procedures on electrical busbar systems
- Describe about how to use thermographic techniques in identifying electrical hotspots in electrical systems

5.4.4. Explain

- Describe about dangers of electrical arcing
- Describe about how to conduct a resistivity test for determining the optimal placement of an earth pit.
- Describe about how to perform Lockout/Tagout (LOTO) procedures on electrical busbar systems
- Describe about how to use thermographic techniques in identifying electrical hotspots in electrical systems

5.4.5. Activity

Demonstrate the steps of performing a Lockout/Tagout procedure on a simulated electrical busbar system:

- Identify the power sources and switches that need to be locked out.
- Place locks and tags on each isolating device.
- Verify that the system is de-energized and cannot be accidentally re-energized.

Divide participant into pairs. Each pair will:

- Follow the LOTO procedure checklist to lock out and tag out the electrical busbar system.
- Verify the isolation by testing the system to ensure no electrical current is flowing.
- Discuss any challenges the students faced while performing the procedure.
- Review the importance of proper LOTO documentation and ensuring all team members are informed about the work to be done.
- Participant will be able to perform the LOTO procedure correctly, ensuring safe isolation of electrical systems for maintenance.

5.4.6. Notes for Facilitation

- Summarize the important points and terms explained in the session.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer questions, as needed, providing concrete and brief answers.
- Tell participants to complete the questions at the end of the unit.

- Ensure that every participant answers all the questions

5.4.7. Summary

Electrical Arcing Hazards and Their Boundaries

Electrical arcing is the jumping of electrical current between two conductive materials or gaps in a circuit. This can be caused by a short circuit, faulty connections, or insulation failure. The hazards associated with electrical arcing include fires, electrical shock, and damage to equipment. The risk is particularly high in high-voltage or high-current environments where arcing can cause extensive damage.

Hazard Boundaries:

In electrical systems, the arcs of hazards boundaries are identified and used to ensure protection of personnel and equipment. The boundaries have been divided into different zones.

Arc Flash Boundary: The distance at which an arc flash occurs, a worker could receive a second-degree burn.

Limited Approach Boundary: The distance within which a worker could come in contact with the exposed energized parts.

Limited Approach Boundary: The distance around the earth where workers can go only with correct protective gear.

Prohibited Approach Boundary: Distance where workers cannot go unaided unless with special types of protection measures.

Knowing these boundaries and having them recognized creates the ability for proper PPE to be utilized on the site. It also will keep workers from areas of exposure.

Earth Pit Placement Resistivity Test

The earth pit is the safe path for electrical currents when faults occur. Its effect on grounding depends on the resistivity of the soil in which it is embedded. Soil resistivity tests help determine the proper siting and design of an earth pit so that the resistance is low enough for grounding to be safe.

Soil Resistivity Test

This test measures the resistivity of the soil at various locations and depths. Resistivity may be affected by the composition of the soil, moisture content, and temperature. Proper treatment of the soil, such as adding salt or charcoal, may be necessary to decrease the resistivity and make the earth pit more effective. A well-installed earth pit minimizes the risk of electrical shock and protects equipment from electrical faults.

Lockout/Tagout Electrical Busbar System

Lockout/Tagout (LOTO) is an important safety measure that will be used in order to avoid electrical energization accidentally during any form of maintenance or repair. While performing electrical busbar system maintenance, employees are required to lock out and tag all forms of energy and ensure the de-energization of the system to prevent electrical shock and other accidents.

LOTO Procedure:

The LOTO procedure includes

- **Lockout:** Installation of locks on all energy isolating devices (circuit breakers, switches, etc.), so they cannot be switched on.

- **Tag:** Affix tags to identify the fact that a maintenance activity is in process and that the equipment should not be operated.
- **Verification:** System is tested to verify that it has been completely de-energized and isolated.

Proper LOTO procedures ensure the safety of workers through the elimination of electrical shock or accidental equipment operation during maintenance.

Detect Electrical Hotspots with Thermography

Electrical hotspots refer to those sections of an electrical system that tend to have high heat levels, primarily due to some form of electrical connection issues, overloading, or poor component functionality. This leads to breakdowns, potential fires, and inefficiency in electrical systems. Thermography can be an efficient diagnostic technique where the electric system does not necessarily need to be touched.

Thermographic Survey

Thermography uses infrared cameras or thermometers to detect temperature variations in electrical systems. Overheating components (such as circuit breakers, terminals, or busbars) often indicate underlying issues like poor connections or faulty equipment. Identifying these hotspots allows for timely maintenance, reducing the risk of fires, system failures, and equipment damage. Regular thermographic inspections are a proactive way to ensure the safety and reliability of electrical systems.

5.4.8. Exercise

1. What is the primary danger associated with electrical arcing?

- A) Overheating of the wires
- B) Electrical shock and fire hazards
- C) Power loss
- D) Voltage drops

2. Which of the following tools is used to identify electrical hotspots in a system?

- A) Multi meter
- B) Infrared thermography camera
- C) Insulation tester
- D) Volt meter

3. LOTO procedures are meant to prevent electrical accidents during equipment repairs by ensuring energy sources are properly isolated. (T/F)

4. Thermographic inspections can detect electrical hotspots that may indicate loose connections, overloaded circuits, or faulty equipment. (T/F)

5. To perform a resistivity test for earth pit placement, the soil's _____ must be measured to ensure that the grounding system will function properly.

6. The purpose of the LOTO procedure is to _____ the electrical power supply to the equipment during maintenance to ensure worker safety.

7. Electrical hotspots can be identified using _____ cameras, which detect temperature variations in electrical systems.

6. Unit 5 NOS : SSD/VSQ/N0109: Statutes & Legislative requirements in Health & Safety

6.1. Key Learning Outcomes

- Understand & comply with statutory regulation related to occupation safety, health, and environment of the worksite.
- Protect Worker Health and Safety: The primary goal is to minimize work-related accidents, injuries, and illnesses.
- Enhance Productivity: A safe and healthy workplace leads to increased productivity and reduced absenteeism.
- Comply with Legal Requirements: Adherence to OSH laws and regulations is mandatory to avoid penalties and legal consequences.
- Promote a Positive Work Culture: A strong OSH culture fosters employee morale, job satisfaction, and loyalty.

6.2. Statutes & Legislative requirements

6.2.1. Unit Objectives

At the end of this unit, students will be able to:

1. Key Provisions of the BOCW Act, 1996

- **Registration of Establishments:** All establishments engaged in building or other construction work must be registered with the appropriate government.
- **Wages and Benefits:** The Act mandates fair wages and provides for various benefits, including provident fund, gratuity, and insurance.
- **Working Hours:** It regulates working hours, including overtime pay and weekly rest days.
- **Safety, Health, and Welfare Measures:** The Act emphasizes the importance of safety, health, and welfare measures at construction sites, including provisions for first aid, drinking water, sanitation, and protective equipment.
- **Welfare Fund:** A welfare fund is established to provide benefits to construction workers, such as housing, education, and medical facilities.
- **Grievance Redressal:** The Act provides mechanisms for resolving grievances and disputes between employers and workers.

2. Understand & comply with Factories Act, 1948

Clause 6. Approval, Licensing and Registration of Factories

1. Requiring the previous permission in writing of the State Government or The Chief Inspector to be obtained for the site on which factory is to be situated and for the construction or extension of any factory or class or description of factories
2. Requiring for the purpose of considering applications for such permission the submission of plans and specifications:
3. Prescribing the nature of such plans and specifications and by whom they shall be certified

Clause 7A General Duties of the Occupier

1. Every occupier shall ensure, so far as is reasonably practicable, the health, safety and welfare of all workers while they are at works in the factory.
2. Without prejudice to the generality of the provisions of sub-section (1), the matters to which such duty extends, shall include –
 - a) The provision and maintenance of plant and systems of work in the factory that are safe and without risks to health

- b) The arrangements in the factory for ensuring safety and absence of risks to health in connection with the use, handling, storage and transport of articles and substances;
- c) The provision of such information, instruction, training and supervision as are necessary to ensure the health and safety of all workers at work;
- d) The maintenance of all places of work in the factory in a condition that is safe without risks to health and the provision and maintenance of such means of access to, and egress from, such places as are safe and without such risks;
- e) the provision, maintenance or monitoring of such working environment in the factory for the workers that is safe, without risks to health and adequate as regards facilities and arrangements for their welfare at work.

Clause 7B General Duties of Manufacturers

Every person who designs, manufactures, imports or supplies any article for use in any factory, shall

- a) ensure, so far as is reasonably practicable, that the article is so designed and constructed as to be safe and without risks to the health of the workers when properly used;
- b) Carry out or arrange for the carrying out of such tests and examination as may be considered necessary for the effective implementation of the provisions of clause (a)
- c) Take such steps as may be necessary to ensure that adequate information will be available –

I. in connection with the use of article in any factory.

II. about the use for which it is designed and tested; and about any condition necessary to ensure that the article, when put to such use, will be safe, and without risks to the health of workers.

3. Key Provisions of the OSH Code 2020:

- **Scope of Application:** The Code applies to a wide range of establishments, including factories, mines, plantations, shops, commercial establishments, and more.
- **Health and Safety Standards:** The Code mandates the establishment and maintenance of health and safety standards, including safe working practices, emergency procedures, and regular inspections.
- **Working Hours and Rest Periods:** It specifies maximum working hours, rest periods, and overtime regulations to prevent employee fatigue and promote work-life balance.
- **Welfare Facilities:** Employers are required to provide essential welfare facilities such as drinking water, first-aid, restrooms, and canteens.
- **Occupational Diseases:** The Code addresses occupational diseases and provides for compensation and rehabilitation measures for affected workers.
- **Safety Committees:** The formation of safety committees at the workplace is mandatory to promote safety awareness and incident prevention.
- **Inspection and Enforcement:** The Code empowers inspectors to conduct inspections, issue notices, and impose penalties for non-compliance.

4. <https://www.cheggindia.com/general-knowledge/environment-protection-act-1986/> Key Provisions of EPA 1986

- **Environmental Protection:** The Act grants the Central Government authority to take all necessary steps to protect and improve the environment.
- **Pollution Control:** It empowers the government to establish authorities to prevent and control pollution in all its forms.
- **Environmental Standards:** The Act sets standards for various pollutants to ensure safe levels in the environment.
- **Hazardous Substances:** It regulates the handling and disposal of hazardous substances.

- **Public Participation:** It encourages public participation in environmental protection efforts.
- **Penalties:** The Act prescribes penalties for violations of its provisions.

Other Relevant Regulations

Electricity Act 2010 & 2003

- **Purpose:** Consolidates laws related to electricity generation, transmission, distribution, trading, and use.
- **Key Provisions:**
 - Promotes competition in the electricity industry.
 - Protects consumer interests.
 - Ensures electricity supply to all areas.
 - Rationalizes electricity tariffs.
 - Promotes efficient and environmentally friendly practices.
 - Establishes regulatory bodies like the Central Electricity Authority and State Electricity Regulatory Commissions.

National Building Code (NBC) – 2016

- **Purpose:** Provides guidelines for building construction and safety.
- **Key Provisions:**
 - Sets standards for structural design, materials, and construction practices.
 - Includes provisions for fire safety, earthquake resistance, and accessibility.
 - Covers a wide range of building types, including residential, commercial, and industrial.

National Fire Protection Association (NFPA) Regulations

- **Purpose:** Offers detailed standards for fire safety.
- **Key Provisions:**
 - Covers fire prevention, detection, and suppression systems.
 - Provides guidelines for emergency response and evacuation procedures.
 - Includes standards for specific industries and hazards.

Petroleum & Explosive Safety Organization (PESO)-Explosive Act 1884

- **Purpose:** Regulates the handling and storage of explosives.
- **Key Provisions:**
 - Licenses the manufacture, import, export, transport, sale, purchase, and storage of explosives.
 - Sets safety standards for explosives handling and storage facilities.
 - Provides for the investigation of accidents involving explosives.

Gas Cylinders Rule 2016

- **Purpose:** Governs the safety of gas cylinders.
- **Key Provisions:**
 - Sets standards for the design, manufacture, testing, filling, transport, storage, and use of gas cylinders.
 - Requires periodic inspection and testing of gas cylinders.
 - Provides for the safe handling and disposal of gas cylinders.

The Boilers Act 1923

- **Purpose:** Regulates the operation and maintenance of boilers.

- **Key Provisions:**

- Requires the registration of boilers.
- Sets standards for the design, construction, installation, and operation of boilers.
- Provides for the inspection and testing of boilers.
- Requires the appointment of boiler attendants.

Workmen Compensation Act 1923 & Employee State Insurance Act 1948

- **Purpose:** Provides social security benefits to workers.

- **Key Provisions:**

- Provides compensation for work-related injuries and diseases.
- Provides medical benefits, disability benefits, and death benefits.
- Provides for maternity benefits and unemployment benefits.

Motor vehicle Act 1988

- **Purpose:** Regulates road safety and vehicle operations.

- **Key Provisions:**

- Sets standards for vehicle design, manufacture, and registration.
- Provides for the licensing of drivers.
- Sets speed limits and traffic rules.
- Provides for the punishment of traffic offenses.

First Aid at workplaces and training on first aid

- **Purpose:** Mandates first aid facilities and training for employees.

- **Key Provisions:**

- Requires employers to provide first aid facilities at the workplace.
- Requires employers to train employees in first aid.
- Provides for the appointment of first aid personnel.

Key Provisions of the Electricity Act, 2003

- Regulation and Monitoring
- Unbundling of Utilities
- Electricity Trading
- Renewable Energy Promotion
- Transmission and Distribution Infrastructure
- Consumer Protection
- Rural Electrification:
- Electricity Duty and Cross-Subsidization
- National Power Policy:
- Safety and Standardization
- Penalties for Offenses
- Energy Conservation
- Power Sector Reforms

6.2.2. Resources

- Whiteboard, erasable marker, board cleaner, projection screen, laptop, speaker, notebook, pen, participant handbook, etc
- Flip chart
- Participant Manual
- Projection screen and PowerPoint presentations.
- Activities (role plays)

6.2.3. Say

- Describe statutory regulation related to occupation safety, health, and environment of the worksite.

6.2.4. Explain

- Describe statutory regulation related to occupation safety, health, and environment of the worksite.

6.2.5. Activity

Statutes and Legislative Requirements in Health and Safety (SSD/VSQ/N0131)

- **Objective:** To understand the key statutes, laws, and legislative requirements related to health and safety, and to practice applying these legal principles in real-world scenarios.

- **Activity Setup:**

- Divide the class into small groups (4-5 students per group).
- Provide each group with a list of **statutes and legislative requirements** relevant to health and safety (e.g., the Factories Act, 1948; the Occupational Safety, Health and Working Conditions Code, 2020; the Employees' State Insurance Act, 1948; the Environment Protection Act, 1986; etc.).
- Prepare a set of **hypothetical workplace scenarios** (e.g., a construction site, a factory, an office, a chemical plant) for each group to analyze.
- Distribute a **legislation reference sheet** that highlights the key aspects of these laws and regulations, including obligations of employers, rights of workers, and specific safety measures.

- **Instructions:**

1. Understanding the Statutes:

Begin by reviewing key statutes and legislative requirements in health and safety, covering the following:

- **Factories Act, 1948:** Regulations on safety, health, and welfare of workers in factories.
- Occupational Safety, Health, and Working Conditions Code, 2020: Consolidated guidelines on worker safety, working conditions, and occupational health.
- **Employees' State Insurance Act, 1948:** Provisions for workers' compensation, medical benefits, and insurance in case of accidents.
- **Environment Protection Act, 1986:** Guidelines for maintaining environmental safety and compliance with pollution control.
- **Other Relevant Legislation:** National Building Code (NBC), Fire Safety regulations, etc.

Scenario Analysis:

- Each group receives a workplace scenario and is asked to **identify which statutes and regulations apply** to the situation. For example:
 - In a **construction site scenario**, they must identify regulations related to worker safety, use of personal protective equipment (PPE), fall protection, and machinery safety.
 - In a **factory setting**, they must consider issues like machinery safety, worker welfare (e.g., sanitation, lighting), and emergency procedures.
 - In an **office environment**, they should look at ergonomics, fire safety regulations, and workplace safety training.
- Each group should also identify potential **legal violations** or non-compliance in their assigned scenario.

Research and Application:

- After identifying relevant laws, groups will research the specific legislative provisions that apply to their scenario. They should:
 - Find the sections of the statutes that specifically address the issues in their scenario.
 - Discuss the legal obligations of employers and the rights of workers within the context of health and safety.
 - Identify consequences for non-compliance (e.g., penalties, legal action, fines).

Develop an Action Plan:

- Based on the identified statutory requirements, each group must develop an action plan for the employer in the scenario, outlining:

- Necessary steps to ensure compliance with the relevant laws.
- Proposed measures to address safety hazards and health concerns.
- Ways to communicate safety policies and procedures to workers.
- Procedures for monitoring and enforcing compliance.

Presentation:

Each group presents their analysis and action plan to the class. Their presentation should cover:

- The statutes they reviewed and how they apply to the scenario.
- The key health and safety obligations for the employer.
- Recommended actions to comply with the legal requirements.
- Potential penalties or consequences of non-compliance.
- After each presentation, allow for questions and feedback from the class.

Discussion:

- Discuss the importance of understanding and adhering to statutory and legislative requirements in maintaining a safe workplace.
- Emphasize the role of health and safety regulations in preventing workplace accidents, protecting workers' rights, and promoting a culture of safety.
- Explore how different industries (construction, manufacturing, healthcare, etc.) have unique legal requirements.

Conclusion:

- Recap the importance of statutory and legislative requirements in health and safety and their role in safeguarding workers and the environment.
- Reinforce that compliance with these laws is not only a legal obligation but also crucial for creating a safe and healthy workplace.
- Encourage students to view health and safety regulations as tools for both compliance and continuous improvement in workplace safety.

6.2.6. Notes for Facilitation

Summarize the important points and terms explained in the session.

- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer questions, as needed, providing concrete and brief answers.
- Tell participants to complete the questions at the end of the unit.
- Ensure that every participant answers all the questions

6.2.7. Summary

- BOCW Act, 1996: Apply safety, health, and environmental compliance as per the Building and Other Construction Workers (BOCW) Act.
- Factories Act, 1948: Implement safety, health, and environmental regulations according to the Factories Act.
- OSH Code 2020 & OSHA: Comply with safety, health, and environmental requirements outlined in the Occupational Safety and Health Code and OSHA standards.
- Environment Protection Act, 1986 & ILO Guidelines: Adhere to environmental protection guidelines and ILO standards for EHS compliance.
- Oil Industry Safety Directorate (OSID): Follow safety regulations as per OSID guidelines.
- Mines Vocational Training Rules - DGMS: Ensure compliance with DGMS rules for safety in mining operations.
- Electricity Act, 2010 & 2003: Apply safety and regulatory obligations related to electricity and electrical installations.

- National Building Code (NBC) - 2016: Follow safety guidelines outlined in the National Building Code for construction and building safety.
- National Fire Protection Association (NFPA): Implement fire safety regulations as per NFPA standards.
- PESO - Explosive Act 1884: Ensure compliance with the Explosive Act and PESO regulations for handling explosives.
- Gas Cylinders Rule, 2016: Apply regulatory obligations for the safe use and handling of gas cylinders.
- Boilers Act, 1923: Follow regulations for the safety and operation of boilers.
- Workmen Compensation Act, 1923 & ESI Act, 1948: Adhere to worker compensation and employee state insurance compliance.
- Motor Vehicle Act, 1988: Ensure compliance with road safety regulations under the Motor Vehicle Act.
- First Aid Training: Provide first aid training and ensure its implementation at workplaces.
- The Electricity Act, 2003 is a comprehensive legislation governing the generation, transmission, distribution, and trading of electricity in India. It provides an avenue for ensuring the proper development of the electrical sector and the promotion of competition, efficiency, and sustainability. The Electricity Act, an important manifestation of liberalization and reform in the power sector of India, intends to improve the supply of electricity, better infrastructure for electricity production and distribution, and create a competitive market.

Key Provisions of Electricity Act, 2003

- Promotion of Competition and Efficiency
 - It allows competition in the electricity industry through deregulation of generation and supply of electricity. It allows private sector participation in the industry.
 - It also fosters efficiency in the generation, transmission, and distribution of electricity. The same is possible with incentives on private sector investment and technological development.
- Central and State Regulatory Commissions
 - The Act also provides for the establishment of the Central Electricity Regulatory Commission and the State Electricity Regulatory Commissions.
 - The commissions will regulate the tariffs, ensure fair competition, and ensure transparency in the electricity market.
 - The commissions have the powers to settle disputes arising between generating companies, transmission companies, and state governments as well as other stakeholders.
- Unbundling of Utilities
 - The Act requires the unbundling of utilities into separate entities for generation, transmission, and distribution of electricity. This was aimed at enhancing the operational efficiency of power companies and promoting competition in the market.
 - This unbundling ensures that the transmission and distribution networks are operated independently. This promotes transparency in the power sector.
- Role of Electricity Regulatory Commissions in Tariff Setting

The Act provides the commissions with authority to set the tariffs for electricity. The commissions measure the cost of producing, transmitting, and distributing electricity. In this manner, the rate is determined.
- Electricity Duty and Cross-subsidization
 - The Act reduces cross-subsidization in electricity tariffs, hence ensuring that the consumers are charged based on the actual cost of service.
 - The provisions also aim at reducing the electricity duty paid by consumers, thus benefitting the end-users in terms of affordable prices.
- Renewable Energy Development

- The Act promotes the use of renewable energy. The Act stipulates that the proportion of energy that is procured must be a percentage from renewable resources such as sunlight, wind, and biomass.
- The establishment of RPOs means that a fraction of the electricity that a distribution company should purchase is bound to come from renewable sources
- The Transmission System Should be Strengthened
- The Act provides guidelines on the improvement of the grid through the encouragement of private investment in the building of transmission systems.
- The Central Government is allowed to establish the National Transmission Grid so that there will be a national supply network of electricity.
- National Power Policy
- The Act also provides for the making of the National Power Policy which is to provide a clear vision of how the power sector will be structured in the future. This ensures that adequate, reliable, and affordable supplies of electricity are available to all consumers in the country.
- Consumer Protection and Right
- The Electricity Act, 2003 places a significant emphasis on consumer rights. It establishes the Electricity Ombudsman to resolve consumer complaints regarding electricity supply, quality, and billing.
- The Act requires distribution licensees to provide reliable and continuous electricity and outlines penalties for violations of service standards.
- Rural Electrification and Village Electrification
- The Act provides for rural electrification in the form of infrastructure to provide electricity supply in remote areas and villages, thus aiding the general socio-economic development of rural India.
- A specific fund for rural electrification is established in the form of Rural Electrification Corporation (REC) to facilitate financing of the electrification process.
- The Concept of Open Access
- The Act introduced the concept of open access, which allows large consumers to choose their electricity supplier. This helps consumers select the best available price, encouraging competition among power suppliers.
- Open access allows for the free flow of electricity through the national transmission system, promoting efficiency and lower tariffs.
- Power Trading
- The Act sets up the legal framework for trading in power. This means electricity trading is allowed between generating companies and distribution utilities or other third-party entities. It promotes a competitive electricity market.
- The Power Trading Corporation is formed to oversee the transactions of power traders in India.
- Penal Provisions and Offense
- The Act also spells out various offenses and penalties upon contravention of the Act, such as illegal use of electricity, non-compliance with license conditions, and non-payment of dues.
- This ensures all stakeholders, including consumers, utilities, and companies, are required to abide by the rules and regulations as laid out by the Act.
- Impact of the Electricity Act, 2003
- **Improved Efficiency and Competition:** This Act has allowed for the betterment of efficiency in the power sector by providing an opportunity for competition. Private investment has gone up, thereby resulting in the enhancement of the generation and distribution network in India.
- **Power Generation Increased:** It supports the establishment of new plants, be it conventional or renewable energy plants, and that has gone a long way in enhancing the electricity generation capacity in the country.
- **Rural Electrification:** The rural electrification provisions have brought electricity to millions of rural households, thus enhancing the quality of life and promoting economic development in rural areas.

- **Regulated Tariff Structure:** The Act has empowered the regulatory bodies to fix fair tariffs. This has ensured that consumers are more transparent, and electricity remains affordable for all sections of society.
- **Growth of Renewable Energy:** The Act has been a spur for growth of renewable energy. India has attracted a lot of investment in solar and wind energy, and thus it has emerged as one of the biggest markets for renewable energy.
- **Consumer Protection:** The Electricity Ombudsman and focus on consumer rights have helped alleviate grievances and bring about better satisfaction among electricity customers.
- **Challenges**
 - **Implementation Gaps:** Although the Act is highly comprehensive, it has been severely lacking in its implementation at ground level, particularly in rural electrification and infrastructure development.
 - **Losses and Theft:** The sector still suffers from transmission and distribution losses as well as theft of electricity, affecting the efficiency of the entire sector.
 - **Lack of Financial Viability:** Several state electricity boards and distribution companies face financial difficulties due to inefficiencies, delayed payments, and high transmission losses.
 - **Issues relating to lack of authority, capacity, and resources** that are needed for the smooth working of the regulatory bodies at the state level have often halted the process. The Electricity Act, 2003 provides an integrated legislative framework for electricity generation, transmission, distribution, and trading within India. In this sense, it is a proper legal framework for the growth of the electric sector and sets out an approach to ensure efficiency, competition, and sustainability in the sector. The Act marks an important milestone in the liberalization and reform of India's power sector toward improving the supply of electricity with better infrastructure and creating a competitive market for generation and distribution.

Key Features of the Electricity Act, 2003

Promotion of Competition and Efficiency

The Act promotes competition in the electricity sector by bringing deregulation into the generation and distribution of electricity. It ensures that the sector is open for private sector participation.

It promotes efficiency in electricity generation, transmission, and distribution. This includes incentives for private sector investments and technological improvements.

- **Central and State Regulatory Commissions**
 - It sets up the Central Electricity Regulatory Commission (CERC) and State Electricity Regulatory Commissions (SERCs). These commissions regulate the tariffs; ensure fair competition and transparency in the market of electricity.
 - The commissions also determine cases or disputes among the generating companies, transmission companies, and state governments, while involving other stakeholders.
- **Unbundling of Utilities**
 - The Act compels unbundling of utilities into generation, transmission, and distribution of electricity. The purpose of unbundling was generally done with a view to boosting the operational efficiencies of power companies so that market competition can flourish.
 - The main aspect of the unbundling is to perform the functions related to transmission and distribution independently; thus, power sector would not face much hiddenness and corruption that can flourish transparency.
- **Electricity Regulatory Commissions and Tariff setting**
 - The Act gives the power to the regulatory commissions to determine electricity tariffs. The commissions would assess the generation, transmission and distribution cost of electricity and quote rates accordingly.

- The tariffs so designed are for recovery of cost by the utilities and at the same time providing fair charges for consumers.
- Electricity Duty and Cross-subsidization
- The Act allows the reduction of cross-subsidization in electricity tariffs, which ensures that the consumers are charged based on the actual cost of service.
- The provisions also focus on reducing the electricity duty paid by consumers, thus benefiting the end-users in terms of affordable prices.
- Renewable Energy Development
- The Act emphasizes the need for renewable energy. Under this law, a percentage had to be supplied from renewable resources, such as solar, wind, or biomass.
- RPOs are introduced so that a specified percentage of electricity supply is generated from renewable sources.
- Strengthening Transmission Infrastructure
- It directs guidelines for the reinforcement of the distribution and transmission system by enabling the private sector in terms of investments made for the growth of transmission infrastructure.
- The centre has been authorized permission to develop an integrated network over the nation in terms of supply.
- National Power Policy
- The Act also makes provisions for the development of the National Power Policy, which would envision the future growth of the power sector. It aims to provide an adequate, reliable, and affordable supply of electricity to consumers across the country.
- Consumer Protection and Rights
- The Electricity Act, 2003 is extremely consumer rights-oriented. It provides a machinery of redressal in the shape of the Electricity Ombudsman for grievances relating to supply, quality, and billing of electricity.
- The Act envisages that distribution licensees shall ensure a constant and reliable supply of electricity and penalties are prescribed for violations of service standards.
- Rural Electrification and Village Electrification
- The Act encompasses provision for electrification of rural regions with provision for required infrastructure for supply of electricity to far-flung regions and villages and, thus promotes all-round socio-economic development in rural India.
- Dedicated fund for rural electrification, namely, Rural Electrification Corporation, is also established for providing financing support during the process of electrification.
- Power Trading
- The Act provides a legal framework for power trading. It allows trading in electricity between generating companies and distribution utilities, or other third-party entities. This promotes the establishment of a competitive electricity market.
- The Power Trading Corporation (PTC) is established to oversee the transactions of power traders in India.

- Penal Provisions and Offenses
- The Act further explains many offenses and punishment that can be held in case the rule is violated, such as illegal use of electricity, violation of license conditions, and unpaid dues.
- This will ensure all the stakeholders, including consumers, utilities, and companies, follow the rules and regulations that this Act has provided.
- Effect of Electricity Act, 2003
- Improved Efficiency and Competition: The Act has brought about a betterment in the efficiency of the power sector by encouraging competition. Private investment has increased, and generation as well as distribution networks have improved along India.
- Increasing Power Generation: The act develops new plants in power, conventional as well as renewable, and this drives the increase in the capacity of generating electricity inside the country.
- Rural Electrification: This provision of the Act has facilitated electrification in millions of households in the countryside, which will enhance the standard of living in the countryside, thereby boosting the economy of those areas.
- Renewable Energy Growth: The Act has played a pivotal role in the growth of renewable energy. India has seen massive investments in solar and wind energy, making it one of the largest markets for renewable energy.
- Consumer Protection: The Electricity Ombudsman and consumer rights have helped address grievances and improve customer satisfaction in the electricity sector.

Challenges

- Implementation Gaps: Although the Act is comprehensive, there have been difficulties in its implementation at the grass-root level. This has mainly been in cases of rural electrification and infrastructure development.
- Losses and Theft: Despite this progress, the country still grapples with transmission and distribution losses, along with electricity theft, which has a bearing on the overall efficiency of the sector.
- Lack of Financial Viability: Most of the state electricity boards and distribution companies suffer from financial instability, mainly due to inefficiencies, delayed payments, and high transmission losses.
- Regulatory Bottlenecks: At the state level, the working of regulatory bodies has often faced issues related to lack of authority, capacity, and resources, which has slowed down the overall progress.

6.2.8. Exercise

1. What does the BOCW Act of 1996 primarily address?
 - A) Environmental Protection
 - B) Construction Workers' Safety
 - C) Oil Industry Regulations
2. Under the BOCW Act, who is responsible for ensuring safety measures at construction sites?
 - A) Only the workers
 - B) The employer and the contractor
 - C) Government inspectors only

D) The workers' unions

3. According to the BOCW Act, which body is responsible for enforcing compliance with safety regulations? (PC1)

A) Local police

B) Chief Inspector of the State

C) Ministry of Labour and Employment

D) Trade unions

4. What is a consequence of non-compliance with the Factories Act, 1948?

A) Increased taxes

B) Legal penalties

C) Improved working conditions

D) Employee promotions

5. Under the Factories Act, which of the following is a key responsibility of the factory manager?

A) To provide entertainment facilities for workers

B) To ensure compliance with health and safety regulations

C) To manage financial accounts of the factory

D) To conduct recruitment drives

6. How often must employers conduct safety training according to OSHA standards?

A) Only during employee onboarding

B) Annually or as needed based on workplace changes

C) Every five years

D) Training is not mandatory

7. What does the Environment Protection Act, 1986 aim to prevent?

A) Worker exploitation

B) Air and water pollution

C) Traffic accidents

D) Natural disasters

8. True or False: The Health and Safety at Work Act is a key piece of legislation that outlines the duties of employers and employees regarding workplace safety.

9. True or False: Health and safety legislation only applies to industrial workplaces, not offices or administrative environments.

10. True or False: Employers are legally required to carry out risk assessments to identify and mitigate potential hazards in the workplace.

11. True or False: Employees are not responsible for their own safety or the safety of others under health and safety laws.

12. Which of the following is the primary objective of the Electricity Act, 2003?

a) To regulate only electricity distribution

- b) To promote competition and liberalization in the electricity sector
- c) To only regulate tariffs
- d) To enforce penalties for electricity theft

13. Which of the following is included in the scope of the Electricity Act, 2003?

- a) Guidelines for rural electrification
- b) Ownership rights for private power plants
- c) Only central government electricity transmission
- d) Complete deregulation of electricity tariffs

14. Which of the following is a major objective of the Electricity Act, 2003 in relation to competition?

- a) To provide exclusive access to the government for power generation
- b) To promote competition by allowing private companies to participate in generation, transmission, and distribution
- c) To ensure all electricity tariffs are regulated by the government
- d) To eliminate the need for energy conservation measures

7. Unit 7 NOS 6: SSD/VSQ/N1306: Plan & Organize Electrical Emergency Protocols

7.1. Key Learning Outcomes

- Planning of resources for own work and communication to concerned subordinates, co-workers, and superiors.
- Provide necessary support to subordinates, coordinate with co-workers and liaise with superiors and other teams.
- Monitor progress of work and adjust, manage, or project requirements on time.

7.2. Unit 7.1: Planning of Work

7.2.1. Unit Objectives

At the end of this unit, students will be able to:

- Understand process of plan the resources, schedules, and timelines as per work timelines given by superiors.
- Understand hierarchy of the organization and communicate to concerned co workers and superiors.
- Understand how to do work within timelines.

7.2.2. Resources

- Whiteboard, erasable marker, board cleaner, projection screen, laptop, speaker, notebook, pen, participant handbook, etc
- Flip chart
- Participant Manual
- Projection screen and PowerPoint presentations.
- Activities (role plays)

7.2.3. Say

- Describe resource allocation and resource schedule
- Describe process of hierarchy of the organization and communicate to concerned co workers and superiors.
- Describe Task allocation and timeline

7.2.4. Explain

- Describe resource allocation and resource schedule
- Describe process of hierarchy of the organization and communicate to concerned co workers and superiors.
- Describe Task allocation and timeline

7.2.5. Activity

Planning of Work

Objective: To understand the process of work planning, including resource allocation, schedule management, and effective communication, while simulating real-world workplace scenarios.

Activity Setup:

- Divide the class into small groups (4-5 students per group).
- Provide each group with a **hypothetical project scenario** (e.g., a construction project, event planning, manufacturing task, or research project) that involves tasks to be completed within a set timeframe.
- Provide **planning tools**, such as:
 - A **Gantt chart template** or **work schedule template**.
 - A **resource list** (e.g., equipment, personnel, materials).
 - A **project timeline** that outlines the total time available and key milestones.

Instructions:

1. Scenario Overview:

- Present each group with a detailed scenario of a project or task. For example, for a construction project, the scenario might include building a new office space within three months, with specific deadlines for tasks like foundation laying, electrical installation, and final inspection.
- Emphasize that each group must plan the resources, schedule, and timelines effectively to complete the project successfully.

Work Breakdown:

- Each group should **break down the overall project** into smaller, manageable tasks or phases. For instance:
 - **Task 1:** Site preparation and foundation laying.
 - **Task 2:** Framing and structure work.
 - **Task 3:** Electrical wiring installation.
 - **Task 4:** Final inspection and project handover.
- Assign responsibilities for each task (e.g., which team member or department will handle which task).

Resource Allocation:

- Identify the resources required for each task:
- **Personnel:** Who will do what (e.g., skilled workers, managers, supervisors)?
- **Equipment:** What tools or machinery are needed?
- **Materials:** What materials (e.g., wood, cement, wiring) are required for the project?
- Groups should allocate resources for each task, ensuring that the necessary items are available at the right time.

Timeline Creation:

- Using a **Gantt chart** or **work schedule**, groups must map out when each task will begin and end, taking into account dependencies (e.g., Task 2 cannot start until Task 1 is completed).
- Ensure that they account for any potential delays, allowing some buffer time between tasks or key milestones.

Communication Plan:

- Develop a **communication plan** to ensure all team members and stakeholders are informed about the work schedule and progress.
- Decide how to communicate with superiors or other departments (e.g., regular progress reports, meetings).
- Discuss how changes to the schedule or issues will be communicated and resolved.

Risk Assessment:

- Identify potential **risks** to the successful completion of the project (e.g., delays in material delivery, workforce shortages).
- Plan **mitigation strategies** to address these risks (e.g., backup suppliers, additional shifts, contingency time in the schedule).

Presentation:

- Each group presents their **work plan** to the class, including:
 - Breakdown of tasks and milestones.
 - Resource allocation plan.
 - Timeline and Gantt chart.
 - Communication strategy and risk management plan.
- After each presentation, encourage questions and feedback from the class on how the plan could be improved.

Discussion:

- Discuss the importance of **effective work planning** in completing projects on time and within budget.
- Emphasize the role of **resource management**, **timeline adherence**, and **communication** in the success of any project.

- Discuss how unplanned risks or delays can affect the overall work plan and how to manage those risks proactively.

Conclusion:

- Recap the essential components of **work planning**, including task breakdown, resource allocation, timeline management, and communication.
- Reinforce that planning is a critical skill for any professional and helps ensure that projects are completed efficiently, safely, and successfully.
- Encourage students to always consider potential risks and communication needs while planning work in real-world situations.

7.2.6. Notes for Facilitation

Summarize the important points and terms explained in the session.

- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer questions, as needed, providing concrete and brief answers.
- Tell participants to complete the questions at the end of the unit.
- Ensure that every participant answers all the questions

7.2.7. Summary

1. Resource and Schedule Planning: Plan resources, schedules, and timelines based on work deadlines set by superiors.
2. Understanding Organizational Hierarchy: Understand the hierarchy within the organization. Communicate effectively with co workers and superiors according to the organizational structure.
3. Task Delegation: Assign tasks to subordinates in alignment with project requirements and timelines.

7.2.8. Exercise

1. What is the first step in planning safety resources for a work task?
 - A) Gathering feedback from team members
 - B) Reviewing the overall work timelines and objectives
 - C) Conducting a financial audit
 - D) Allocating tasks to subordinates
2. What is the primary purpose of resource planning?
 - A) To allocate tasks to employees
 - B) To minimize costs
 - C) To ensure resources are available when needed
 - D) To increase profit margins
3. Which document typically outlines the project schedule?
 - A) Project charter
 - B) Statement of work
 - C) Project management plan
 - D) Risk management plan
4. Which term describes the resources needed to complete a project?
 - A) Resource pool
 - B) Resource allocation
 - C) Resource capacity
 - D) Resource requirement
5. True or False: In work planning, it is essential to consider worker skill levels and ensure adequate training for the tasks they will perform.
6. True or False: Work planning should avoid including safety protocols if the tasks seem simple or low-risk.
7. True or False: A detailed work plan helps in minimizing delays, reducing accidents, and increasing productivity.

7.3. Unit 7.2: Organizing of Work

7.3.1. Unit Objectives

At the end of this unit, students will be able to:

- Resource collection and provisioning.
- Understand Communication Medium to concerned co workers and superiors.
- Briefing to subordinates about the schedule, sequence, timing and resources to subordinates

7.3.2. Resources

- Whiteboard, erasable marker, board cleaner, projection screen, laptop, speaker, notebook, pen, participant handbook, etc
- Flip chart
- Participant Manual
- Projection screen and PowerPoint presentations.
- Activities (role plays)

7.3.3. Say

- Describe Resource collection and provisioning
- Describe process of hierarchy of the organization and communicate to concerned co workers and superiors.
- Describe process of Briefing to subordinates about the schedule, sequence, timing and resources to subordinates

7.3.4. Explain

- Describe Resource collection and provisioning
- Describe process of hierarchy of the organization and communicate to concerned co workers and superiors.
- Describe process of Briefing to subordinates about the schedule, sequence, timing and resources to subordinates

7.3.5. Activity

Organizing of Work

Objective: To understand the process of organizing work, focusing on resource collection, team communication, and task delegation to ensure efficient execution.

Activity Setup:

Divide the class into small groups (4-5 students per group).

Provide each group with a hypothetical project that requires organizing work (e.g., organizing a company event, launching a new product, or completing a team task in a manufacturing setting).

Provide resources such as a resource list, a timeline, and a task delegation sheet.

Instructions:

Project Overview:

Present each group with a project scenario that requires organizing tasks and resources. For example:

Scenario 1: Organize an employee health and safety training seminar for 100 staff members.

Scenario 2: Organize a new product launch event that includes product display, marketing, and customer engagement.

Scenario 3: A factory maintenance project that involves machine inspection, repair, and quality control.

Identify Resources:

Instruct each group to identify the resources needed for their project:

Personnel: Who will do what? (E.g., team leaders, helpers, specialists).

Materials/Equipment: What materials or tools are required? (E.g., seminar materials, decorations, machinery).

Time: How much time is allocated for each task? (E.g., deadlines for completing specific project phases).

Task Delegation:

Groups should delegate tasks to each team member based on skills and available resources.

Discuss who will be responsible for specific tasks (e.g., one person may handle event logistics, another may be in charge of communications).

Ensure that tasks are evenly distributed and that every member knows their responsibilities and deadlines.

Develop a Task Schedule:

Each group creates a task schedule that outlines when each task will begin and end, who will handle it, and any dependencies (e.g., Task B cannot start until Task A is completed).

Use a work schedule template to visualize the sequence of tasks.

Emphasize the importance of setting realistic deadlines and allocating time for contingencies.

Communication Plan:

Discuss how communication will take place among team members and superiors.

How will progress be tracked and reported? (E.g., weekly meetings, progress updates).

How will issues or delays be communicated and addressed?

Risk Management:

Each group should consider potential risks that could disrupt the project (e.g., a supplier delay, unexpected absences) and develop contingency plans.

For example, if an equipment breakdown occurs, the team should have an alternative vendor or maintenance procedure.

Final Presentation:

Each group will present their organized work plan to the class, covering:

Key resources needed (personnel, materials, time).

How tasks were delegated and why.

The task schedule and timeline.

The communication plan and risk management strategies.

Encourage classmates to ask questions and give feedback on how the organizing process could be improved.

Discussion:

Discuss the importance of organizing work effectively for successful project execution.

Highlight the role of delegating tasks based on skills, available resources, and time constraints.

Emphasize the importance of clear communication and monitoring progress to ensure all tasks are completed on time.

Conclusion:

Recap the key steps in organizing work: identifying resources, delegating tasks, creating schedules, and planning communication and risk management.

Reinforce that organizing work is essential for maximizing efficiency and ensuring project success.

Encourage students to use these organizational principles in their future professional tasks to improve teamwork and productivity.

7.3.6. Notes for Facilitation

Summarize the important points and terms explained in the session.

- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer questions, as needed, providing concrete and brief answers.
- Tell participants to complete the questions at the end of the unit.
- Ensure that every participant answers all the questions

7.3.7. Summary

1.Resource Collection and Provisioning:

Collect and provide necessary resources for the tasks at hand.

2.Effective Communication:

Communicate relevant information to co-workers and superiors.

3.Briefing Subordinates:

Brief subordinates about the work schedule, task sequence, timing, and available resources.

7.3.8. Exercise

1. What is the primary purpose of resource collection in project management?

- A) To allocate tasks
- B) To gather necessary materials and inputs
- C) To create budgets
- D) To schedule meetings

2. What is the first step in resource collection?

- A) Allocation of resources
- B) Identifying resource needs
- C) Distribution of resources
- D) Evaluation of resources

3. What is the first step in the resource provisioning process?

- A) Allocating resources
- B) Identifying resource requirements
- C) Monitoring resource usage

D) Reporting resource status

4. What is the best way to ensure your message is understood by co-workers?

A) Use technical jargon

B) Keep the message concise and clear

C) Avoid summarizing key points

D) Speak quickly

5. True or False: It is not necessary to assign clear responsibilities for safety and emergency procedures when organizing work.

6. True or False: Organizing work includes scheduling tasks in a way that optimizes productivity without compromising safety.

7. True or False: Organizing work should only focus on the efficiency of the process and not on the health and safety of the workers.

7.4. Unit 7.3: Monitoring of Work

7.4.1. Unit Objectives

At the end of this unit, students will be able to:

- Understand process of monitoring progress of work, management of resources, guidance to subordinates.
- Understand process of reporting to superiors and keeping the other teams informed.
- Documentations and compliances and report submission.

7.4.2. Resources

- Whiteboard, erasable marker, board cleaner, projection screen, laptop, speaker, notebook, pen, participant handbook, etc
- Flip chart
- Participant Manual
- Projection screen and PowerPoint presentations.
- Activities (role plays)

7.4.3. Say

- Describe about process of monitoring progress of work, management of resources, guidance to subordinates
- Describe about process of reporting to superiors and keeping the other teams informed
- Describe importance of Documentations and compliances and report submission

7.4.4. Explain

- Describe about process of monitoring progress of work, management of resources, guidance to subordinates
 - Describe about process of reporting to superiors and keeping the other teams informed
- Describe importance of Documentations and compliances and report submission

7.4.5. Activity

Monitoring of Work

- **Objective:** To understand the process of monitoring work, ensuring tasks are completed as planned, and addressing issues in real-time to ensure efficiency and quality.

- **Activity Setup:**

- Divide the class into small groups (4-5 students per group).
- Provide each group with a **project scenario** that involves multiple tasks and objectives. Examples could include:

- Organizing a conference or event.
- Managing a product launch.
- Completing a construction project or factory maintenance task.
- Distribute **monitoring tools**, such as a **progress tracking sheet**, **performance checklist**, and **issue resolution template**.

- **Instructions:**

1. **Scenario Overview:**

- Present a project scenario where the group needs to **monitor progress** and ensure that tasks are completed on time and according to quality standards. For example:
 - **Scenario 1:** You are managing a team to plan and organize a corporate training event. The team has various tasks like booking the venue, creating materials, sending invitations, and arranging catering.
 - **Scenario 2:** You are overseeing a construction project. The tasks include scheduling deliveries, organizing team work shifts, and ensuring safety protocols are followed.
- Each group is tasked with organizing and monitoring the project to ensure all tasks are completed as planned.

2. **Task Breakdown:**

- Ask each group to break down the project into smaller tasks. For example:
 - **Task 1:** Booking the venue for the event.
 - **Task 2:** Sending invitations to participants.
 - **Task 3:** Preparing presentation materials.
 - **Task 4:** Setting up the venue and arranging logistics.
- Assign specific tasks to each group member, ensuring that they each have clear responsibilities.

3. **Establish Monitoring Criteria:**

- Instruct each group to establish clear **monitoring criteria** for each task. For example:
 - What is the **deadline** for each task?
 - What are the **quality standards** to be met?
 - What are the **key milestones** for checking progress?
- Use a **progress tracking sheet** to track whether the tasks are on schedule, on budget, and meeting quality standards.

4. **Monitor Progress:**

- Each group should regularly **monitor the progress** of the tasks:

- Conduct regular **check-ins** (e.g., weekly or bi-weekly) to ensure that the tasks are being completed on time.
- **Compare the progress** with the original plan (e.g., check if task deadlines are being met).
- Use the **performance checklist** to evaluate if tasks are being performed correctly and according to the defined quality standards.
- Address any issues that arise, such as:
 - **Delays:** If a task is behind schedule, what corrective actions will be taken?
 - **Quality issues:** If the work doesn't meet the expected quality, how will you address it?

5. Issue Resolution:

- Each group will need to deal with hypothetical **issues** that could arise during the project. For example:
 - **Issue 1:** Task 2 (sending invitations) is delayed because the contact list wasn't updated on time.
 - **Issue 2:** Task 4 (venue setup) is being delayed due to supplier delivery problems.
- Use the **issue resolution template** to propose solutions for the issues, such as:
 - Reassigning tasks.
 - Extending deadlines.
 - Procuring alternative resources.

6. Final Report:

- At the end of the activity, each group will **present a report** that includes:
 - A summary of the **tasks assigned** and their deadlines.
 - The **monitoring process** used to track progress and ensure quality.
 - Any **issues encountered** and how they were resolved.
 - Final assessment of whether the project was completed on time and met quality standards.
- Groups should highlight the **lessons learned** from the monitoring process, such as:
 - The importance of early issue identification.
 - The need for clear communication within the team.
- **Discussion:**
 - Discuss the importance of **monitoring work** to ensure it stays on track and meets quality standards.
 - Explore different **monitoring techniques**, such as setting clear objectives, tracking progress, and holding regular check-ins.
 - Highlight the need for **flexibility** in monitoring and adjusting the plan as issues arise.
- **Conclusion:**

- Recap the key steps in **monitoring work**, including setting clear tasks, establishing criteria, tracking progress, addressing issues, and adjusting plans.
- Reinforce that monitoring is essential to ensure that work is completed efficiently, on time, and to the required standard.
- Encourage students to apply these **monitoring techniques** in future projects to improve team performance and project outcomes.

7.4.6. Notes for Facilitation

Summarize the important points and terms explained in the session.

- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer questions, as needed, providing concrete and brief answers.
- Tell participants to complete the questions at the end of the unit.
- Ensure that every participant answers all the questions

7.4.7. Summary

1. Track Progress:

Continuously monitor the progress of tasks and projects against set timelines and goals.

2.Ensure Compliance:

Ensure work is being carried out according to established procedures, safety standards, and quality guidelines.

3.Identify Issues:

Identify any delays, resource shortages, or obstacles and address them promptly.

4.Provide Support:

Offer assistance or guidance to team members as needed to ensure smooth workflow.

5.Report Status:

Regularly report work progress to superiors and stakeholder

7.4.8. Exercise

1.What role does leadership play in monitoring work?

- A) It is irrelevant
- B) It sets the tone for accountability and support
- C) It complicates processes
- D) It should be avoided

2. What is the primary purpose of monitoring progress in a project?

- A) To assign blame for delays
- B) To ensure tasks are completed on time and within budget
- C) To ignore issues as they arise
- D) To complicate project management

3. Which of the following is a key indicator of project progress?

- A) Employee satisfaction
- B) Milestone completion
- C) Office atmosphere
- D) Social media engagement

4.True or False: Organizing work should consider the availability of resources, including tools, materials, and equipment, to avoid delays or inefficiencies.

5. True or False: It is not necessary to assign clear responsibilities for safety and emergency procedures when organizing work.

6. True or False: Organizing work includes scheduling tasks in a way that optimizes productivity without compromising safety.

7.5. Unit 7.4. Emergency Protocols

7.5.1. Unit Objectives

At the end of this unit, students will be able to:

- Set up medical emergency measures, in case of accidents/incidents at the workplace.
- Set up fire emergency measures as per plans in case of any fire accidents at the workplace.
- Set up emergency assembly area, evacuation plan, sign boards and guidance

7.5.2. Resources

- Whiteboard, erasable marker, board cleaner, projection screen, laptop, speaker, notebook, pen, participant handbook, etc
- Flip chart
- Participant Manual
- Projection screen and PowerPoint presentations.
- Activities (role plays)

7.5.3. Say

- Describe about process of medical emergency measures, in case of accidents/incidents at the workplace.
- Describe about process of fire emergency measures
- Describe importance of emergency assembly area, evacuation plan, sign boards and guidance

7.5.4. Explain

- Describe about process of medical emergency measures, in case of accidents/incidents at the workplace.
- Describe about process of fire emergency measures
- Describe importance of emergency assembly area, evacuation plan, sign boards and guidance

7.5.5. Activity

Divide the class into small groups and assign each group a workplace accident scenario (e.g., a chemical spill, electrical shock, or severe bleeding).

Have the groups discuss and create a detailed Medical Emergency Response Plan, including:

Immediate steps to take in their scenario.

How to access and use first aid supplies.

Communication protocols (e.g., who to call for help and how).

The roles and responsibilities of employees in the medical emergency response.

7.5.6. Notes for Facilitation

- Summarize the important points and terms explained in the session.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer questions, as needed, providing concrete and brief answers.

- Tell participants to complete the questions at the end of the unit.
- Ensure that every participant answers all the questions

7.5.7. Summary

1.Set Up Medical Emergency Measures

Setting up medical emergency measures at the workplace is crucial to ensuring prompt and effective response in the event of accidents or incidents. This includes having a well-stocked First Aid Kit, designated first aid responders, and an organized system for medical emergencies. Emergency contacts, procedures for assessing and treating injuries, and clear instructions on how to seek medical assistance should all be in place. Additionally, regular training and drills are important to maintain preparedness in dealing with various medical emergencies, ensuring quick and efficient response when accidents occur.

2.Set Up Fire Emergency Measures

Fire safety at the workplace is vital to minimize the risks of fire hazards. Setting up fire emergency measures involves identifying fire hazards, providing accessible fire extinguishers, and ensuring that fire alarms and fire exits are in place. A comprehensive fire emergency plan should be developed, which includes evacuation routes, emergency contacts, and roles assigned to staff members (e.g., fire marshals). Regular fire drills are essential for ensuring that everyone is familiar with evacuation procedures and can act quickly in case of a fire emergency.

3.Set Up Emergency Assembly Area, Evacuation Plan, Sign Boards, and Guidance

An evacuation plan is essential for guiding individuals to safety during emergencies, whether fire-related or other critical incidents. The workplace should have designated emergency assembly areas away from potential hazards. Clear signage and guidance are necessary for directing employees to these assembly areas and safe exits. Evacuation routes should be well marked, easily accessible, and designed to accommodate all employees, including those with special needs. Regular practice drills are also important to ensure employees are familiar with the evacuation process and can follow the procedures efficiently in case of an emergency.

7.5.8. Exercise

1. Which of the following is a key component of setting up medical emergency measures at the workplace?

- First Aid Kit
- Fire extinguishers
- Emergency assembly area
- Security cameras

2. What should be included in a fire emergency plan at the workplace?

- A list of employees
- Locations of fire exits and extinguishers
- Employee break times
- Parking lot layout

3.What is the primary purpose of an emergency assembly area?

- To store emergency medical supplies
- To gather employees during an evacuation
- To provide refreshments during emergencies

d) To conduct safety drills

4. In the event of a fire, employees should follow the _____ to evacuate the building safely.

5. The _____ is designated as a safe area where employees should gather after evacuating the workplace during an emergency.

6. A fire emergency plan should include clear instructions about the location of _____, fire exits, and emergency contact information.

7. True or False: All employees should be familiar with the workplace's emergency evacuation routes and assembly areas.

8. **True or False:** In case of fire, it is important to use the nearest exit and not to wait for instructions.

8. Unit 8 NOS 7: Employability Skills (DGT/VSQ/N0102)

8.1. Key Learning Outcomes

- Introduction to Employability Skills Constitutional values - Citizenship
- Becoming a Professional in the 21st Century Basic English Skills
- Career Development & Goal Setting Communication Skills
- Diversity & Inclusion
- Financial and Legal Literacy Essential Digital Skills
- Entrepreneurship Customer Service
- Getting ready for Apprenticeship & Jobs

8.2. Unit 10.1: Preparing for Employment & Self Employment

8.2.1. Unit Objectives

At the end of this unit, students will be able to

1. Develop Job Readiness Skills:
2. Create Effective Job Search Strategies:
3. Prepare for job interviews and networking opportunities.
4. Identify potential self-employment ideas and business opportunities.
5. Understand Employment Rights and Responsibilities:
6. Enhance Personal Branding:
7. Develop Financial and Organizational Skills:

8.2.2. Resources

- Whiteboard, erasable marker, board cleaner, projection screen, laptop, speaker, notebook, pen, participant handbook, etc
- Flip chart
- Participant Manual
- Projection screen and PowerPoint presentations.
- Activities (role plays)

8.2.3. Say

Tell the participants that when an interviewer asks you to say something about yourself, he/she is not asking you to present your life history.

Introduction should be short and crisp, and should present you in a positive light. It should include the following points:

- Any work experience that you might have
- A brief summary of your educational qualifications
- Your strengths and achievements
- Any special projects that you might have been part of

The following topics should be avoided during an introduction:

- Detailed description of your family (unless you are specifically asked to do so)
- Too much information about your weaknesses
- Information that is not true

8.2.4. Do

- Congratulate each participant for making their first attempt towards creating an effective resume.
- As a follow up activity, you can suggest them to prepare their own resume and show it to you the next day.

8.2.5. Role Play

Conduct a role play for the situation given.

Role Play –

The interviewer will start by asking the interviewee a few generic questions such as:

- What is your name?
- Tell me something about yourself?
- Can you tell me something about your family?

Then, at the end of the interview, ask the interviewee:

- There are over 200 people who have applied for this job, some with excellent work experience.
- Why should I hire you?

8.2.6. Notes for Facilitation

Summarize the important points and terms explained in the session.

- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer questions, as needed, providing concrete and brief answers.
- Tell participants to complete the questions at the end of the unit.
- Ensure that every participant answers all the questions

8.2.7. Summary

Job Readiness:

Develop skills for seeking and securing employment or starting a business.

Job Search Tools:

- Create a professional resume, cover letter, and online presence.
- Prepare for job interviews and networking.

Self-Employment:

- Identify and explore potential self-employment or business ideas.
- Understand the basics of starting and managing a small business.

Workplace Rights

Learn about employment laws, rights, and responsibilities.

Personal Branding:

Build a strong personal brand for career or business growth.

Financial Planning:

Develop essential financial and organizational skills for employment or entrepreneurship.

8.2.8. Exercise

1. What is the first step in preparing for employment?

- A) Writing a resignation letter
- B) Creating a resume
- C) Opening a business
- D) Networking with friend

2. Which of the following is NOT typically required for self-employment?

- A) A business plan
- B) An employer to answer to
- C) Financial management skills
- D) Marketing and sales strategies

3. What should be included in a self-employment business plan?

- A) The business idea and goals
- B) A list of personal contacts
- C) A resume
- D) A job offer letter

4. True or False: In self-employment, you are responsible for your own business operations, including financial management and legal compliance.

5. True or False: Having relevant qualifications and work experience is the only factor to consider when preparing for employment.

6. True or False: Personal branding is important for both self-employment and traditional employment opportunities.

8.3. Unit 10.2. Understanding Entrepreneurship

8.3.1. Unit Objectives

At the end of this unit, students will be able to

- Discuss the concept of entrepreneurship
- Discuss the importance of entrepreneurship
- Discuss the characteristics of an entrepreneur
- Describe the different types of enterprises
- List the qualities of an effective leader
- Discuss the benefits of effective leadership
- List the traits of an effective team
- Discuss the importance of listening effectively
- Discuss how to listen effectively
- Discuss the importance of speaking effectively
- Discuss how to speak effectively
- Discuss how to solve problems
- List the important problem solving traits
- Discuss ways to assess problem solving skills

8.3.2. Resources

- Whiteboard, erasable marker, board cleaner, projection screen, laptop, speaker, notebook, pen, participant handbook, etc
- Flip chart
- Participant Manual
- Projection screen and PowerPoint presentations.
- Activities (role plays)

8.3.3. Say

Let's start this session with some interesting questions about Indian entrepreneurs

8.3.4. Do

Tell them that you will ask them few questions about a few entrepreneurs.

- Divide the class in to two groups.
- In turns ask the quiz questions to the groups.
- If the answer is incorrect pass the question to the other group.
- Share the answer if the groups are not able to answer.
- Congratulate the participants who answered correctly

8.3.5. Team Activity

Divide the class into small teams (4-5 participants per team).

- Each team needs to come up with a unique business idea. Encourage participants to think creatively, focusing on solving a real-world problem.
- Teams should discuss and finalize their business idea

Business Plan Development

- Teams will work together to develop a simple business plan for their idea. The plan should cover the following key points:
 - Business Idea: What is the product or service? How does it solve a problem?
 - Target Market: Who are the customers? What are their needs?
 - Unique Value Proposition: Why is the business idea different or better than others in the market?
 - Revenue Model: How will the business make money (e.g., sales, subscriptions, ads)?
 - Marketing Strategy: How will the business attract customers?
 - Launch Plan: How will they introduce the business to the market?

8.3.6. Notes for Facilitation

Summarize the important points and terms explained in the session.

- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer questions, as needed, providing concrete and brief answers.
- Tell participants to complete the questions at the end of the unit.
- Ensure that every participant answers all the questions

8.3.7. Summary

Close the discussion by summarizing about the opportunities for entrepreneurs in India

8.3.8. Exercise

1. Which of the following is a good practice for writing a professional email?

- A) Using a casual tone and slang
- B) Including a clear subject line
- C) Writing long paragraphs without breaks
- D) Not using a greeting

2. Which research method is often used to assess market opportunities for a new business?

- A) Historical analysis
- B) Surveys and questionnaires
- C) Personal opinions
- D) Guesswork

3. Which of the following is a primary motivation for entrepreneurs?

- A) Seeking a stable salary
- B) Solving problems and creating value
- C) Avoiding risk
- D) Working within a corporate structure

4. True or False: An entrepreneur's role in the economy is limited to running a business for profit.
5. True or False: The entrepreneurial mindset involves risk-taking, resilience, and the ability to adapt to challenges.
6. True or False: Entrepreneurship only applies to individuals who start their own businesses and does not include individuals who work within large corporations.