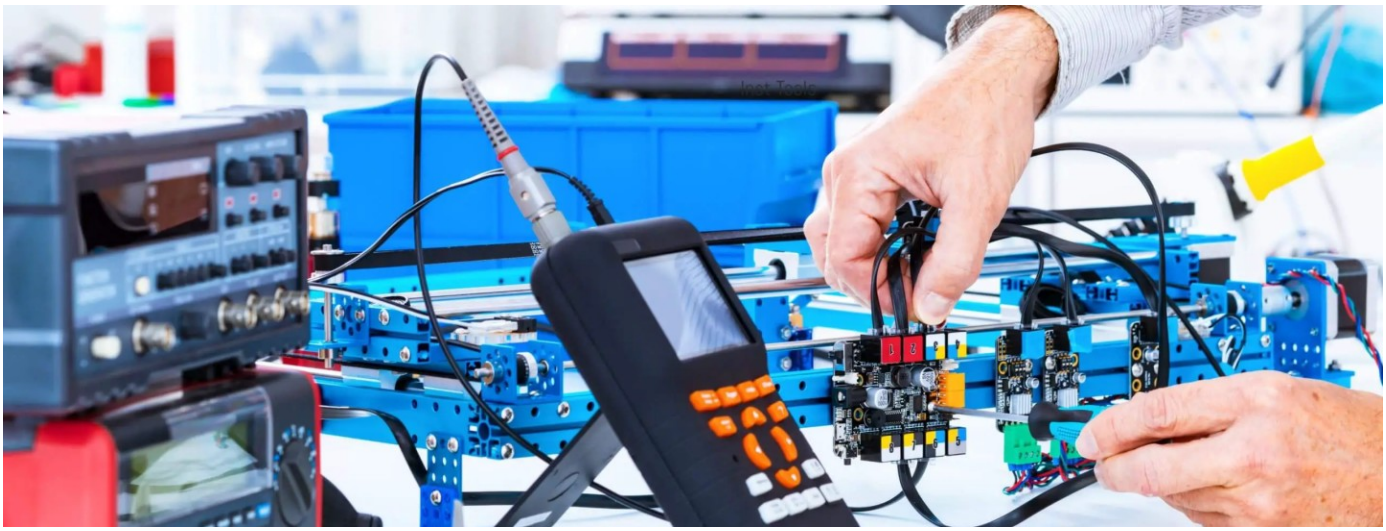
TECHNICAL
EDUCATION
ACADEMY

School of Engineering

COURSE PROGRAMME

000494

ELPO018 - Electrical Equipment Monitoring, Diagnostics, and Maintenance



Learn from the Best in the Business!

Course overview

Foundation level

Why take this course

Our course, "Electrical Equipment Monitoring, Diagnostics, and Maintenance," has been meticulously designed to cater to professionals in the electrical engineering field, delivering comprehensive knowledge and practical skills necessary to navigate the complex landscape of modern electrical systems.

In a world increasingly reliant on electrical power, the ability to efficiently monitor, diagnose, and maintain electrical equipment is invaluable. This course offers a detailed exploration of electrical machines, power electronics, and drives, touching on everything from basic principles to advanced diagnostic techniques. Participants will be introduced to an array of equipment, including transformers, inverters, rectifiers, switchgear, circuit breakers, relays, cables, motors, and generators, among others.

Understanding how this equipment operates, fails, and can be repaired is at the core of our curriculum. We guide participants through methods for inspecting and diagnosing issues in various components, helping them develop troubleshooting skills that minimize downtime and optimize operating costs. From there, we delve into repair and refurbishment techniques, providing a nuanced understanding of how to prolong the life of electrical equipment and enhance efficiency.

Yet, the course is not limited to problem-solving. We believe prevention is better than cure, which is why we focus on online condition monitoring and protective systems, equipping participants with strategies to proactively detect potential faults and mitigate risks.

In addition, the training programme takes into account the regulatory landscape, covering applicable codes and standards to ensure compliance. A unique feature of our course is the hands-on labs and simulations that allow participants to apply theoretical knowledge in practical scenarios.

Whether you are an engineer, technician, project manager, or any professional working with electrical systems, this course offers a robust understanding of electrical equipment, as well as the necessary toolkit to maintain them. Upon completion, you will be equipped to boost the performance, reliability, and lifespan of electrical systems, providing a competitive edge in today's dynamic electrical engineering field.

Who it is for and how it helps

This course is ideally suited for a range of individuals in the field of electrical engineering and related disciplines. Specifically, it will be most beneficial for:

- Electrical Engineers: Individuals involved in the design, installation, maintenance, or inspection of electrical systems, equipment, and machinery.

- Technicians and Maintenance Personnel: Individuals responsible for the upkeep, troubleshooting, and repair of electrical equipment.

Course overview — continued

- Plant and Facility Managers: Those overseeing operations in facilities where electrical machines, power electronics, and drives are heavily used.
- Electricians: Professionals who install, maintain, and repair electrical systems and equipment, who can enhance their understanding and capabilities with this advanced knowledge.
- Electrical Equipment Suppliers: Staff who deal with the supply of electrical machinery, power electronics, and drives, who need to understand the operation, maintenance, and potential issues that clients may face.
- Power Systems Engineers: Professionals working in power generation, transmission, and distribution who need an advanced understanding of the machinery and equipment they work with.
- Inspection and Quality Control Personnel: Those tasked with ensuring the quality and safety of electrical systems, who can benefit from the comprehensive inspection and diagnostic techniques taught.
- Project Managers: Those managing projects involving the use and maintenance of electrical equipment, who can use this knowledge to better plan and execute their projects.
- Safety Officers: Professionals in charge of ensuring safe practices and protocols in an electrical environment.
- Individuals seeking certification or advancement in the field of electrical engineering, specifically related to electrical machines, power electronics, and drives.

What you will learn

- Understand the core principles and operations of electrical machines, power electronics, and drives, and identify common failures
- Apply advanced diagnostic techniques for fault detection in synchronous generators, multi-phase machines, and other electrical components
- Conduct comprehensive testing, maintenance, and inspection procedures for essential electrical equipment
- Implement effective troubleshooting strategies to minimize downtime and reduce operating costs of various electrical systems
- Utilize online condition monitoring practices for real-time assessment of equipment performance
- Apply repair, refurbishment, and upgrading techniques to enhance the efficiency and longevity of electrical systems
- Perform vibration analysis and balance rotating equipment like motors and generators
- Understand and adhere to the applicable codes and standards for electrical equipment
- Recognize the causes and modes of equipment failure and devise preventive measures
- Successfully complete the hands-on labs and simulations, pass the final assessment, and earn the certification in Modern Diagnostics Techniques for Electrical Machines, Power Electronics, and Drives

Curriculum

Modules 01–06

01 Introduction to Electrical Machines, Power Electronics, and Drives

- Basic principles and functions
- Overview of common failures and the need for diagnostic techniques
- Overview of key electrical equipment

02 Inspection, Testing, and Maintenance of Electrical Equipment

- In-depth inspection processes
- Testing and maintenance procedures for each type of equipment
- Diagnostics techniques for various equipment types

03 Stator-Generator Model Simulation Techniques and Troubleshooting

- Introduction to the Winding Function Approach and dq0 transform
- Understanding hybrid models for stator-interturn short circuits
- Analysing the effects of local saturation of the magnetic circuit
- Techniques to minimize downtime and operating costs

04 Fault Localization in Synchronous Generators and Online Condition Monitoring

- Analyzing excitation-system faults
- Understanding the influence of fault resistance
- Introduction to fault location algorithms
- Principles and processes of online condition monitoring

05 Diagnosing Interturn Short-Circuit in Multi-Phase Machines

- Introduction to space vector spectral analysis
- Fault diagnosis in five-phase Permanent Magnet Synchronous Motors (PMSMs)

06 Fault Detection in Three-Phase PMSMs and Repair, Refurbishment of Electrical Equipment

- Understanding parameter identification methods
- Working with the Extended Kalman Filter (EKF) for real-time estimations

Curriculum

Modules 06–11 · Module 06 — continued

- Dealing with variable load and speed conditions
- Techniques and strategies for equipment repair

07 Diagnosis of Static Eccentricities in Axial Flux PMSMs and Maximizing Efficiency, Reliability, and Longevity

- Introduction to Static Eccentricity Factor (SEF)
- Understanding search coils and back electromotive forces
- Understanding and improving equipment efficiency

08 Sensor Failure Detection in Induction Motor Drives and Vibration Analysis, Balancing of Rotating Equipment

- Understanding the vector-controlled Induction Motor (IM) drive
- Identifying current and speed sensor failures
- Fundamentals of vibration analysis

09 Fault Detection in Coupling Inductors and Understanding Electrical Equipment Codes, Standards

- Identifying incipient faults in coupling inductors in adjustable-speed drives
- Developing strategies for early fault detection
- Comprehensive study of applicable codes and standards

10 Rotor Position Sensor Fault Detection in PMSM Drives and Causes, Modes of Equipment Failure

- Understanding the use of full-order Luenberger observers
- Working with adaptive thresholds for fault detection
- Understanding potential causes of equipment failure

11 Electronic Failure Detection in IGBT and Generator Upgrades, Rewinds

- Adaptive threshold-based approach for IGBT failure detection
- Dealing with open-circuit and short-circuit failures

Curriculum

Modules 11–12 · Module 11 — continued

- Techniques for upgrading generators

12 Power Loss Analysis in Fault-Tolerant Drives and Introduction to Protective Systems

- Evaluating losses in power components
- Understanding thermal stresses and rated power reduction
- Overview of protective systems for various electrical equipment

Joining the programme

Contact the Academy and quote course code 000494 to confirm dates, delivery format, prices and enrolment terms.

Training for your team

Tell us your business goals, the roles and number of participants, and your preferred dates and location. This will help us discuss the right training option.

Preparing for the programme

The published programme does not specify any prerequisites. Contact us before enrolling to confirm how to prepare.

Discuss your training needs

mail@tecedu.org
www.tecedu.academy

Learn from the Best in the Business!