COURSE OVERVIEW EE0766
Power System Stability

Course Title
Power System Stability

Course Date/Venue
Session 1: July 20-24, 2025/Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

Session 2: December 22-26, 2025/Fujairah Meeting Room, Grand Milleneum, Al Wahda Hotel, Abu Dhabi, UAE

Course Reference
EE0766

Course Duration
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 Power System Stability. It covers the concept of power system stability including its significance and the critical role it plays in maintaining reliable power supply; the elements of power system control used to control voltage, power and frequency; the proper methods of controlling reactive power to maintain voltage stability in the network including devices and technologies; and the control mechanisms in power generation including automatic generation control (AGC) and primary and secondary control loops.

Further, the course will also discuss the different types of power system stabilities (voltage, rotor angle, frequency stability) and the factors affecting them; the frequency control mechanisms and their importance for stable operation of the grid; the proper methods of controlling active power including load frequency control, tie-line bias control and economic dispatch; and the power system stability studies using simulations to predict the behavior of power networks under different conditions.

Moreover, the course will also cover the swing equation and its role in modeling the rotor dynamics of synchronous machines and how it affects stability; the swing curve to analyze stability margins and potential instability under dynamic conditions; analyzing the disturbances caused by frequency variations and how the power system responds to these changes; the different types of disturbances (faults, loss of generation/load) and their effects on system stability; the transient stability including how the system behaves immediately following a disturbance; and how different loading conditions affect the stability of power systems.

During this interactive course, participants will learn the causes of blackouts in power networks and studying methods to prevent them; the blackout networks, their characteristics and how cascading failures can occur; the black start, its necessity and its limitations when restarting a power system after a blackout; the black start procedures, system restoration planning, islanding operations in blackouts and critical path restoration; the advanced concepts in power system stability and coordination of stability control systems; managing frequency stability in large and interconnected networks including multi-area control; the stability and control of renewable energy sources; and the future trends in power system stability.

Course Objectives

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

- Apply and gain an in-depth knowledge on power system stability
- Discuss the concept of power system stability including its significance and the critical role it plays in maintaining reliable power supply
- Identify the elements of power system control used to control voltage, power and frequency
- Apply proper methods of controlling reactive power to maintain voltage stability in the network including devices and technologies
- Review the control mechanisms in power generation including automatic generation control (AGC) and primary and secondary control loops
- Recognize the different types of power system stabilities (voltage, rotor angle, frequency stability) and the factors affecting them
- Discuss the frequency control mechanisms and their importance for stable operation of the grid
- Apply proper methods of controlling active power including load frequency control, tie-line bias control and economic dispatch
- Conduct power system stability studies using simulations to predict the behavior of power networks under different conditions
- Identify swing equation and its role in modeling the rotor dynamics of synchronous machines and how it affects stability
- Study the swing curve to analyze stability margins and potential instability under dynamic conditions
- Analyze disturbances caused by frequency variations and how the power system responds to these changes

- Explore different types of disturbances (faults, loss of generation/load) and their effects on system stability
- Discuss transient stability including how the system behaves immediately following a disturbance
- Analyze how different loading conditions affect the stability of power systems
- Identify the causes of blackouts in power networks and studying methods to prevent them
- Specify blackout networks, their characteristics and how cascading failures can occur
- Explain black start, its necessity and its limitations when restarting a power system after a blackout
- Employ black start procedures, system restoration planning, islanding operations in blackouts and critical path restoration
- Discuss advanced concepts in power system stability and coordination of stability control systems
- Manage frequency stability in large and interconnected networks including multi-area control
- Discuss the stability and control of renewable energy sources and the future trends in power system stability

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 stability for electrical engineers, power system analysts, energy managers, control engineers, utility operators, regulatory professionals, consultants, renewable energy professionals and other technical staff.

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 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

This course will be conducted by the following instructor. However, we have the right to change the course instructor 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.

Course Fee

US$ 5,500 per Delegate. 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 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	***Overview of Power System Stability*** *Introduction to the Concept of Power System Stability, its Significance and the Critical Role it Plays in Maintaining Reliable Power Supply*
0930 - 0945	*Break*
0945 - 1100	***Power System Control Fundamentals*** *Discussing the Elements of Power System Control Used to Control Voltage, Power and Frequency*
1100 – 1230	***Voltage Control & Reactive Power Management*** *Methods of Controlling Reactive Power to Maintain Voltage Stability in the Network Including Devices and Technologies*
1230 – 1245	*Break*
1245 – 1330	***Power Generation Control*** *Review of the Control Mechanisms in Power Generation Including Automatic Generation Control (AGC) and Primary and Secondary Control Loops*
1330 – 1400	***Types Of Power System Instabilities*** *Overview of Different Types of Power System Stabilities (Voltage, Rotor Angle, Frequency Stability) and the Factors Affecting Them*
1400 - 1420	***Case Study: Voltage Collapse in Power Systems*** *Practical Case Study Discussing a Real-World Voltage Collapse Scenario and The Key Lessons Learned*
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	***Frequency Control in Power Networks*** *Understanding Frequency Control Mechanisms and Their Importance for Stable Operation of the Grid*
0830 - 0930	***Active Power Control*** *Methods of Controlling Active Power Including Load Frequency Control, Tie-Line Bias Control and Economic Dispatch*
0930 – 0945	*Break*
0945 – 1100	***Power System Stability Studies*** *Conducting Power System Stability Studies Using Simulations to Predict the Behavior of Power Networks Under Different Conditions*
1100 - 1200	***The Swing Equation & its Importance*** *Introduction to the Swing Equation its Role in Modeling the Rotor Dynamics of Synchronous Machines and How it Affects Stability*
1200 – 1215	*Break*

1215 - 1330	***The Swing Curve & its Analysis*** *Studying the Swing Curve to Analyze Stability Margins and Potential Instability Under Dynamic Conditions*
1330 - 1420	***Frequency Disturbances & Network Response*** *Analysis of Disturbances Caused by Frequency Variations and How the Power System Responds to these Changes*
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	***Types of Disturbances in Power Systems*** *Exploring Different Types of Disturbances (Faults, Loss of Generation/Load) and Their Effects on System Stability*
0830 - 0930	***Transient Stability*** *In-Depth Study of Transient Stability, Including How the System Behaves Immediately Following a Disturbance*
0930 – 0945	*Break*
0945 – 1100	***Stability Under Different Load Conditions*** *Analysis of How Different Loading Conditions Affect the Stability of Power Systems*
1100 - 1200	***Power System Blackouts: Causes And Prevention*** *Identifying the Causes of Blackouts in Power Networks and Studying Methods to Prevent Them*
1200 – 1215	*Break*
1215 - 1330	***Understanding the Blackout Network*** *Specifying Blackout Networks, Their Characteristics and How Cascading Failures Can Occur*
1330 - 1420	***Case Study: Famous Blackouts & Lessons Learned*** *Reviewing Past Major Blackout Events, Their Causes and How They Could Have Been Prevented.*
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	***Black Start Concepts*** *Introduction to Black Start, its Necessity and its Limitations When Restarting a Power System after a Blackout*
0830 - 0930	***Black Start Procedures*** *Detailed Step-by-Step Procedures for Black Starting a Power System Including Synchronization of Generating Units*
0930 – 0945	*Break*
0945 – 1100	***System Restoration Planning*** *Strategies and Considerations for Restoring Power to the Grid Following a System-Wide Blackout*

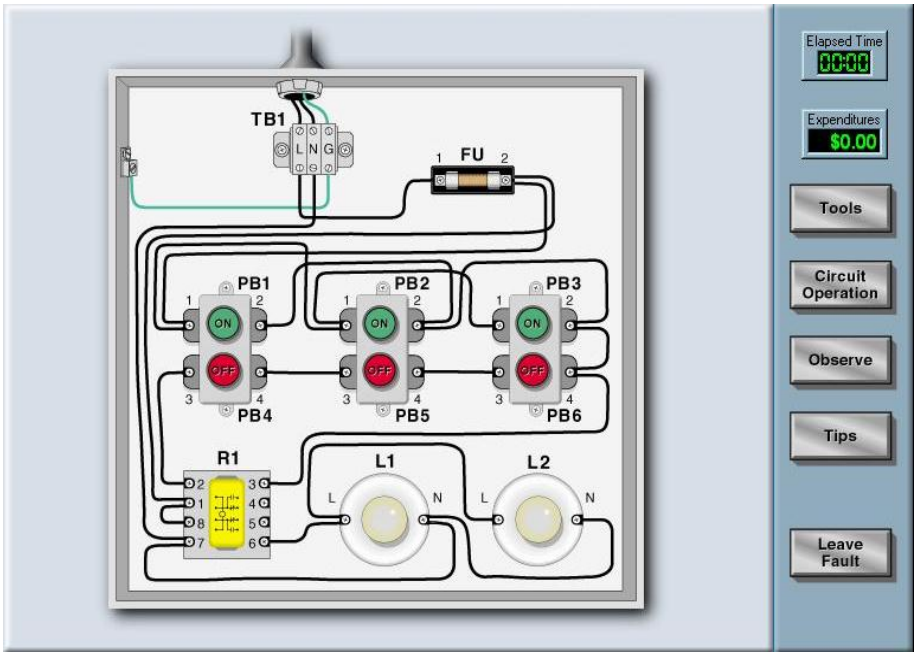
1100 - 1200	***Islanding Operations in Blackouts*** *The Role of Islanding in Maintaining Stability During Blackouts and the Procedures Involved in Restoring Isolated Systems*
1200 – 1215	*Break*
1215 - 1330	***Critical Path Restoration*** *Determining Critical Path for Restoring Power and the Role of Priority Loads in System Restoration*
1330 - 1420	***Practical Exercises: Black Start Simulation*** *Hands-On Session Involving Simulation of a Black Start and System Restoration Process in a Controlled Environment*
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

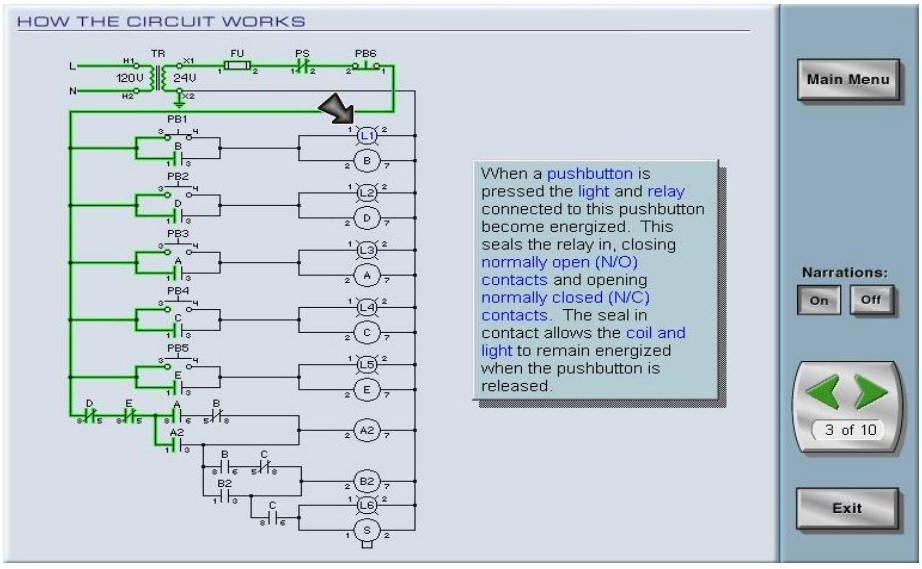
0730 - 0830	***Advanced Concepts in Power System Stability*** *Overview of Advanced Topics in Power System Stability, Such as Small-Signal Stability and Voltage Collapse Phenomena*
0830 - 0930	***Coordination of Stability Control Systems*** *How Different Stability Control Systems (such as PSS, SVC, and STATCOM) Work Together to Enhance System Stability*
0930 – 0945	*Break*
0945 – 1100	***Frequency Stability & Control in Large Networks*** *Managing Frequency Stability in Large and Interconnected Networks Including Multi-Area Control*
1100 - 1200	***Stability & Control of Renewable Energy Sources*** *Integration of Renewable Energy Sources (Wind, Solar) and Their Impact on Power System Stability*
1200 – 1215	*Break*
1215 - 1300	***Future Trends in Power System Stability*** *Discussing Emerging Trends, Technologies and the Future of Power System Stability in Modern Grids*
1300 - 1420	***Final Case Study: Comprehensive Stability Analysis*** *Participants Will Conduct a Final Comprehensive Stability Analysis, Incorporating All Concepts Covered During the Course*
1345 – 1400	***Course Conclusion***
1400 – 1415	***POST-TEST***
1415 - 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Simulators (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 “Basic Techniques”, “Basic Control Circuits”, “Motor Control Techniques” and “Power World.

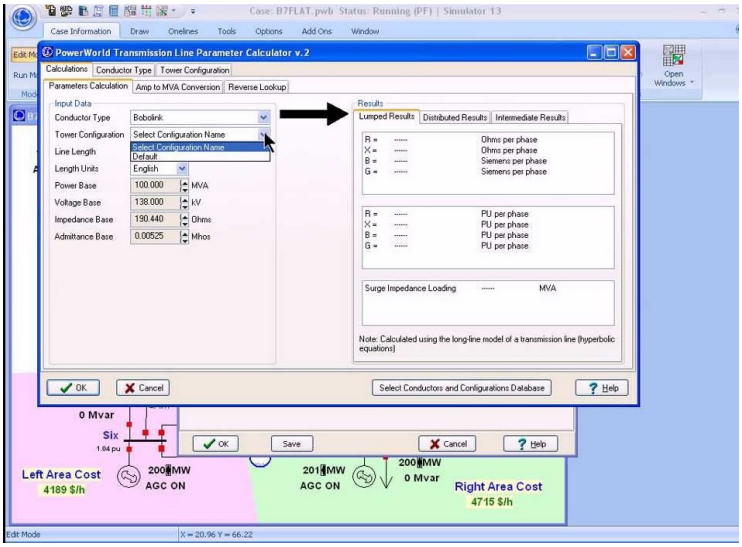


Basic Techniques



Basic Control Circuits

Motor Control Techniques



Power World Simulator

Course Coordinator

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