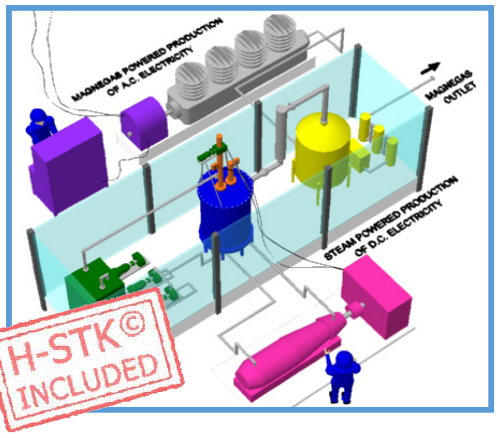
COURSE OVERVIEW EE0510
DC Machine Maintenance



Course Title
DC Machine Maintenance

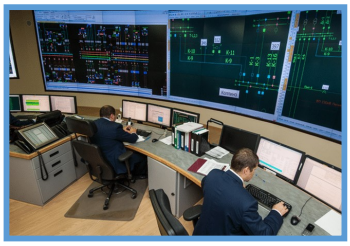
Course Date/Venue
Session 1: May 18-22, 2025/Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE
Session 2: December 08-12, 2025/Fujairah Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE

Course Reference
EE0510

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description

This practical and highly-interactive course includes real-life case studies and exercises where participants will be engaged in a series of interactive small groups and class workshops.



Power Electronics is an integral part of all modern systems design. Its applications range from the Power Utilities to the design of information superhighways and building space stations. The purpose of this course is to understand the basic operating principles of power conversion using advanced electronic devices. The structures and characteristics of switching devices are reviewed. Basic converters such as ac/dc rectifiers, dc/dc switching regulators, and dc/ac inverters are studied. Resonant power conversion techniques are introduced. Methods of analysis with derivatives of waveforms and computation of circuit quantities such as average and RMS values, power, power factor, and harmonics are given in some details.

Course Objectives

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

- To learn about the various types of power conversion systems
- To learn about different applications of power electronics, and get an overview of future trends in power electronics
- To understand ideal and practical switches and their switching characteristics
- To learn how to analyze power electronics circuits
- To learn techniques for calculating power using harmonic concepts
- To understand the operation and characteristics of rectifier circuits
- To understand the operation and characteristics of phase-controlled converter circuits
- To understand the operation and characteristics of force-commutated converter circuits
- To understand the operation and characteristics of Pulse Width Modulated (PWM) converters
- To understand the operation of the Buck, Boost, and Buck-Boost converters
- To learn about operating the converters in continuous and discontinuous conduction modes
- To understand the operation and characteristics of DC-AC inverters
- To learn about pulse-width modulation and its use in operating inverter circuits.
- To recognize the differences between high- and low-power converters
- To understand the advantages and disadvantages of soft-switching topologies
- To study the operation of Zero-Current and Zero-Voltage switching circuits
- To recognize the differences between resonance- and PWM converters

Exclusive Smart Training Kit - H-STK®

*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of all significant aspects and considerations of operations of interconnected power systems through AC and DC converter for electrical, electronics, control and instrumentation personnel.

Course Fee

US$ 5,500 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Accommodation

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

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: -

- 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.

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

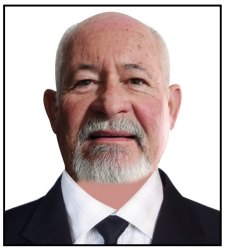
Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** 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.

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. Ken Steel is a **Senior Electrical & Instrumentation Engineer** with over **30 years** of extensive experience. His expertise widely covers **Earthing & Lightning Protection Design, Underground Equipment**, **Electrical Safety**, **Electrical Motors Testing**, **Heat Tracing** & Insulation Installation & Testing, **HV Terminations**, **High & Low Voltages** on Overhead Cranes, **HV/MV Cable Splicing**, **Cable & Over Head Power Line**, **HV/MV Switchgear, HV Cable** Design, **Medium & High Voltage** Equipment, **High Voltage Circuit Breaker** Inspection & Repair, **High Voltage Power** System, **HV Equipment** Inspection & Maintenance, **HV Switchgear** Operation & Maintenance, Resin / **Heat Shrink & Cold Shrink** Joints, **HV/LV Equipment**, **LV & HV** Electrical System, **Cable** Splicing & Termination, **High Voltage** Electrical Safety, **LV**, **MV & HV Cable** Installations & Properties, **LV Substation**, **MV & LV Cable**, **UPS Systems**, **MV & LV** Direct on Line Motor Drives, **MV & LV** VSD Motor Drives, **MV & LV** Soft Starter Motor Drives, **LV Two Speed Motor Drives**, Underground **Transformer Oil Containment Tank**, **Electrical & Instrumentation Construction** Installation, 1500KW, 1000KW, 1752KW **Diesel Power Plant Installation**, **110KV Overhead Line**, **110KV Outdoor Switchgear**, 110KV/10KV 6500KVA **Transformer**, **Transformer Substation**, 1600KVA 10KV/0.4KV & 2 Off 1000KVA **Diesel Generators**, 1600KVA 10KV/0.4KV & 1650KVA **Diesel Generator**, **110KV/35KV/10KV Substation**, 110KV/10KV **Transformers**,110KV & 2 Off 6KV **Overhead Lines**, 34.5KV,13.8KV ,4.16KV & 480V **Switchgear**, 4.16KV & 480V MCC, **Transformers & Motor Drives** Substations, **Diesel Driven Generators**, **Overhead Cranes**, **Overhead Cranes & HVAC Units**, **AC & DC Drives**, **Data Logger**, **Electrical, Instrumentation & Mechanical** Installation Maintenance, Slab Mills, Pre Heat Ovens, Hydraulic Shears, Stamping Machine, Gearboxes, Rollers, Pumps, Valves, Electro Magnets & Pump House Operation, Boilers Construction And Commissioning, Valve Calibration & Testing, Level Gauges, Pressure & Flow Transmitters Installation & Calibration, Pressure & Leak Testing of Boilers, Leak Testing, SMP, Elect, I&C, F&G, HVAC & Utility Services, Nitrogen Leak Test Operations, Steam Blowing Activities, SMP, Elect, I&C, F&G, HVAC & Utility Services, PTW Issue (PA/AC), Installation & Mechanical Piping and Hydro Testing & Leak Testing of Lines Installation.

During Mr. Steel's career life, he has gained his practical experience through several significant positions and dedication as the **3GP PBF & Boilers SC Commission Support**, **SC Site Execution Superintendent**, **E&I Construction Superintendent**, **High Voltage Construction Supervisor**, **Control & Power Construction Supervisor**, **Electrical & Instrumentation Supervisor**, **Electrical Technician**, **Construction Support Electrical Engineer**, **E&I Engineer**, **Electrical/Instrumentation Site Supervisor**, **Q.A/Q.C Inspector**, **Electrical/ Instrumentation Technician**, **Maintenance Fitter Instrumentation Technician**, **Millwright**, **Apprentice Millwright** and **Senior Instructor/Lecturer** for Tengiz Chevron Oil Kazakhstan, Al Jubail Saudi Arabia, Escravos Delta state Nigeria, Lurgi S.A, SuD Chemie Sasol Catalysts, J C Groenewalds Construction (LTA), Tycon (Goodyear S.A.), Dragline Construction and Iscor Vanderbijlpark.

Mr. Steel has a **Diploma** in **Electronics Mechanic**. Further, he is a **Certified Instructor/Trainer** and delivered numerous trainings, courses, workshops, seminars and conferences internationally.

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

0730 - 0800	*Registration & Coffee*
0800 - 0815	*Welcome & Introduction*
0815 - 0830	***PRE-TEST***
0830 - 0915	***Power Electronic System*** *Introduction • Power Electronics versus Linear Electronics • Scope and Applications • Classification of Power Processors and Converters • About the Text • Interdisciplinary Nature of Power Electronics • Convention of Symbols Used*
0915 - 0930	*Break*
0930 - 1100	***Overview of Power Semiconductor Switches*** *Introduction • Diodes • Thyristors • Desired Characteristics in Controllable Switches • Bipolar Junction Transistors and Monolithic Darlingtons • Metal-Oxide-Semiconductor Field Effect Transistors • Gate-Turn-Off Thyristors • MOS-Controlled Thyristors • Comparison of Controllable Switches • Drive and Snubber Circuits • Justification for Using Idealized Device Characteristics*
1100 - 1245	***Review of Basic Electrical and Magnetic Circuit Concepts*** *Introduction • Electric Circuits • Magnetic Circuits*
1245 - 1300	*Break*
1300 - 1420	***Computer Simulation of Power Electronic Converters and Systems*** *Introduction • Challenges in Computer Simulation • Simulation Process • Mechanics of Simulation • Solution Techniques for Time-Domain Analysis • Widely Used, Circuit-Oriented Simulators • Equation Solvers*
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 One*

Day 2

0800 - 0915	***Line-Frequency Diode Rectifiers: Line-Frequency AC → Uncontrolled DC*** *Introduction • Basic Rectifier Concepts • Single-Phase Diode Bridge Rectifiers • Voltage-Doubler (Single-Phase) Rectifiers • Effect of Single-Phase Rectifiers on Neutral Currents in Three-Phase, Four-Wire Systems*
0915 - 0930	*Break*
0930 - 1100	***Line-Frequency Diode Rectifiers: Line-Frequency AC → Uncontrolled DC (cont'd)*** *Three-Phase, Full-Bridge rectifiers • Comparison of Single-Phase and Three-Phase Rectifiers • Inrush Current and Overvoltages at Turn-On • Concerns and Remedies for Line-Current Harmonics and Low Power Factor*
1100 - 1245	***Line-Frequency Phase-Controlled Rectifiers and Inverters: Line-Frequency ↔ Controlled DC*** *Introduction • Thyristor Circuits and Their Control • Single-Phase Converters • Three-Phase Converters • Other Three-Phase Converters*
1245 - 1300	*Break*
1300 - 1420	***DC-DC Switch-Mode Converters*** *Introduction • Control of DC-DC Converters • Step-Down (Buck) Converter • Step-Up (Boost) Converter • Buck-Boost Converter • Cúk DC-DC Converter • Full Bridge DC-DC Converter • DC-DC Converter Comparison*
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

0800 - 0915	***Switch-Mode DC-AC Inverters: DC ↔ Sinusoidal AC*** *Introduction • Basic Concepts of Switch-Mode Inverters • Single-Phase Inverters • Three-Phase Inverters • Effect of Blanking Time on Output Voltage in PWM Inverters • Other Inverter Switching Schemes • Rectifier Mode of Operation*
0915 - 0930	*Break*
0930 - 1100	***Resonant Converters: Zero-Voltage and/or Zero-Current Switchings*** *Introduction • Classification of Resonant Converters • Basic Resonant Circuit Concepts • Load-Resonant Converters • Resonant-Switch Converters • Zero-Voltage-Switching, Clamped-Voltage Topologies • Resonant-dc-Link Inverters with Zero-Voltage Switchings • High-Frequency-Link Integral-Half-Cycle Converters*
1100 - 1245	***Switching DC Power Supplies*** *Introduction • Linear Power Supplies • Overview of Switching Power Supplies • DC-DC Converters with Electrical Isolation • Control of Switch-Mode DC Power Supplies • Power Supply Protection • Electrical Isolation in the Feedback Loop • Designing to Meet the Power Supply Specifications*
1245 - 1300	*Break*

1300 - 1420	***Power Conditioners and Uninterruptible Power Supplies*** *Introduction • Power Line Disturbances • Power Conditioners • Uninterruptible Power Supplies (UPSs)*
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

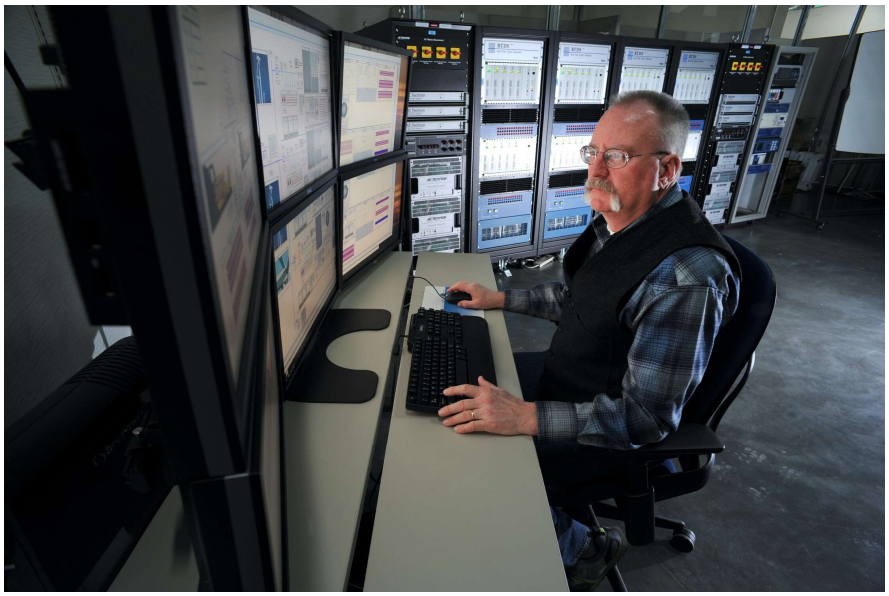
0800 - 0915	***Introduction to Motor Drives*** *Introduction • Criteria for Selecting Drive Components* ***DC Motor Drives*** *Introduction • Equivalent Circuit of DC Motors • Permanent-Magnet DC Motors • DC Motors with a Separately Excited Field Winding • Effect of Armature Current Waveform • DC Servo Drives • Adjustable-Speed DC Drives*
0915 - 0930	*Break*
0930 - 1100	***Induction Motor Drives*** *Introduction • Basic Principles of Induction Motor Operation • Induction Motor Characteristics at Rated (Line) Frequency and Rated Voltage • Speed Control by Varying Stator Frequency and Voltage • Impact of Nonsinusoidal Excitation on Induction Motors • Variable-Frequency Converter Classifications • Variable-Frequency PWM-VSI Drives • Variable-Frequency Square-Wave VSI Drives • Variable-Frequency CSI Drives • Comparison of Variable-Frequency Drives • Line-Frequency Variable-Voltage Drives • Reduced Voltage Starting ("Soft Start") of Induction Motors • Speed Control by Static Slip Power Recovery* ***Synchronous Motor Drives*** *Introduction • Basic Principles of Synchronous Motor Operation • Synchronous Motor Operation • Synchronous Servomotor Drives with Sinusoidal Waveforms • Synchronous Servomotor Drives with Trapezoid Waveforms • Load-Commutated Inverter Drives • Cycloconverters*
1100 - 1245	***Electric Utility Applications*** *Introduction • High-voltage DC Transmission*
1245 - 1300	*Break*
1300 - 1420	***Electric Utility Applications (cont'd)*** *Static var Compensators • Interconnection of Renewable Energy Sources and Energy Storage Systems to the Utility Grid*
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 Four*

Day 5

0800 - 0915	***Electric Utility Applications (cont'd)*** *Active Filters*
0915 - 0930	*Break*
0930 - 1045	***Optimizing the Utility Interface with Power Electronic Systems*** *Introduction • Generation of Current Harmonics • Current Harmonics and Power Factor*
1045 - 1100	*Break*
1100 - 1230	***Optimizing the Utility Interface with Power Electronic Systems (cont'd)*** *Harmonic Standards and Recommended Practices • Need for Improved Utility Interface*
1230 - 1345	***Optimizing the Utility Interface with Power Electronic Systems (cont'd)*** *Improved Single-Phase Utility Interface • Improved Three-Phase Utility Interface • Electromagnetic Interference*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course*
1400 - 1415	***POST-TEST***
1415 - 1430	*Presentation of Certificates*
1430	*Lunch & End of Course*

Practical Sessions

This practical and highly-interactive course includes real-life case studies and exercises:-



Course Coordinator

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