COURSE OVERVIEW EE0907(AD4)
Transformer Types & Basic Theoretical Operations

Course Title
Transformer Types & Basic Theoretical Operations

Course Date/Venue
Session 1: June 16-20, 2025/Fujairah Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
Session 2: November 23-27, 2025/Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

Course Reference
EE0907(AD4)

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.

This course is designed to provide participants with a detailed and up-to-date overview of power transformers. It covers the testing of protective relays for a power transformer, transformer winding and dielectric tests, transformer oil, inter-tripping connection and the results of each test; the causes of common failures of transformers; the different types of transformers and insulation material used for the winding and core lamination; the routine checks for existing power transformers; the requirements of a design data sheet; the conditions required for the parallel operation of two transformers; the different types of cooling for transformers; the effect of abnormal load conditions on the transformer performance; and the circuit diagram for the main protection of a power transmission transformer.

During this interactive course, participants will learn the requirements for FAT test; the tests required for new transformers; the effect of harmonics on transformers; the types and applications of transformers tap changers; the inrush current for a power transformer; the sizing calculations for a power transformer; the required data input and results; and the preparation of data sheet for equipment and its requirements.

Course Objectives

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

- Apply and gain a comprehensive knowledge on power transformers
- Demonstrate the testing of protective relays for a power transformer, transformer winding and dielectric tests, transformer oil, inter-tripping connection and explain the results of each test
- Explain the causes of common failures of transformers
- List in writing the different types of transformers and where they are used and the components of a transformer
- Identify the different types of insulation material used for the winding and core lamination as well as identify the purpose of a transformer tap changer
- List the routine checks for existing power transformers and state the requirements of these checks
- Explain the requirements of a design data sheet for a power transformer
- List in the conditions required for the parallel operation of two transformers and explain what happens if these conditions are not met
- Explain the different types of cooling for transformers including AN, ONAN, ONAF and OFAF
- Explain the effect of abnormal load conditions on the transformer performance like the over load, over voltage and under frequency
- Draw the circuit diagram for the main protection of a power transmission transformer and explain how this protection system works
- Demonstrate the requirements for FAT test for power transformers
- State the tests required for new transformers and identify the requirements for each test
- Explain the effect of harmonics on transformers and how this can be eliminated and the transformer vector groups
- State the types and applications of transformers tap changers
- Explain what is the inrush current for a power transformer and why is it important for a protection coordination study, the different methods of earthing and the different applications and how to prepare a requisition and analyze technical bids
- Perform the sizing calculations for a power transformer and explain the required data input and results
- Prepare a data sheet for this equipment and explain the requirements

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 power transformers for those who are involved in power transformers.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course 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. Ahmed Hayajneh is a **Senior Electrical Engineer** with **20 years** of experience in **Oil**, **Gas**, **Petrochemical**, **Refinery** & **Power** industries. His expertise widely covers in the areas of **HV/MV** Cable Splicing, Jointing, Inspection & Termination, **HV/LV** Equipment, **High Voltage Electrical Safety**, **LV & HV Electrical** System, **HV** Equipment Inspection & Maintenance, **HV Switchgear** Operation & Maintenance, **LV Distribution Switchgear & Equipment**, LV/MV Electrical Safety (**11 KV, 415 & 220 Voltage**), **Power System Equipment**, **Power Cable** Standard and Testing, **Cables & Wiring**, **Overhead Transmission Lines**, **Transmission Network** Maintenance, **Electrical Forecasting** Techniques, **Inspection Reporting** Techniques, **Electrical Substation** Design & Planning, **Electrical Drawings** & **Schematics**, **Fault Detection** Analysis, **Distribution Networks** & **Load Forecasting**, **Power Generation**, **Electrical Power** System, **Electrical** Installations & Utilities, **Electrical Distribution Systems & Control Circuits**, **Electrical Drawings**, **Relay Logic Circuits**, Troubleshooting **Transformers**, **System Grounding**, **Circuit Breakers**, **Protection Devices & Technology**, **Protection Relay**, **Transformers**, **Generators**, **Power Transformers**, **Motors**, **Substations**, **Switchgears & Distribution**, **Power System** Analysis, **Electrical Equipment** Control Systems, **Transformer Maintenance & Testing**, **Electrical Substation & Design**, **Power Quality** Studies & Load Criteria, **Substation Earthing System**, **Electrical Equipment** Maintenance, **Electrical Safety**, **Electrical Protection**, **Batteries**, **Chargers & UPS**, **Electrical Submersible Pumps** (**ESP**), **Power Supply** Substations, Area Classification, Safety Management System, Permit to Work & Issuing Authority, Emergency **Diesel Generator**, **Variable Frequency Drives** (VFD), **PLC & SCADA** for Automation & Process Control, **Automation Solutions & Techniques**, **Automating Process Equipment**, **DCS** Automated Process Control Systems, High & Low Voltage **Electrical Safety**, **Electrical Inspection** & Testing, **Electrical Control** & Monitoring System, **Electric Power System**, Intensive Overhead **Transmission** Line (OHTL), **Generator** Maintenance & Troubleshooting, **Transmission** Line Networks, **Distribution** Engineering, HVDC **Transmission** & Control, **Substation** Maintenance Techniques and **Overhead Power Line** Construction & Patrolling.

Mr. Ahmed gained his expertise and experience through several positions as a **Senior Electrical Project Engineer**, **Senior Electrical Engineer**, **Site Electrical Engineer** and **Senior Instructor/Trainer** for various companies such as United Electro-Mechanical International Company, AL OSAIS Contracting Co., ASTRACO, Saudi Service for Electro Mechanic Work Co. (S.S.E.M), Dubai Electricity & Water Authority (DEWA) and Saudi Electricity Company (SEC).

Mr. Ahmed has a **Bachelor's** degree in **Electrical Engineering**. Further, he is a **Certified Instructor/Trainer** and has delivered various trainings, seminars, conferences, workshops and courses globally.

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.

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	***Theory of Transformers & Functions***
0915 - 1000	***Equivalent Diagrams and Vector Diagrams***
1000 – 1015	*Break*
1015 – 1100	***Importance & Reliability Requirements of Transformers in Power Systems***
1100 – 1145	***Classification of Transformers*** *Functions ● Power ● Distribution ● Inter Connection ● Generator Transformers ● Classification Based on Construction*
1145 - 1230	***Introduction to IEEE/IEC Power Transformer Standards***
1230 – 1245	*Break*
1245 – 1330	***Basic Materials & Components of Transformers*** *Transformer Bushings and Terminals ● Bushing CT's ● Conservator and Breathers*
1330 – 1420	***3 Phase Transformer Connections, Vector Groups***
1420 -1430	***Recap***
1430	*Lunch & End of Day One*

Day 2

0730 – 0830	***Transformer Oil as Cooling & Insulation Media***
0830 - 0930	***Characteristics of Oil***
0930 - 0945	*Break*
0945 - 1100	***Cooling Systems & their Designations***
1000 - 1015	*Break*
1015 - 1100	***Simulations - Line Charging***

1100 - 1145	***Arcing Current***
1145 - 1230	***Resistance Switching***
1230- 1245	*Break*
1245 - 1315	***Capacitor Switching***
1315 –1420	***Transformer Instrumentation & Fittings***
1420 - 1430	***Recap***
1430	*Lunch & End of Day Two*

Day 3

0730 – 0830	***Tap Changers - No-Load Tap Changer***
0830 - 0930	***Tap Changing Under Load***
0930 - 0945	*Break*
0945 - 1100	***Types of Tap Changing Gears***
1100 - 1145	***Phase-Angle Control & RTCC***
1145 - 1230	***Simulation Examples - Transformer Charging, Inrush Current & Faults***
1230 - 1245	*Break*
1245 -1315	***Simulation Examples - Transformer Charging, Inrush Current & Faults***
1315 - 1420	***Transformer Sizing From Power System Studies***
1420 - 1430	***Recap***
1430	*Lunch & End of Day Three*

Day 4

0730 – 0830	***Continuous Loads, Intermittent Loads & Over Loading Capacities of Transformers***
0830 - 0930	***Transformer Testing, Shop testing, Commissioning Tests & Routine Maintenance tests***
0930 – 0945	*Break*
0945 - 1100	***FRA, DC Winding Resistance testing & Dissolved gas analysis***
1100 - 1145	***Important Rating Parameters & Rating Plates of Transformers, Type & Routine Shop Tests and Life Expectancy Tests***
1145 - 1230	***Transformers & Relaying***
1230 - 1245	*Break*
1245 - 1315	***Transformer Faults***
1315 - 1420	***Recap***
1000 - 1015	*Lunch & End of Day Four*

Day 5

0730 – 0830	***Differential Relaying***
0830 - 0930	***Normal Load***
0930 - 0945	*Break*
0945 – 1030	***External Faults***
1030 - 1100	***Internal Faults***
1100 - 1230	***On-Line Condition Monitoring of Transformer***
1230 – 1245	*Break*
1245 – 1315	***On-line Monitoring of Bushings & Lightning Arrester***

1315 - 1345	***Interactive Session on Quiz & Any Queries of Participants***
1345 - 1400	***Course Conclusion***
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Practical Sessions

This hands-on, highly-interactive course includes real-life case studies and exercises:-

Course Coordinator

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