ICTD
المركز العالمي للتدريب والتطوير
International Centre For Training & Development

# EE121

# Generator Excitation Systems & Avr:

## *Selection, Commissioning, Operation, Maintenance, Testing & Troubleshooting*

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# Course Introduction:

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.

This course will provide engineers and technicians 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 successful completion of this course, the delegates 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

# Who Should Attend?

This course is intended for those 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 Outline:

***DAY 1:***

- **Major Generator Set Components**
  - Generator Power Sources
  - Anatomy of a Steam Turbine
- **Major Generator Set Components**
  - Generator Construction
  - Ancillary Equipment
- **Major Generator Set Components**
  - Governor Systems
  - Excitation Systems
- **Major Generator Set Components**
  - Generator Protection

***DAY 2:***

- **Exciter Operation**
  - Anatomy of an Excitation System
- **Exciter Operation**
  - Excitation Configuration
- **Exciter Operation**
  - AVR Steady State Operation

***DAY 3:***

- **Exciter Operation**

- Excitation Protection

- **Excitation System Performance**
  - Hardware Configurations

***DAY 4:***

- **Substation Maintenance Techniques (*cont'd*)**
  - Metal Clad Switchgear
  - Maintenance Details
  - Metal Clad Switchgear Maintenance Details
  - Maintenance & Repair Fundamentals
  - Maintenance & Repair Procedures

***DAY 5:***

- **Maintenance Work Orders**
  - Maintenance & Repair Procedures (cont'd)
  - Process Development
  - Procedures
  - Problems Encounters
  - Samples, Discussions
- **Fundamentals of Computerized Maintenance (CMMS)**

# Course Certificate:

**International Center for Training & Development (ICTD)** will award an internationally recognized certificate(s) for each delegate on completion of training.

# Course Methodology:

**A variety of methodologies will be used during the course that includes:**

- (30%) Based on Case Studies
- (30%) Techniques
- (30%) Role Play
- (10%) Concepts
- Pre-test and Post-test
- Variety of Learning Methods
- Lectures
- Case Studies and Self Questionaires
- Group Work

- Discussion
- Presentation

# Course Fees:

**To be advised as per the course location.** This rate includes participant's manual, and-Outs, buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

# Course Timings:

**Daily Course Timings:**

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|---|---|
| 08:00 - 08:20 | Morning Coffee / Tea |
| 08:20 - 10:00 | First Session |
| 10:00 - 10:20 | Coffee / Tea / Snacks |
| 10:20 - 12:20 | Second Session |
| 12:20 - 13:30 | Lunch Break & Prayer Break |
| 13:30 - 15:00 | Last Session |