



# SYNCHRONOUS MACHINES AND EXCITATION SYSTEMS

Hands-on industrial training designed for engineers and technicians working with synchronous generators and excitation systems.

- PRACTICAL KNOWLEDGE
- REAL-WORLD APPLICATIONS
- IMPROVED EFFICIENCY AND PERFORMANCE

<b>DURATION</b> 12 Hours (2 Days x 6 Hours)	<b>DELIVERY</b> In-Person or Online	<b>CERTIFICATE</b> Certificate of Completion Provided
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## WHO SHOULD ATTEND

- Electrical engineers working in: Power generation (utilities, IPPs), Transmission and distribution
- Industrial power systems
- Protection & control engineers
- Field service engineers and commissioning engineers
- Engineering technologists and technicians
- Graduate students specializing in power systems
- Engineers aiming to fulfill their Continuing Professional Development (CPD) requirements, including those mandated by Professional Engineers Ontario (PEO).
- Professors and instructors interested in teaching this course at universities, community colleges, or private educational institutions.

## COURSE BENEFITS

Participants will gain a solid understanding of synchronous generators and excitation systems, including operation, voltage and torque relationships, AVR and excitation system types, capability curves, voltage control, reactive power management, stability, and protection. The course improves skills in commissioning, troubleshooting, and operation.

## INDUSTRY RELEVANCE

Synchronous generators provide grid stability, voltage support, and fault current: Excitation systems are vital for voltage control and reliability, especially with renewable integration. Aging infrastructure and a shortage of skilled engineers make this knowledge essential.

## MARKET DEMAND

Demand for this course is strong due to the continued reliance on synchronous generators in power systems. Engineers with hands-on knowledge of machines and excitation systems are highly sought after in today's evolving energy landscape.

## FUTURE LEARNING PATH

This course can lead to advanced topics such as power system stability, advanced excitation control, protection and relaying, and power system dynamics.

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## COURSE OUTLINE

- 1** Fundamentals of Synchronous Generators: Basic construction and operating principles, magnetic fields, induced voltage and frequency relationships, equivalent circuit model
- 2** Steady-State Operation and Power Flow: Power-angle relationship, active and reactive power control, power factor and voltage regulation, generator capability curves and operating limits
- 3** Excitation Systems and AVR Fundamentals: Purpose and importance of excitation systems, types of excitation systems (DC, AC brushless, static), AVR operation and control loops
- 4** Voltage Control, Reactive Power, and Parallel Operation: Voltage control strategies, reactive power sharing, parallel operation and load sharing, impact of excitation on system performance
- 5** Dynamic Performance and Stability: Transient and subtransient behavior, rotor angle stability, response to disturbances (faults, load changes), role of excitation in enhancing stability
- 6** Practical Excitation Systems, Protection, and Operation: Overview of modern systems, control architecture and key components, limiter functions and protection, loss of excitation and over/under excitation protection, commissioning, tuning, and operational best practices

## WHAT YOU WILL GAIN

A solid understanding of synchronous generators and excitation systems, with the ability to apply concepts for voltage control, reactive power management, stability analysis, and reliable operation in real-world power systems.

## ABOUT THE INSTRUCTOR



### HUSSIN HASSEN, P.Eng

**Degree:** Master of Applied Science in Electrical Engineering from University of Waterloo

**Certificate:** Professional Engineering Certificate from PEO in Ontario

**Practical Experience:** Over 20 years of experience in testing and commissioning of UPS systems, excitation systems for hydroelectric plants and smart battery storage systems.

**Teaching Experience:** Experienced educator with more than a decade of teaching in electrical engineering, specializing in power electronics and electric machines.

## COURSE DELIVERY

This course can be delivered online or in-person at our location or at the customer's location.

## ADDITIONAL INFORMATION

- ✓ Course materials and practical examples included
- ✓ Certificate of completion provided
- ✓ Hands-on training (when delivered in-person)
- ✓ Customized delivery available for corporate clients

**VENUE & STARTING DATE**  
TBA  
Please contact us for details on upcoming sessions.

**COST**  
Please contact us for competitive pricing packages.

**COURSE SCHEDULE**  
• Duration: 2 days (6 hours/day)  
• Delivery: In-person / Online  
• Next Session: TBA

**CERTIFICATE**  
Certificate of attendance will be provided upon successful completion.

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www.solatronix.com

**INVEST IN KNOWLEDGE. DRIVE PERFORMANCE. BUILD THE FUTURE.**