

**COURSE OVERVIEW EE0421**  
**Electrical Transformers & Switchgears**  
*Faults, Inspection, Testing, Maintenance & Troubleshooting*

**Course Title**

Electrical Transformers & Switchgears  
*Faults, Inspection, Testing, Maintenance & Troubleshooting*

**Course Date/Venue**

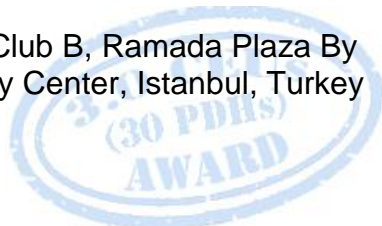
October 27-31, 2024/Club B, Ramada Plaza By Wyndham Istanbul City Center, Istanbul, Turkey

**Course Reference**

EE0421

**Course Duration/Credits**

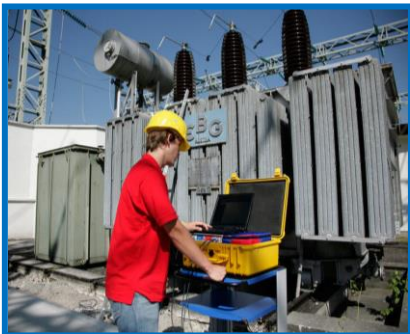
Five days/3.0 CEUs/30 PDHs



**Course Description**



***This practical and highly-interactive course includes various practical sessions and. Theory learned will be applied using our state-of-the-art simulators.***



This course is designed to provide participants with a detailed and up-to-date overview of Electrical Transformers and Switchgears: Faults, Inspection, Testing, Maintenance and Troubleshooting. It covers the electrical transformers and switchgears and their role in power distribution and protection; the principles of transformer operation, construction, components, ratings and specifications; the types of transformers, common faults and failure modes in transformers; the transformer cooling methods, transformer insulation degradation and transformer protection schemes; the pre-installation inspection of transformers, visual and mechanical inspections, electrical tests and transformer oil testing; and the transformer maintenance strategies, condition monitoring techniques and transformer temperature, vibration and noise monitoring.



During this interactive course, participants will learn the switchgears and their functions, types of switchgears, components of switchgears and switchgear ratings and specifications; the common faults and failure modes in switchgears, insulation breakdown, flashover, circuit breaker failures and maloperations, overcurrent and short circuit faults; the switchgear inspection, testing, maintenance and troubleshooting; the lubrication, cleaning and tightening practices; and the diagnostic techniques for switchgear components, emergency repairs and fault rectification.

## Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Inspect, test, maintain and troubleshoot electrical transformers and switchgears faults in a professional manner
- Discuss electrical transformers and switchgears and their role in power distribution and protection
- Explain the principles of transformer operation, construction, components, ratings and specifications
- Identify the types of transformers, common faults and failure modes in transformers
- Carryout transformer cooling methods, transformer insulation degradation and transformer protection schemes
- Apply pre-installation inspection of transformers, visual and mechanical inspections, electrical tests and transformer oil testing
- Employ transformer maintenance strategies, condition monitoring techniques and transformer temperature, vibration and noise monitoring
- Identify switchgears and their functions, types of switchgears, components of switchgears and switchgear ratings and specifications
- Recognize common faults and failure modes in switchgears, insulation breakdown, flashover, circuit breaker failures and maloperations, overcurrent and short circuit faults
- Employ switchgear inspection, testing, maintenance and troubleshooting
- Apply lubrication, cleaning and tightening practices as well as diagnostic techniques for switchgear components, emergency repairs and fault rectification

## Who Should Attend

This course provides an overview of all significant aspects and considerations of inspection, testing, maintenance and troubleshooting of electrical transformers and switchgears faults for electrical engineers, electrical technicians and other maintenance and project technical staff who are involved in the design testing, commissioning, maintenance, repair and troubleshooting of power transformer and medium voltage switchgears.

## Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

- 30% Lectures
- 20% Practical Workshops & Work Presentations
- 30% Hands-on Practical Exercises & Case Studies
- 20% Simulators (Hardware & Software) & Videos


In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

### Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

### Certificate Accreditations


Certificates are accredited by the following international accreditation organizations: -

- 
The International Accreditors for Continuing Education and Training (IACET - USA)

Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units (CEUs)** in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

- 
British Accreditation Council (BAC)

Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

### Course Fee

**US\$ 6,000** per Delegate + **VAT**. This rate includes Participants Pack (Folder, Manual, Hand-outs, etc.), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.



### Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:



**Mr. Pan Marave, PE, MSc, BEng**, is a **Senior Electrical & Instrumentation Engineer** with over **40 years** of extensive experience in **Oil, Gas, Petrochemical, Refinery & Power** industries. His expertise includes **CEMS Operations and Maintenance, ABB 11KV Distribution Switchgear, Operation & Maintenance of Rotork make MOVs, Maintaining Instrument Air Compressors, Circuit Breaker, HV Switchgear Maintenance, HV/LV Electrical Authorisation, Basic Electricity, Electrical & Special Hazards, Personnel Protection, HV/LV Equipment, Motor Controllers, Electrical Switching Practices, Emergency Planning, Safety Management, Safety Instrumented Systems (SIS), Safety Integrity Level (SIL), Emergency Shutdown (ESD); DCS, SCADA & PLC; Measurement (Flow, Temperature, Pressure); Process Analyzers & Analytical Instrumentation; Process Control, Instrumentation & Safeguarding; Process Controller, Control Loop & Valve Tuning; Industrial Distribution Systems; Industrial Control & Control Systems, Power Systems Protection & Relaying; Earthing, Bonding, Grounding, Lightning & Surge Protection; Electric Power Substation & Systems; Electrical Engineering Principles; Motor Control Circuit; Electrical Fault Analysis; Electrical Networks & Distribution Cables; Circuit Breakers, Switchgears, Transformers, Hazardous Areas Classification and Detailed Engineering Drawings, Codes & Standards.** Furthermore, he is also well-versed in Microprocessors Structure, Lead Auditor (**ISO 9000:2000**), **ISO 9002**, Quality Assurance, and Projects & Contracts Management.

Presently, Mr. Marave is the **Technical Advisor** of **Chamber of Industry & Commerce** in Greece. Prior to this, he gained his thorough practical experience through several positions as the **Technical Instructor, Engineering Manager, Electronics & Instruments Head, Electrical, Electronics & Instruments Maintenance Superintendent, Assistant General Technical Manager** and **Engineering Supervisor** of various international companies such as the **Alumil Mylonas, Athens Papermill, Astropol** and the **Science Technical Education**.

Mr. Marave is a **Registered Professional Engineer** and has **Master's** and **Bachelor's** degrees in **Electrical Engineering** from the **Polytechnic Institute of New York** and **Pratt Institute of New York (USA)** respectively. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management (ILM)** and an active member of the **Technical Chamber** and the **Institute of Electrical and Electronics Engineer (IEEE)** in Greece. He has presented and delivered **numerous international** courses, conferences, trainings and workshops worldwide.

### Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

### Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

#### **Day 1 Sunday, 27<sup>th</sup> of October 2024**

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	<b>PRE-TEST</b>
0830 – 0930	<b>Introduction to Transformers &amp; Switchgears</b> Electrical Transformers & Switchgears • Role in Power Distribution & Protection • Types & Classifications of Transformers & Switchgears • Relevant Standards & Regulations
0930 – 0945	Break
0945 – 1030	<b>Transformer Basics &amp; Construction</b> Principles of Transformer Operation • Transformer Construction & Components
1030 – 1230	<b>Transformer Basics &amp; Construction (cont'd)</b> Transformer Ratings & Specifications • Types of Transformers (Power, Distribution, Instrument, Etc.)
1230 – 1245	Break
1245 – 1420	<b>Transformer Basics &amp; Construction (cont'd)</b> Transformer Cooling Methods
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day One

#### **Day 2 Monday, 28<sup>th</sup> of October 2024**

0730 – 0930	<b>Transformer Faults &amp; Failure Modes</b> Common Faults & Failure Modes in Transformers • Transformer Insulation Degradation • Overheating & Thermal Faults
0930 – 0945	Break
0945 – 1100	<b>Transformer Faults &amp; Failure Modes (cont'd)</b> Short Circuits & Electrical Faults • Transformer Protection Schemes
1100 – 1230	<b>Transformer Inspection &amp; Testing</b> Pre-Installation Inspection of Transformers • Visual & Mechanical Inspections • Electrical Tests (Turns Ratio, Insulation Resistance, Etc.)
1230 – 1245	Break
1245 – 1420	<b>Transformer Inspection &amp; Testing (cont'd)</b> Transformer Oil Testing (Dissolved Gas Analysis, Moisture Content, Etc.) • Interpretation & Analysis of Test Results
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day Two

#### **Day 3 Tuesday, 29<sup>th</sup> of October 2024**

0730 – 0930	<b>Transformer Maintenance &amp; Condition Monitoring</b> Transformer Maintenance Strategies (Preventive, Predictive, Corrective) • Maintenance of Transformer Accessories (Bushings, Tap Changers, Etc.) • Importance of Condition Monitoring Techniques
0930 – 0945	Break
0945 – 1100	<b>Transformer Maintenance &amp; Condition Monitoring (cont'd)</b> Monitoring Transformer Temperature, Vibration & Noise • Use of Diagnostic Tools & Equipment

1100 – 1230	<b>Switchgear Basics &amp; Construction</b> Switchgears & Their Functions • Types of Switchgears (Low Voltage, Medium Voltage, High Voltage) • Components of Switchgears (Circuit Breakers, Disconnect Switches, Relays, Etc.)
1230 – 1245	Break
1245 – 1420	<b>Switchgear Basics &amp; Construction (cont'd)</b> Arc Interruption & Quenching Techniques • Switchgear Ratings & Specifications
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day Three

**Day 4 Wednesday, 30<sup>th</sup> of October 2024**

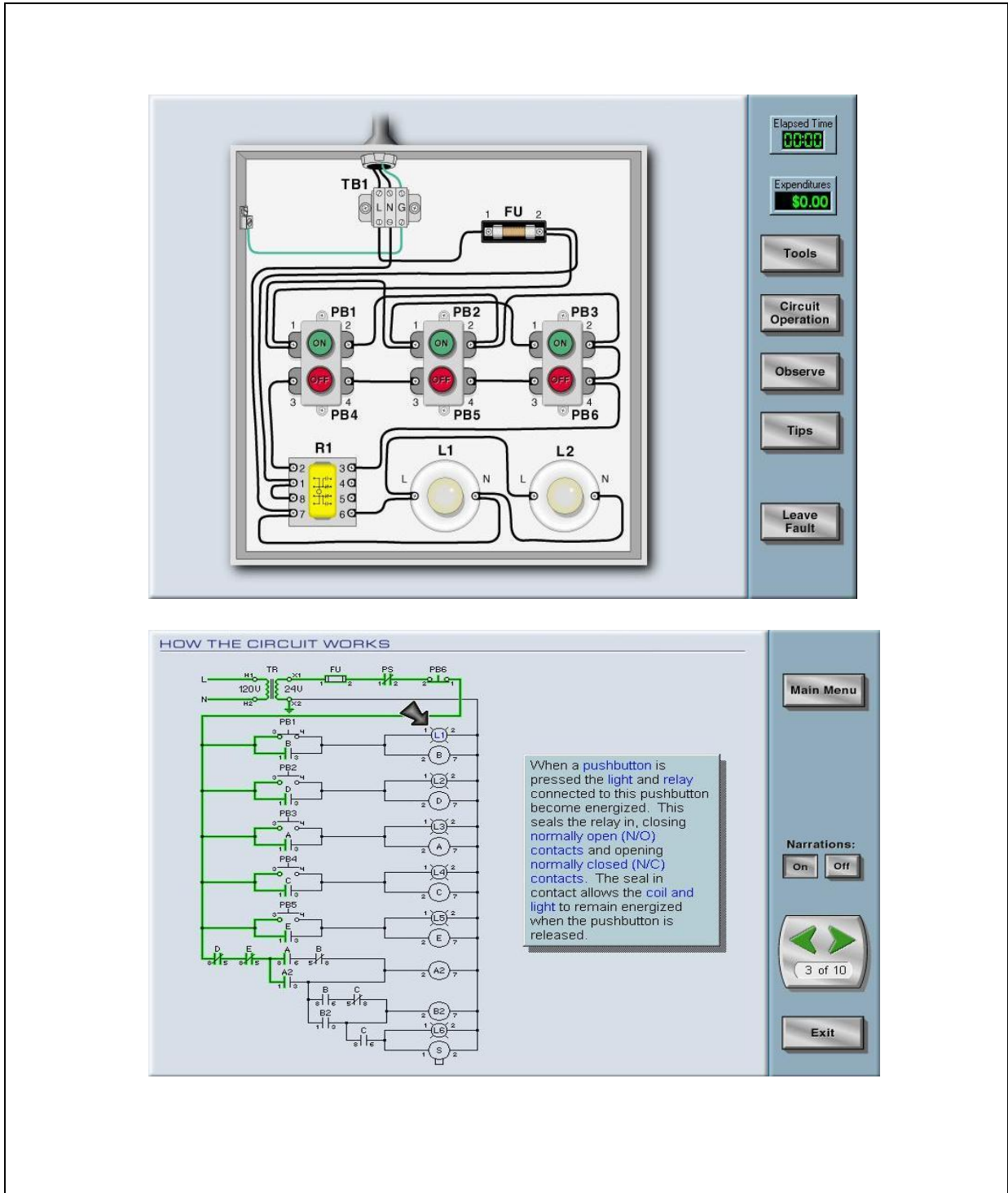
0730 – 0930	<b>Switchgear Faults &amp; Failure Modes</b> Common Faults & Failure Modes in Switchgears • Insulation Breakdown & Flashover • Circuit Breaker Failures & Maloperations
0930 – 0945	Break
0945 – 1100	<b>Switchgear Faults &amp; Failure Modes (cont'd)</b> Overcurrent & Short Circuit Faults • Switchgear Coordination & Selectivity
1100 – 1230	<b>Switchgear Inspection &amp; Testing</b> Pre-Installation Inspection of Switchgears • Visual & Mechanical Inspections • Electrical Tests (Contact Resistance, Insulation Resistance, Etc.)
1230 – 1245	Break
1245 – 1420	<b>Switchgear Inspection &amp; Testing (cont'd)</b> Protection Relay Testing & Calibration • Testing of Auxiliary Devices (Alarms, Meters, Trip Circuits, Etc.)
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day Four

**Day 5 Thursday, 31<sup>th</sup> of October 2024**

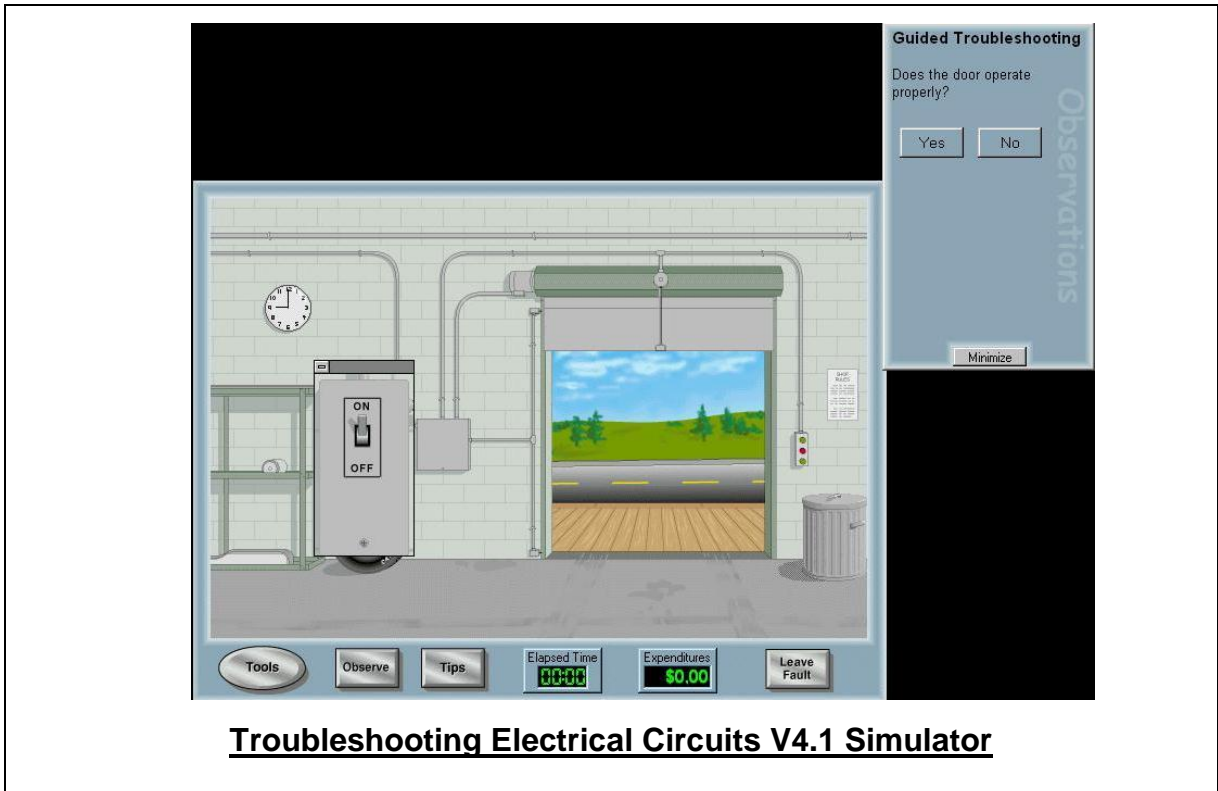
0730 – 0930	<b>Switchgear Maintenance &amp; Troubleshooting</b> Maintenance Procedures for Switchgears • Lubrication, Cleaning, & Tightening Practices
0930 – 0945	Break
0945 – 1100	<b>Switchgear Maintenance &amp; Troubleshooting (cont'd)</b> Troubleshooting Common Switchgear Issues • Diagnostic Techniques for Switchgear Components
1100 – 1230	<b>Switchgear Maintenance &amp; Troubleshooting (cont'd)</b> Emergency Repairs & Fault Rectification
1230 – 1245	Break
1245 – 1345	<b>Case Studies &amp; Practical Exercises</b> Analyzing Real-World Case Studies Related to Transformer & Switchgear Faults • Practical Exercises for Transformer Testing, Maintenance, & Troubleshooting • Group Discussions & Knowledge Sharing • Q&A Session for Clarifications & Further Discussions
1345 – 1400	<b>Course Conclusion</b>
1400 – 1415	<b>POST-TEST</b>
1415 – 1430	Presentation of Course Certificates
1430	Lunch & End of Course

### Simulators (Hands-on Practical Sessions)

Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using our state-of-the-art “Troubleshooting Electrical Circuits V4.1 Simulator” and “Lab Volt Testing Device”.







**Course Coordinator**

Mari Nakintu, Tel: +971 2 30 91 714, Email: [mari1@haward.org](mailto:mari1@haward.org)