COURSE OVERVIEW EE0026
Digital Analysis of Electrical System

Course Title
Digital Analysis of Electrical System

Course Date/Venue
Session 1: May 18-22, 2025/Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE
Session 2: October 20-24, 2025/Fujairah Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE

Course Reference
EE0026

Course Duration/Credits
Five days/3.0 CEUs/30 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 participants with a detailed and up-to-date overview of Digital Analysis of Electrical System. It covers the importance of digital analysis in petroleum operations and the fundamentals of electrical system analysis; the digitalization and smart grid technologies, power quality analysis in digital systems and electrical fault detection using digital tools; the industry standards and regulations in digital electrical analysis; the digital monitoring and data acquisition systems as well as remote monitoring and control of electrical systems; and the predictive maintenance in electrical systems, condition monitoring techniques and reducing downtime with predictive analysis.

During this interactive course, participants will learn the digital relays and protection systems; the digital load flow and stability analysis including digital fault recording and event analysis; the digital signal processing (DSP) in electrical systems and AI and machine learning in electrical system analysis; the harmonic analysis and digital filtering including power system transients and digital analysis; the digital energy management and optimization and cybersecurity in digital electrical systems; the short circuit analysis, protection coordination, voltage stability and reactive power management and digital testing of electrical equipment; the digital twin technology and its benefits for electrical system analysis; and the best practices for implementing digital electrical analysis.

Course Objectives

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

- Apply and gain an in-depth knowledge on digital analysis of electrical system
- Discuss the importance of digital analysis in petroleum operations and the fundamentals of electrical system analysis
- Carryout digitalization and smart grid technologies, power quality analysis in digital systems and electrical fault detection using digital tools
- Review industry standards and regulations in digital electrical analysis
- Recognize digital monitoring and data acquisition systems as well as remote monitoring and control of electrical systems
- Apply predictive maintenance in electrical systems, condition monitoring techniques and reducing downtime with predictive analysis
- Recognize digital relays and protection systems as well as apply digital load flow and stability analysis including digital fault recording and event analysis
- Discuss digital signal processing (DSP) in electrical systems and AI and machine learning in electrical system analysis
- Carryout harmonic analysis and digital filtering including power system transients and digital analysis
- Apply digital energy management and optimization as well as cybersecurity in digital electrical systems
- Employ short circuit analysis, protection coordination, voltage stability and reactive power management and digital testing of electrical equipment
- Discuss digital twin technology and its benefits for electrical system analysis
- Employ best practices for implementing digital electrical analysis

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 digital analysis of electrical system for electrical engineers, power system engineers, control engineers, graduate students, renewable energy professionals, Maintenance and operations personnel, consultants and researchers, utility providers and other technical staff.

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 **45 years** of extensive experience. His expertise widely covers **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 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 Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the workshop 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 – 0930	***Overview of Digital Analysis in Electrical Systems*** *Importance of Digital Analysis in Petroleum Operations • Evolution from Analog to Digital Electrical Systems • Role of Digital Analysis in Predictive Maintenance • Adoption of Digital Technologies*
0930 – 0945	*Break*
0945 – 1030	***Fundamentals of Electrical System Analysis*** *Basics of Electrical Power Systems (Generation, Transmission, Distribution) • Electrical Parameters: Voltage, Current, Power, Frequency, Harmonics • Understanding Electrical Load Flow & System Stability • Measuring Electrical Performance in Real-Time*
1030 – 1130	***Digitalization & Smart Grid Technologies*** *Introduction to Smart Grid & Its Benefits • Key Components of a Digital Power System • Role of IoT in Electrical System Monitoring • Case Studies on Digitalization in Oil & Gas*
1130 – 1215	***Power Quality Analysis in Digital Systems*** *Definition & Importance of Power Quality • Identifying & Analyzing Power Quality Issues • Role of Digital Meters & Sensors in Power Quality Monitoring • Mitigation Strategies for Power Quality Problems*
1215 – 1230	*Break*

1230 – 1330	***Electrical Fault Detection Using Digital Tools*** *Common Electrical Faults in Petroleum Facilities • Digital Techniques for Fault Detection & Diagnosis • Implementation of Digital Protective Relays • AI & Machine Learning for Fault Prediction*
1330 – 1420	***Industry Standards & Regulations in Digital Electrical Analysis*** *IEEE & IEC Standards for Electrical System Analysis • Electrical System Compliance Requirements • NFPA 70E: Electrical Safety in the Workplace • Ensuring Regulatory Compliance in Digital Electrical Systems*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2

0730 – 0830	***Digital Monitoring & Data Acquisition Systems*** *Role of SCADA in Electrical System Monitoring • Data Acquisition Systems (DAQ) for Electrical Analysis • Communication Protocols (MODBUS, IEC 61850) • Integration with Power Infrastructure*
0830 – 0930	***Remote Monitoring & Control of Electrical Systems*** *Real-Time Data Collection & Analysis • Remote Diagnostics for Electrical Assets • Cloud-Based Electrical System Management • Cybersecurity in Remote Monitoring*
0930 – 0945	*Break*
0945 – 1100	***Predictive Maintenance Using Digital Technologies*** *Principles of Predictive Maintenance in Electrical Systems • Condition Monitoring Techniques (Vibration, Temperature, Ultrasound) • Role of Digital Twins in Electrical Asset Management • Reducing Downtime with Predictive Analysis*
1100 – 1215	***Digital Relays & Protection Systems*** *Basics of Digital Protective Relays • Differential Protection for Transformers & Motors • Digital Circuit Breakers & Their Applications • Integration with Digital Substations*
1215 – 1230	*Break*
1230 – 1330	***Digital Load Flow & Stability Analysis*** *Importance of Load Flow Studies in Operations • Using ETAP & MATLAB for Digital Load Flow Analysis • Identifying & Mitigating Power System Instabilities • Digital Approaches to System Optimization*
1330 – 1420	***Digital Fault Recording & Event Analysis*** *Functionality of Digital Fault Recorders (DFRs) • Capturing & Interpreting Event Data • Using Oscillography for Electrical Analysis • Case Studies on Fault Analysis in Petroleum Operations*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Two*

Day 3

0730 – 0830	***Digital Signal Processing (DSP) in Electrical Systems*** *Introduction to DSP for Power Systems • Fourier Transform & Wavelet Analysis • Noise Reduction & Signal Filtering • Applications in Real-Time Power Monitoring*
0830 – 0930	***AI & Machine Learning in Electrical System Analysis*** *Machine Learning Algorithms for Electrical System Prediction • AI-Based Fault Detection & Classification • Neural Networks for Load Forecasting • Implementing AI in Electrical Networks*
0930 – 0945	*Break*
0945 – 1100	***Harmonic Analysis & Digital Filtering*** *Sources & Effects of Harmonics in Petroleum Facilities • Harmonic Measurement Techniques • Digital Filtering for Harmonic Mitigation • Compliance with IEEE 519 Harmonic Standards*
1100 – 1215	***Power System Transients & Digital Analysis*** *Understanding Electrical Transients & Their Causes • Tools for Digital Transient Analysis (EMTP, PSCAD) • Case Studies on Surge & Switching Transients • Strategies for Mitigating Power System Transients*
1215 – 1230	*Break*
1230 – 1330	***Digital Energy Management & Optimization*** *Importance of Energy Management in Company's Operations • Smart Metering & Digital Energy Analytics • Dem& Response Strategies for Cost Savings • AI-Driven Load Forecasting & Optimization*
1330 – 1420	***Cybersecurity in Digital Electrical Systems*** *Cyber Threats to Electrical Networks • Securing SCADA & Industrial Control Systems • Best Practices for Protecting Digital Power Infrastructure • Cybersecurity Compliance Framework*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Three*

Day 4

0730 – 0830	***Electrical System Simulation Tools*** *Introduction to ETAP, MATLAB, & DIgSILENT • Building Digital Models for Power Systems • Benefits of Simulation for Electrical Assets • Case Studies on Digital System Simulation*
0830 – 0930	***Load Flow Analysis & Digital Simulations*** *Understanding Load Flow in Power Networks • Performing Load Flow Simulations in ETAP • Optimizing Load Distribution • Real-Time Applications in Electrical Load Balancing*
0930 – 0945	*Break*
0945 – 1100	***Short Circuit Analysis & Protection Coordination*** *Basics of Short Circuit Faults in Electrical Systems • Digital Analysis of Fault Currents • Protection Coordination Studies Using ETAP • Enhancing Electrical System Reliability*
1100 – 1215	***Voltage Stability & Reactive Power Management*** *Importance of Voltage Stability in Company's Operations • Digital Methods for Analyzing Voltage Stability • Reactive Power Compensation Strategies • Case Studies on Voltage Control & Optimization*

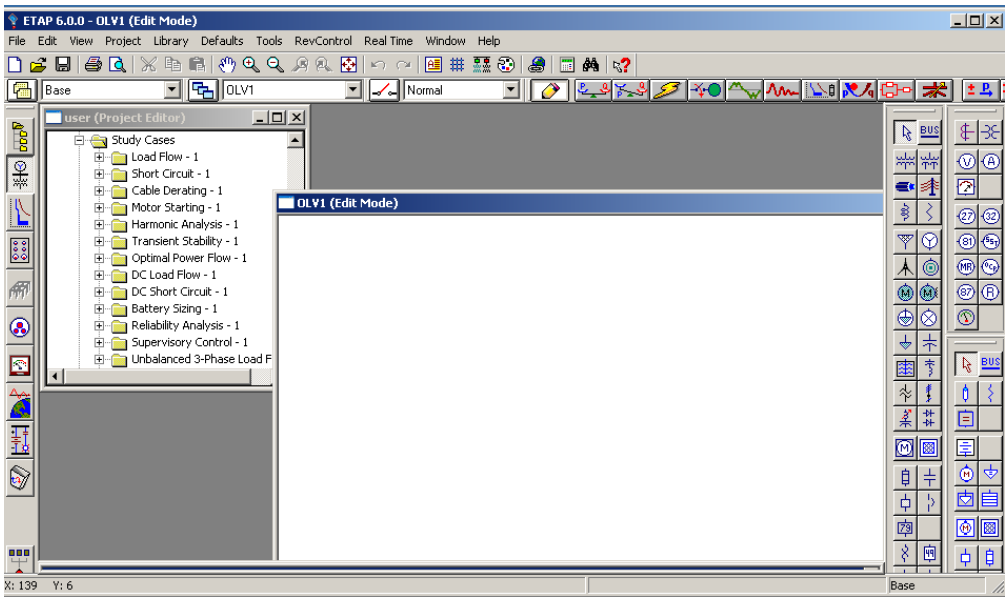
1215 – 1230	*Break*
1230 – 1420	***Digital Testing of Electrical Equipment*** *Importance of Digital Testing in Predictive Maintenance • Online vs. Offline Testing Methods • Digital Testing of Transformers, Switchgear, & Motors • Approach to Electrical Asset Management*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Four*

Day 5

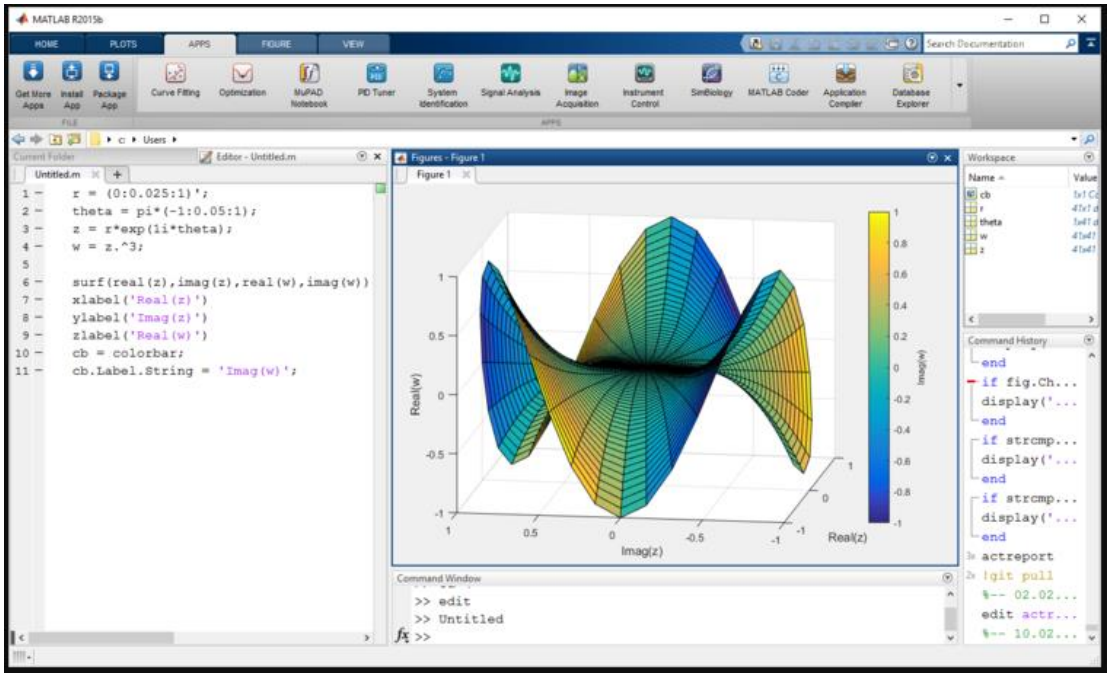
0730 – 0900	***Digital Twin Technology in Electrical Systems*** *Introduction to Digital Twin Technology • Benefits of Digital Twins for Electrical System Analysis • Applications in Power Grid Optimization • Implementing Digital Twins*
0900 – 1030	***Case Studies on Digital Electrical System Analysis*** *Digital Analysis of company's Power Networks • Lessons from Successful Implementations • Failures & Improvements in Digital Monitoring • Future Plans for Digital Transformation*
1030 – 1045	*Break*
1045 – 1230	***Best Practices for Implementing Digital Electrical Analysis*** *Benchmarking Against Industry Best Practices • Key Challenges & Solutions • Strategic Roadmap for Digital Power Management • Training & Skill Development for Digital Engineers*
1230 – 1245	*Break*
1245 – 1345	***Practical Hands-On Simulation & Analysis*** *Conducting Load Flow & Fault Analysis • Using ETAP & MATLAB for Digital Electrical Simulations • Implementing Predictive Maintenance • Case Study-Based Problem Solving*
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 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 "ETAP software" and "MATLAB" Simulator.



ETAP Software Simulator



MATLAB Simulator

Course Coordinator

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