

COURSE OVERVIEW EE0170-4D
Generator Excitation Systems & AVR

Selection, Commissioning, Operation, Maintenance, Testing & Troubleshooting

Course Title

Generator Excitation Systems & AVR:
*Selection, Commissioning, Operation,
 Maintenance, Testing & Troubleshooting*

Course Date/Venue

August 05-08, 2024/Boardroom 1, Elite
 Byblos Hotel Al Barsha, Sheikh Zayed
 Road, Dubai, UAE

Course Reference

EE0170-4D



Course Duration/Credits

Four days/2.4 CEUs/24 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.

Excitation systems directly affect power system stability where generators are large, connected with long lines, at sensitive voltage locations, or in systems with local or intertie oscillations. Excitation system reliability and availability can be a matter of skilled routine maintenance activity and proficient troubleshooting capability. Proficient troubleshooting is greatly aided by a solid operational understanding of the excitation system and its voltage regulator.

This course is designed to cover the excitation system design, commissioning, operation, maintenance, performance analysis, testing, tuning, repair and troubleshooting. The course will address the adjustment of excitation systems for high-initial response excitation using a PID controller.

The course will provide participants with the necessary knowledge to maintain, repair and calibrate an excitation system together with the automatic voltage regulator (AVR).

This includes using effective routine maintenance practices, knowing what checks may be performed on-line and how to perform these checks without causing an equipment shutdown, increasing the likelihood of accurate problem diagnosis by thoroughly understanding how the equipment operates, increasing the likelihood of accurate problem diagnosis by understanding any given circuit's impact upon operations; ie., quickly linking the symptom(s) to the faulty circuit, verifying suspected faulty circuit by analyzing voltage levels and/or signal traces, and understanding the necessary calibrations, after the faulty part has been replaced, including how the calibrations are performed.

Course Objectives

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

- Select, start-up, operate, maintain, test and troubleshoot the generator excitation systems and automatic voltage regulators (AVR)
- Apply and gain an in-depth knowledge on the major generator set components which include generator power sources, anatomy of a steam turbine, generator construction, ancillary equipment, governor systems, excitation systems and generator protection
- Illustrate the proper exciter operation and give emphasis to the anatomy of an excitation system, excitation configuration, AVR steady state operation & excitation protection
- Discuss the excitation system performance including the hardware configurations, generator dynamics, AVR dynamics & dynamic and transient stability
- Explain the hardware configuration of control electronics, static converters, crowbar, field circuit breaker, field discharge resistor and auto/manual dual systems
- Enumerate the different software functions for structures, software documentation, AVR communication systems and hardware & software interface
- Employ the proper commissioning, operation, troubleshooting and maintenance of AVR 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, 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 is designed for those who are involved in the selection, commissioning, operation, maintenance, testing or troubleshooting of the generator excitation systems and AVR including engineers, supervisors 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:-


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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 Energy Industry, Global Warming, Hydroelectric & Geothermal Power, Biomass & Biogas, Four 'C's of the Energy Transition, Fifth Generation Heat, Protection Relay Maintenance, Application & Testing, System Analysis, Power System Faults, Protection Scheme Components, Current & Voltage Transformers, Power System Neutral Grounding, Feeder Overcurrent Protection, Electrical Protection Systems, Bus Protection, Motor Protection, Starting & Control, Transformer Protection, Generator Protection, Capacitor Protection, Numerical Relays, SCADA Security, ESD System Analysis & Control, Electrical & Instrumentation, Installation & Inspection, Custody Measurement, Loss Control for Petroleum Products, Process Control & Instrumentation, Fiber Optics Access Network Planning, Safety Instrumented System (SIS), Safety Integrity Level (SIL), PLC Design, Power System, Power Supply Design Management, Basic Electronics & Transformers, Diesel Generator, Electric Motors, Electrical Fundamentals, Basic Electricity and 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. Currently, he is the Technical Advisor of Izmir Altek.

During his career life, Dr. Tay worked with various companies such as the KOC Sistem, Meteksan Sistem, Altek BT, Yasar University, Dokuz Eylul University, METU and occupied significant positions like the **Aegean Region Manager, Group Leader, Technical Services Manager, Field Engineer, Research Assistant, Instructor, Technical Advisor and the Dr. Instructor.**

Dr. Tay has **PhD, Master and Bachelor** degrees in **Electrical & Electronic Engineering** from the **Dokuz Eylul University** and the **Middle East Technical University (METU)** respectively. Further, he is a **Certified Instructor/Trainer, Technical Trainer (Australia), Trainer for Data-Communication System (England & Canada), 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 delivered and presented innumerable training courses and workshops 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 Fee

US\$ 4,500 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: Monday, 05th of August 2024

0730 – 0800	Registration, Coffee
0800 - 0815	Welcome & Introduction
0815 – 0830	PRE-TEST
0830 - 0915	Major Generator Set Components
0915 - 0945	Generator Power Sources
0930 - 0945	Break
0945 - 1030	Anatomy of a Steam Turbine
1030 - 1130	Generator Construction
1130 - 1230	Ancillary Equipment
1230 - 1245	Break
1245 - 1345	Governor Systems
1345 - 1400	Excitation Systems
1400 – 1410	Generator Protection
1410 - 1420	Exciter Operation
1420 - 1430	Recap
1430	Lunch & End of Day One

Day 2: Tuesday, 06th of August 2024

0730 - 0830	Anatomy of an Excitation System
0830 - 0900	Excitation Configuration
0900 - 0930	AVR Steady State Operation
0930 - 0945	Break
0945 - 1030	Excitation Protection
1030 - 1130	Excitation System Performance
1130 - 1230	Hardware Configurations
1230 - 1245	Generator Dynamics
1245 – 1300	AVR Dynamics



1300 – 1315	Break
1315 – 1340	<i>Dynamic & Transient Stability</i>
1340 - 1420	<i>Hardware Configuration</i>
1420-1430	<i>Recap</i>
1430	<i>Lunch & End of Day Two</i>

Day 3: Wednesday, 07th of August 2024

0730 – 0800	<i>Overview to Hardware</i>
0800 - 0830	<i>Control Electronics</i>
0830 – 0900	<i>Basics of Static Converters</i>
0900 - 0915	<i>Converters</i>
0915 - 0930	<i>Crowbar, Field Circuit Breaker & Field Discharge Resistor</i>
0930-0945	Break
0945-1030	<i>Dual Systems - Auto/Manual</i>
1030-1130	<i>Software Functions</i>
1130-1230	<i>Software Description</i>
1230-1245	Break
1245-1315	<i>Structures - Parameters & Signals</i>
1315-1420	<i>Software Documentation</i>
1420-1430	<i>Recap</i>
1430	<i>Lunch & End of Day Three</i>

Day 4: Thursday, 08th of August 2024

0730-0830	<i>AVR Communications Systems</i>
0830-0930	<i>Interface - Hardware & Software</i>
0930-0945	Break
0945-1030	<i>Operation of AVR Systems</i>
1030-1130	<i>Commissioning of AVR Systems</i>
1130-1230	<i>Troubleshooting of AVR Systems</i>
1230-1245	Break
1245-1345	<i>Maintenance of AVR Systems</i>
1345 – 1400	<i>Course Conclusion</i>
1400 – 1415	<i>POST-TEST</i>
1415 - 1430	<i>Presentation of Course Certificates</i>
1430	<i>Lunch & End of Course</i>



Practical Sessions

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



Course Coordinator

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