



COURSE OVERVIEW EE0275-4D
Power System Protection & Relaying
Electrical Protection Systems

Course Title

Power System Protection & Relaying: *Electrical Protection Systems*

Course Date/Venue

June 24-27, 2024/Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

Course Reference

EE0275-4D

Course Duration/Credits

Four days/2.4 CEUs/24 PDHs



Course Description

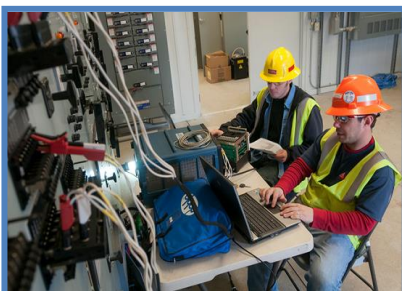


This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.

This course is designed to provide delegates with detailed and up-to-date overview of power system protection and relaying. It covers the various faults, their effects and calculations including the effect of faults on equipment; and the earthing system and standard requirement.



The course will also discuss the protection devices and technology including history, construction and principles of protection relays; the IED's and fuses; the instrument transformers, current and voltage transformers as well as types, construction, performance, specification and applications; the tripping devices of circuit breakers; the mechanism of electric arc breakdown; and the principles & calculation of settings for grading and protection coordination.



Overhead lines and feeder protection including the common types of faults and causes; the proper procedure for transformer protection related to restricted Buchholz relay, overpressure, oil and winding temperature; the proper procedure for motor protection; various electrical and mechanical faults; the various generator data requirements; the types of faults, excitation fault protection and mechanical fault protection; the miscellaneous protection including voltage and frequency protections, bus bar protection; and the circuit breaker failure protection will also be discussed during the course.

Course Objectives

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

- Apply and gain systematic techniques in power system protection and relaying
- Identify various faults, their effects and calculations including the effect of faults on equipment
- Recognize earthing system and standard requirement
- Explain protection devices and technology including history, construction and principles of protection relays
- Describe IED's and fuses covering the main protection and back-up protection
- Discuss instrument transformers including current and voltage transformers as well as types, construction, performance, specification and applications
- Review tripping devices of circuit breakers and illustrate the mechanism of electric arc breakdown
- Explain the principles & calculation of settings for grading and protection coordination & cite practical examples
- Analyse overhead lines and feeder protection including the common types of faults and causes
- Implement the proper procedure for transformer protection related to restricted Buchholz relay, overpressure, oil and winding temperature
- Apply the proper procedure for motor protection by analyzing motor data requirements as well as identifying various electrical and mechanical faults
- List the various generator data requirements, types of faults, excitation fault protection and mechanical fault protection
- Identify miscellaneous protection including voltage and frequency protections, bus bar protection and circuit breaker failure protection
- Employ protection relay management and practice simulator

Exclusive Smart Training Kit - H-STK®



Participants of this course will receive the exclusive “Howard Smart Training Kit” (H-STK®). The H-STK® consists of a comprehensive set of technical content which includes **electronic version** of the course materials, sample video clips of the instructor’s actual lectures & practical sessions during the course conveniently saved in a **Tablet PC**.

Who Should Attend

This course provides a complete and up-to-date overview of the power system protection and relaying for engineers and other technical staff who are involved in the protection and relaying of various power systems, equipment and networks.

Course Fee


US\$ 4,500 per Delegate + **VAT**. This rate includes H-STK® (Howard Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

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:-

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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 **2.4 CEUs** (Continuing Education Units) or **24 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.

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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.

Accommodation

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



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:



Dr. Mike Tay, PhD, MSc, BSc, is a Senior Electrical, Instrumentation & Communications Engineer with over 40 years of extensive experience. His expertise widely covers Protective Devices Troubleshooting, Protective Devices Testing & Maintenance, Uninterruptible Power Supply (UPS) Design, Industrial UPS Systems & Battery Power Supplies Maintenance & Troubleshooting, UPS & Battery System, Battery & Battery Charger & UPS and Measurement Devices, UPS System & Battery Chargers Maintenance & Troubleshooting, UPS & Battery Design, Operation, Maintenance & Troubleshooting, UPS Operation & Alarm Panel Reading, Process Control & Instrumentation, Process Control Troubleshooting & Problem Solving, Process Control System, Advanced Process Control (APC) Technology, Process Control & Loop Tuning, Process Control & Automation, Data Accuracy & System Function, Control System Interface, Artificial Intelligence Application, Data Analytics and its Importance, AI is Used in Exploration and Production, AI for Reservoir Management, Distributed Control Systems (DCS), Programmable Logic Controller (PLC), Interruptible Power Systems (UPS), Supervisory Control and Data Acquisition (SCADA), Network Comprehensive, Systems Analysis, SCADA Security, ESD System Function, Analysis & Control, Modern Power Systems Protective Relaying, Custody Measurement & Loss Control, Fiber Optics Access Network Planning, Process Analyzer & Analytical Instrumentation, HV/MV Substation Design & Maintenance, Combined Cycle Power Generation, PLC & SCADA Automation, Advanced Online Analyzer, Protection Relay Maintenance, Power System Faults, Current & Voltage Transformers, Power System Neutral Grounding, Feeder Overcurrent Protection, Electrical Protection Systems, Bus Protection, Motor Protection, Transformer Protection, Generator Protection, Numerical Relays, ESD System Analysis & Control, Custody Measurement, Safety Instrumented System (SIS), Safety Integrity Level (SIL), Power System, Power Supply Design Management, Diesel Generator, Electric Motors and Basic Electricity & Electrical Codes. Further, he is also well-versed in Communications, Telecommunications, Mobile Protocols, 4G LTE, GSM/UMTS, CMDA2000, WIMAX Technology, HSPA+, Alarm Management System, Computer Architecture, Logic & Microprocessor Design, Embedded Systems Design plus Computer Networking with CISCO, Network Communication, Industrial Digital Communication, Designing Telecommunications Distribution System, Electrical Engineering, WiMAX Broadband Wireless System, TT Intranet & ADSL Network, TT Web & Voicemail, Off-site ATM Network, IT Maintenance, Say2000i, IP Phone, National Address & ID Automation, Electricity Distribution Network, Customs Network & Maintenance, LAN & WAN Network, UYAP Network, Network Routing Protocols, Multicast Protocols, Network Management Protocols, Mobile & Wireless Networks and Digital Signal Processing.

During his career life, Dr. Tay worked with various universities and institutions such as the KOC Sistem, Meteksan Sistem, Altek BT, Yasar University, Dokuz Eylul University and METU and occupied significant positions being the **Aegean Region Manager, Group Leader, Technical Services Manager, Field Engineer, Instrumentation & Control Engineer, Research Assistant, Instructor, Instrumentation & Control Instructor, Technical Advisor, Technical Consultant and Senior Instructor/Lecturer.**

Dr. Tay has **PhD, Master and Bachelor** degrees in **Electrical & Electronics Engineering** from the **Dokuz Eylul University** and the **Middle East Technical University (METU)** respectively. Further, he is a **Certified Instructor/Trainer, a Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management (ILM)**, a **Certified CISCO (CCSP, CCDA, CCNP, CCNA, CCNP) Specialist, a Certified CISCO IP Telephony Design Specialist, CISCO Rich Media Communications Specialist, CISCO Security Solutions & Design Specialist and Information Systems Security (INFOSEC) Professional.** He has further hold certification in **Fundamentals of Process Control and Understanding Process Control: An Overview** and delivered and presented innumerable trainings, courses, workshops, seminars and conferences worldwide.

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 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: Monday, 24th of June 2024

0730 – 0800	<i>Registration & Coffee</i>
0800 – 0815	<i>Welcome & Introduction</i>
0815 – 0830	PRE-TEST
0830 - 0930	Basic Concepts <i>Introduction to the Topic • Main Electric Parameters & Laws • Standards & Regulations • Standard Voltages</i>
0930 - 0945	<i>Break</i>
0945 – 1100	Faults, Their Effects & Calculations <i>Types of Faults & Causes • Lightning, Switching Overvoltage & Use of Surge Arresters • Safety, Safety Distances & the Dangers of Faults • Short-circuit Faults (Phase & Earth Faults) • The Effect of Faults On Equipment (Thermal & Electromechanical Stress) • Short-circuit Calculations • Examples & Exercises</i>
1115 - 1230	Earthing System & Standard Requirement <i>Solid, Impedance & Ungrounded Systems • The Implications of Various Grounding Techniques on System Performance • Earth Grid & Calculations • Touch & Step Potentials • Examples & Exercises</i>
1230 - 1245	<i>Break</i>
1245 - 1420	Protection Devices & Technology <i>Introduction to Protection • Simple Protection Devices • Protection Relays (History; Construction & Principles of Operation; Modern Technology) • Classification of Protection Relays & Codes</i>
1420 - 1430	Recap <i>Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow</i>
1430	<i>Lunch & End of Day One</i>

Day 2: Tuesday, 25th of June 2024

0730 - 0930	Relays <i>Thermal Overload • Induction Type & Microprocessors Relays • Earth Fault • Over Current • Reverse Power • Field Failure • Shunt Trip, • Earth Leakage Relays</i>
0930 – 0945	<i>Break</i>

0945 – 1100	IED's & Fuses Main Protection & Back-up Protection • Intelligent Electronic Devices (IED's) • Fuses (Characteristics, Applications & Special Cares) • Examples & Exercises
1100 – 1230	Instrument Transformers Current & Voltage Transformers • Types, Construction, Performance, Specification & Applications • Magnetisation Curve & Characteristics (Ratio, Accuracy & Burden Power) • Testing • Examples
1230 - 1245	Break
1245 - 1420	Tripping Devices – Circuit Breakers The Mechanism of Electric Arc Breakdown • Types of Circuit Breakers & Applications (LV, MV & HV) • Main Characteristics • Operating Mechanism, Tripping Circuits & Control Systems • Examples
1420 - 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Two

Day 3: Wednesday, 26th of June 2024

0730 – 0930	Grading & Protection Co-ordination Principles • Analysis in HV, MV and LV Networks (Transmission & Distribution Networks; Users' Networks) • Calculation of Settings • LV Approach (Typical Time-Current Curves & Selectivity of LV Circuit Breakers) • Practical Examples
0930 – 0945	Break
0945 – 1115	Overhead Lines & Feeder Protection Analysis in HV, MV & LV Networks (Transmission & Distribution Networks) – Common Types of Faults & Causes • Distance Protection (Principle & Application) • Line Differential Protection (Principle & Application) • Overcurrent Protection • Temporary Faults & Auto-Reclosing
1115 - 1200	Overhead Lines Protection Practical Examples
1200 - 1230	Cable Protection Common Types of Faults & Causes • Differential Protection • Overcurrent Protection (Thermal & Short-circuit)
1230 - 1245	Break
1245 - 1420	Transformer Protection Basic Theory of Transformers • Types of Transformers & Applications • Main Electric Characteristics & Vector Group • Built-on Protections (Buchholz Relay, Overpressure, Oil & Winding Temperature) • Transformer Differential Protection (Principle & Application) • Overcurrent Protection • Practical Examples
1420 - 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Three

Day 4: Thursday, 27th of June 2024

0730 - 0930	<p>Motor Protection <i>Motor Data Requirements • Common Types of Faults (Electrical & Mechanical) • Motor Controllers & Starters • Overcurrent (Phase-to Earth & Phase-to-Phase Short-circuit) & Thermal Overload Protection • Negative Phase Sequence, Phase Unbalance & Phase Reversal Protections • Bearing Temperature, Winding Temperature, Vibration & Blocked Rotor Protections • Practical Examples & Exercises</i></p>
0930 - 0945	Break
0945 - 1100	<p>Generator Protection <i>Generator Data Requirements & Basic Theory • Common Types of Faults (Electrical & Mechanical) • Rotor & Stator Electric Faults Protection • Excitation Fault Protection • Voltage and Power (Reverse Power) Protections • Overfrequency & Overspeed Protections • Mechanical Faults Protection • Practical Examples & Exercises</i></p>
1100 - 1230	<p>Miscellaneous Protections <i>Voltage & Frequency Protections • Bus Bar Protection • Circuit Breaker Failure Protection • Testing • Single Phase Distribution Protections • Three Phase Distribution Protections • Circuit Diagrams for Protection Relays • Protection Coordination Curves & Grading • Testing of Relays • Causes of Termination Heating & Preventive Measure • Cause & Effect of Overload, Over Current, Short Circuit & Preventive Measures</i></p>
1230 - 1245	Break
1245 - 1345	<p>Protection Relay Management & Practice Simulator <i>Scheme Design • SAT & FAT • Commissioning • Maintenance & Testing</i></p>
1345 - 1400	<p>Course Conclusion <i>Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course</i></p>
1400 - 1415	POST-TEST
1415 - 1430	Presentation of Course Certificates
1430	Lunch & End of Course

Simulator (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 simulators “GE Multilin Relay 469” and “GE Multilin Relay 750”.



GE Multilin Relay 469 Simulator



GE Multilin Relay 750 Simulator

Course Coordinator

Mari Nakintu, Tel: +971 2 30 91 714, Email: mari1@haward.org