COURSE OVERVIEW EE0119(GA2)
Power Generation & Distribution Engineering

Course Title
Power Generation & Distribution Engineering

Course Date/Venue
Session 1: August 17-21, 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
EE0119(GA2)

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 system, generation and distribution. It covers the main components of the power generation system and its functions; the block diagram of the auxiliary systems; the purpose of a gas or steam turbine; the function of turbine components and the starting sequence of a gas turbine; the turbine variables, controlled speed, pressure and temperature; and the meaning of excitation, the function of these auxiliary systems and why loads need to be shed and under what circumstances this would need to be done.

This course will also cover the procedure and conditions for synchronizing two generators; drawing a block diagram of the excitation system and a line diagram indicating the protection requirements for a medium sized generator; the requirements and precautions for startup, synchronizing and generator loading procedures; the requirements of a design data sheet for a power generator; and the function of governors in different mode of operations.

Further, the course will also discuss the steps necessary to put a generator on line and off load, how to increase the loading of a generator and the difference between load shedding and load sharing; the generator excitation system and the operation of the auxiliaries specifically for the turbine and generator; the control philosophy in relation to turbine, generator and auxiliaries; the purpose of an AVR/digital excitation control system and how it works; the safety measures that shall be taken before and after a high voltage test has been made on a generator; the tests that are done on a generator; the schematic diagram of the excitation system of an alternator; and preparing a data sheet for this equipment.

During this interactive course, participants will learn the capability chart indicating the limitations; how the reactive load is shared between generators connected in parallel; the startup, synchronizing and loading of a generator as well as the startup and shutdown of a turbine; how to put the load shed/share systems in operation and the data of the load sharing system; the testing of the generator protection system; the tests/checks to be conducted during maintenance; the startup, synchronizing and loading steps of a generator being taken and why; the excitation system diagram explaining how this system works and the outcome when an alternator has lost its excitation when connected in parallel with others; and the effects of failures of any auxiliary systems.

Course Objectives

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

- Apply and gain an in-depth knowledge on power system, generation and distribution
- Identify the main components of the power generation system and its functions
- Draw a block diagram of the auxiliary systems and state the purpose of a gas or steam turbine
- List the function of turbine components and explain the starting sequence of a gas turbine
- Identify turbine variables, controlled speed, pressure and temperature
- State the meaning of excitation, the function of these auxiliary systems and why loads need to be shed and identify under what circumstances this would need to be done
- Demonstrate and explain the procedure and conditions for synchronizing two generators
- Draw a block diagram of the excitation system and a line diagram indicating the protection requirements for a medium sized generator
- Demonstrate and explain the requirements and precautions for startup, synchronizing and generator loading procedures
- Explain the requirements of a design data sheet for a power generator and describe the function of governors in different mode of operations
- Explain the steps necessary to put a generator on line and off load, how to increase the loading of a generator and the difference between load shedding and load sharing

- Explain the generator excitation system and the operation of the auxiliaries specifically for the turbine and generator
- State what is meant by control philosophy in relation to turbine, generator and auxiliaries
- Explain the purpose of an AVR / digital excitation control system and how it works
- Explain the safety measures that should be taken before and after a high voltage test has been made on a generator
- List the tests that are done on a generator and draw a schematic diagram of the excitation system of an alternator
- Prepare a data sheet for this equipment and explain the requirements
- Read and explain the capability chart indicating the limitations and describe how the reactive load is shared between generators connected in parallel
- Demonstrate the startup, synchronizing and loading of a generator as well as the startup and shut down of a turbine
- Demonstrate how to put the load shed/share systems in operation and analyze the data of the load sharing system
- Demonstrate the testing of the generator protection system and explain the results
- Demonstrate the tests/checks to be conducted during maintenance and explain the startup, synchronizing and loading steps of a generator being taken and why
- Use the excitation system diagram explain how this system works and explain the outcome when an alternator has lost its excitation when connected in parallel with others
- Explain the effects of failures of any auxiliary systems

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 system, generation and distribution for electrical engineers, specialists, production staff and technicians.

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)

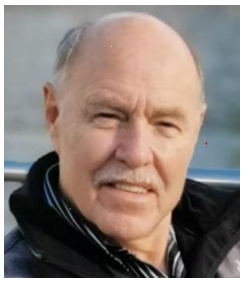
Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** 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. Fred Du Plessis is a **Senior Electrical Engineer** with over **30** years of extensive experience within the **Oil**, **Gas**, **Petrochemical**, **Refinery** & **Power** industries. His expertise widely covers in the areas of **Thermal Gas Power Generation**, **Power Station** Operations, **Power Generation Plant Outage** Management, **Power System** Analysis, **Power System** Generation & Distribution, **Electric Power System** Design, **Renewable Energy**, **Energy Storage** Technologies, Maintenance, Testing & Troubleshooting, **Transformer Protection**, **Transformer** Problem and Failure Investigations, **Power System Operation and Control**, Fault Analysis in **Power Systems**, **HV/MV Cable Splicing**, **High Voltage Electrical Safety**, **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**, ORHVS for Responsible and Authorized Person **High Voltage Regulation**, **Transformers** Maintenance, inspections & repairs, Commissioning of **LV & HV Equipment**, Oil Purification and **High Voltage Maintenance**, HT Switch Gear -Testing, Safe Operating, Maintenance, Inspection & Repairs on **LV & HT Cables** - Testing (Pulse & Megger), Line Patrol in **Low Voltage & Distribution**, **Transmission**, **Operating Principles up to 132KV**, Abnormal Conditions & Exceptions, Commissioning & Testing, **Transformer Inspections & Repairs**, **Live Line Work up to 33KV**, **Basic Power System Protection**, **High Voltage** Operating Preparedness Phasing (**110V to 132KV**), **HV Operating & Fault** Finding (up to 132KV), Maintenance & Construction Supervision, **VSD/VFD** Installations & Testing, **Electrical Panel Design**, **VSD/VFD Installations & Testing**, Instrument Installation and wiring, **AC/DC Supplies & Change Over Systems**, **AC & DC Winders** and VLF Testing, **Gas Turbines**, **Steam Turbine** with a **Station Generation**, **Project** Management & Project Controls, **Water Treatment & Reverse Osmosis** Plant Management and **Mechanical Maintenance** Management.

During Mr. Du Plessis's career life, he has gained his practical experience through several significant positions and dedication as the **Project Manager/Owner**, **Maintenance Manager**, **Project Excecution Manager**, **Commissioning & Operating Manager**, **Acting Operating Manager**, **Optimization/Commissioning Manager**, **Operating Support Manager**, **Operating Production/Shift Manager**, **Operations Lead Engineer**, **Electrical Engineer**, **Production/Maintenance Planner**, **Unit Shift Supervisor**, Principal **Plant Operator**, **Workshop & Maintenace Consultant**, Assistant **Electrical Supervisor**, Trainee **Motor Mechanic** and **Senior Instructor/Trainer** from various international **power station** companies like the Dunamis Energy, Peterhead Power Station, Lijaco Services, Eskom, Matla Power Station, Grootvlei Power Station, Ellisras Brick & Ceramic, Hlalisanani Mechanical Contractor, Matimba Power Station, Matimba Power Station, Eskom Kriel Power Station and Transvaal Provincial.

Mr. Du Plessis has a **Bachelor's** (with Honours) degree in **Operations Management**. Further, he holds certification in Red & Silver Seal Accreditation Power Generation – (ESETA), a SAMTRAC & NOSA **Auditor** – (NOSA), a **Certified Instructor/Trainer** and has further 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 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 – 0930	***Direct Current Generators*** *Principle of a Generator • Induced E.M.F. in a Generator • Dynamo Construction • Classification of Generators • Voltage Regulation of D.C. Shunt & Comp. Generator • Rating of Generators • Efficiency of DC. Generator • Eddy Currents • Losses in D.C. Generator • Dynamo Troubles & their Causes • Practical: To Find the Polarity of D.C. Generator*
0930 – 0945	*Break*
0945 – 1100	***Alternating Current Generators*** *Principle of A.C. generator • Constructional Detail of an Alternator • Exciter • Advantages of Rotating Field System • Advantages of Poly Phase Over Single Phase • Comparison of Star & Delta Connection • Types of Alternators; Rating of an Alternator • Equipment for Controlling Alternators • Possible Faults in a Alternator & their Remedies • Losses & Efficiency of an Alternator • Protection of A.C. Generators*
1100 – 1200	***Diesel Engine Generator Set*** *The Engine Description/Components • Starting Aids • Operation Manual • Generator*
1200 – 1215	*Break*
1215 – 1420	***Generator Main Component*** *The Rotor • Rotor Winding • Rotor End Rings • Wedges & Dampers • Fans • Rotor Threading & Alignment • Vibration • Bearings & Seals • Slip Rings, Brush Gear & Shaft Grounding • Size & Weight*
1420 – 1430	***Recap***
1430	*Lunch & End of Day One*

Day 2

0730 – 0930	***Turbine-Generator Components—the Stator*** *Stator Core • Core Frame • Stator Winding • End Winding Support • Electrical Connections & Terminals • Stator Winding Cooling Components • Hydrogen Cooling Components • Stator Casing*
0930 – 0945	*Break*
0945 – 1015	***Cooling Systems***
1015 – 1100	***Shaft Seals & Seal Oil System*** *Thrust-Type Seal • Journal-Type Seal • Seal Oil System • Other Cooling Systems • Stator Winding Water Cooling System*
1100 – 1200	***Excitation*** *AC Excitation Systems • Exciter Transient Performance • The Pilot Exciter • The Main Exciter • Exciter Performance Testing • Pilot Exciter Protection • Brushless Excitation Systems • The Rotating Armature Main Exciter*
1200 – 1215	*Break*
1215 – 1420	***The Voltage Regulator*** *System Description • The Regulator • Auto Follow-Up Circuit • Manual Follow-Up • AVR Protection • The Digital AVR*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Two*

Day 3

0730 – 0930	***Excitation Control*** *Rotor Current Limiter • Overfluxing Limit • The Power System Stabilizer • Characteristics of Generator Exciter Power System (GEP) • Excitation System Analysis*
0930 – 0945	*Break*
0945 – 1100	***Generator Operation*** *Running Up to Speed • Open-Circuit Conditions & Synchronizing • The Application of a Load • Capability Chart • Neutral Grounding • Rotor Torque*
1100 – 1200	***Synchronous Generators*** *Synchronous Generator Construction • The Speed of Rotation of a Synchronous Generator • The Internal Generated Voltage of a Synchronous Generator • The Equivalent Circuit of a Synchronous Generator • The Phasor Diagram of a Synchronous Generator • Power & Torque in Synchronous Generators • The Synchronous Generator Operating Alone • The effect of Load Changes on a Synchronous Generator Operating Alone*
1200 – 1215	*Break*
1215 – 1420	***Synchronous Generators (cont'd)*** *Parallel Operation of a Generators • The Conditions Required for Paralleling • The General Procedure for Paralleling Generators • Frequency-Power & Voltage-Reactive Power Characteristics of a Synchronous Generator • Operation of Generators in parallel with Large Power Systems • Synchronous Generator Ratings • Synchronous Generator Capability Curves • Short-time Operation & Service Factor*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Three*

Day 4

0730 – 0930	***Prime Movers*** *Diesel Engines • Gas Turbine Engines*
0930 – 0945	*Break*
0945 – 1100	***Distribution Transformer*** *Principle of Operation • Construction & Description • Terms & Definitions • Sub-station Equipment Associated with Transformers & Protection of Transformers*
1100 – 1200	***Distribution Transformer (cont'd)*** *Transformer in Generating Stations • Standard Specifications • Ratings of a Transformer • Stresses on Transformer in Service • Transformer Failure & Failure Modes*
1200 – 1215	*Break*
1215 – 1420	***Transformer Isolation & Testing*** *Transformer System Pre-Operational Checkout • Distribution Transformer Troubleshooting*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Four*

Day 5

0730 – 0930	***Power System Blackout*** *Causes & Occurrence • Effects of Blackout • Triggering Blackout 1: Loads - Induction Motor • Triggering Blackout 2: Faults - Line Outage • Triggering Blackout 3: Protection - Inrush Current • Blackout Recommendations to Prevent Blackout • Survey of Blackout in Different Countries • Monitoring of Power Systems & Improving Operators Real Time Tools*
0930 – 0945	*Break*
0945 – 1100	***Considerations in Rebuilding the Power System*** *Cold Load Pickup • Generator Load Pickup Rate Limitations • Synchronizing Methods • Resynchronization of Generators & Islands*
1100 – 1200	***Considerations in Rebuilding the Power System (cont'd)*** *Frequency Control During Restoration • Black Start • Voltage Control During Restoration • Coordination of Station & Plant Operator • Power System Rebuild Scenario*
1200 – 1215	*Break*
1215 – 1345	***Generator Testing, Inspection, & Maintenance*** *Generator Operational Checks (Surveillance & Monitoring) • Major Overhaul (Every 8 to 10 years) • Generator Diagnostic Testing • Mechanical Tests*
1345 – 1400	***Course Conclusion***
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course 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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