COURSE OVERVIEW EE0170
Generator Excitation Systems & AVR
Selection, Commissioning, Operation, Maintenance, Testing & Troubleshooting

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



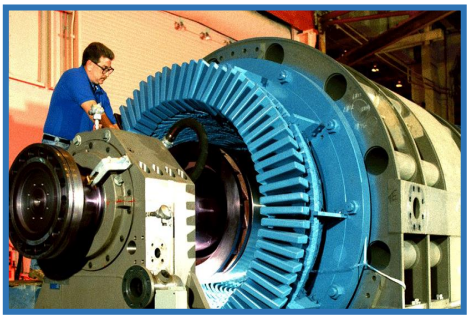
Course Date/Venue
Session 1: May 30-June 03, 2027/Meeting Plus 9, City Centre Rotana, Doha, Qatar
Session 2: August 29-September 02, 2027/Meeting Plus 9, City Centre Rotana, Doha, Qatar

Course Reference
EE0170

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.

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; i.e., 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/Outcomes & Benefits for the Participants

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 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

Haward's 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**. Haward's certificates are internationally recognized and accredited by the British Accreditation Council (BAC). 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.

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:



Mr. Pan Marave, PE, MSc, BEng, is a **Senior Electrical & Instrumentation Engineer** with **over 30 years** of extensive experience in **Oil**, **Gas**, **Petrochemical**, **Refinery** & **Power** industries. His expertise includes **CEMS** Operations and Maintenance, **ABB 11KV Distribution Switchgear**, Operation & Maintenance of **Rotork make MOVS**, **Maintaining Instrument Air Compressors**, **Circuit Breaker**, **HV Switchgear Maintenance**, **HV/LV Electrical** Authorisation, Basic **Electricity**, **Electrical & Special Hazards**, **Personnel Protection**, **HV/LV Equipment**, **Motor Controllers**, **Electrical Switching** Practices, **Emergency Planning**, **Safety Management**, Safety Instrumented Systems (**SIS**), Safety Integrity Level (**SIL**), Emergency Shutdown (**ESD**); **DCS**, **SCADA** & **PLC**; **Measurement** (**Flow**, **Temperature**, **Pressure**); **Process Analyzers** & **Analytical Instrumentation**; **Process Control**, **Instrumentation** & **Safeguarding**; **Process Controller**, **Control Loop & Valve Tuning**; Industrial **Distribution Systems**; Industrial **Control & Control Systems**, Power Systems **Protection & Relaying**; **Earthing**, **Bonding**, **Grounding**, **Lightning & Surge Protection**; Electric Power **Substation** & **Systems**; Electrical Engineering Principles; **Motor Control Circuit**; **Electrical Fault Analysis**; Electrical Networks & Distribution **Cables**; **Circuit Breakers**, **Switchgears**, **Transformers**, **Hazardous Areas Classification** and **Detailed Engineering Drawings**, **Codes** & **Standards**. Furthermore, he is also well-versed in Microprocessors Structure, Lead Auditor (**ISO 9000:2000**), **ISO 9002**, Quality Assurance, and Projects & Contracts Management.

Presently, Mr. Marave is the **Technical Advisor** of **Chamber of Industry & Commerce** in Greece. Prior to this, he gained his thorough practical experience through several positions as the **Technical Instructor**, **Engineering Manager**, **Electronics & Instruments Head**, **Electrical**, **Electronics & Instruments Maintenance Superintendent**, **Assistant General Technical Manager** and **Engineering Supervisor** of various international companies such as the **Alumil** Mylonas, **Athens Papermill**, **Astropol** and the **Science Technical Education**.

Mr. Marave is a **Registered Professional Engineer** and has **Master's** and **Bachelor's** degrees in **Electrical Engineering** from the **Polytechnic Institute of New York** and **Pratt Institute of New York** (**USA**) respectively. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management** (**ILM**) and an active member of the **Technical Chamber** and the Institute of Electrical and Electronics Engineer (**IEEE**) in Greece. He has presented and delivered **numerous international** courses, conferences, trainings and workshops worldwide.

Course Fee

US$ 6,000 per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Training Methodology

Our courses employ an interactive, learner-centred methodology that integrates theoretical knowledge with practical application. The training is delivered through a suitable combination of some or all of the following methods, selected according to the course content and learning objectives:

- Instructor-led presentations and facilitated discussions
- Practical workshops and participant presentations
- Hands-on exercises and real-world case studies
- Equipment demonstrations and technical drawings
- Hardware- and software-based simulations
- Gamification & Role Play in soft-skills courses only
- Virtual Reality (VR) and Augmented Reality (AR)
- Instructional videos and other relevant training resources

This blended approach encourages active participation, strengthens practical skills and supports the effective application of acquired knowledge in the workplace.

Learning Design & Customization

This course can be customized to the exact requirements of clients. Haward Technology is so proud of our huge capabilities in tailoring our courses to the training needs of our valued clients.

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	***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***
1345-1420	***Excitation Systems***
1420-1430	***Recap***
1430	*Lunch & End of Day One*

Day 2

0730-0800	***Generator Protection***
0800-0830	***Exciter Operation***
0830-0930	***Anatomy of an Excitation System***
0930-0945	*Break*

0945-1045	***Excitation Configuration***
1045-1145	***AVR Steady State Operation***
1145-1230	***Excitation Protection***
1230-1245	*Break*
1245-1345	***Excitation System Performance***
1345-1420	***Hardware Configurations***
1420-1430	***Recap***
1430	*Lunch & End of Day Two*

Day 3

0730-0830	***Generator Dynamics***
0830-0930	***AVR Dynamics***
0930-0945	*Break*
0945-1030	***Dynamic & Transient Stability***
1030-1130	***Hardware Configuration***
1130-1230	***Overview to Hardware***
1230-1245	*Break*
1245-1345	***Control Electronics***
1345-1420	***Basics of Static Converters***
1420-1430	***Recap***
1430	*Lunch & End of Day Three*

Day 4

0730-0830	***Converters***
0830-0930	***Crowbar, Field Circuit Breaker & Field Discharge Resistor***
0930-0945	*Break*
0945-1030	***Dual Systems - Auto/Manual***
1030-1130	***Software Functions***
1130-1230	***Software Description***
1230-1245	*Break*
1245-1315	***Structures - Parameters & Signals***
1315-1420	***Software Documentation***
1420-1430	***Recap***
1430	*Lunch & End of Day Four*

Day 5

0730-0830	***AVR Communications Systems***
0830-0930	***Interface - Hardware & Software***
0930-0945	*Break*
0945-1030	***Operation of AVR Systems***
1030-1130	***Commissioning of AVR Systems***
1130-1230	***Troubleshooting of AVR Systems***
1230-1245	*Break*
1245-1400	***Maintenance of AVR Systems***
1400-1415	***Course Conclusion***
1415-1430	***POST-TEST***
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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