ICTD
المركز العالمي للتدريب والتطوير
International Centre For Training & Development

Modern Electrical Power Systems

Course Introduction:

Current practice is reviewed to establish a sound understanding of the underlying principles of power system transmission, distribution, operation & control with an emphasis on the developments taking place, as a result of:

- New forms of generation
- Load interconnection
- CO2 Emissions control
- Fault level limitation
- FACTS (Flexible AC Transmission Systems) and DMS (demand side management)

The course aims to make candidates aware of improvements that technological advances makes possible and to consider implementation these on their system.

Course Objectives:

Delegates will gain a detailed appreciation of the following:

- Alternative forms of generation and embedded generation - carbon emission limiting, etc.
- Power flow optimization for 'real power' and use of a of FACTS devices to improve system operation, including DSM approach
- New CT and VT optical transducers and protection system using micro processor relays
- Non linear loads and injected Harmonics, at the PCC (point of common coupling)
- Diagnostic monitoring of plant and in particular GIS substations
- High speed fault limiters and thermal monitoring systems for cables

Who Should Attend?

- Designers
- Engineers
- Technicians
- Professionals involved with the planning, operation and maintenance of small to large scale power networks, from around 11kV, upwards.
- Professionals from the Distribution Companies, Power Utilities, Engineering Professionals in the Electricity Supply Industry and Petrochemical Companies who have to deal with aspects of generation, transmission and distribution should be interested in learning how to handle increased demand, how to drive the system harder, but safely, and with increased reliability, security and monitoring.

Course Outline:

Introduction

- Overview of a typical systems covering generation, transmission and distribution

- Determination of flow of real (P) and reactive power (Q)
- Determination and control of fault level
- Control of reactive power & voltage
- Control of active power & system frequency
- The requirements for reactive compensation – voltage profiles
- Quality of supply

Current Operational Problems

- Coping with rising demand for power - transmission and distribution
- The costs associated with increasing fault level
- Catering for increasing load on the existing system - ratings of plant
- Monitoring of plant condition - e.g. temperature
- A review of analytical methods & demonstration of software for optimizing system operation
- Increasing problems of heavily loaded systems - stability, voltage dips

Introduction to System Operation

- Active Power and Frequency Control - automated
- Voltage Control and Reactive Power Requirements - automated
- Generation, including combined cycle and small embedded generators
- Transmission voltage levels - line and cable design, power loading and de-rating for temperature effects

Emerging technologies

- Energy and the Environment - solar power, geothermal power, etc. CO2 and its impact on the world
- Green' generation? Is it possible on a large scale or are there stability problems?
- Demand Side Management - remote load control - minimizing demand - optimizing transmission – coping with dips and swells
- Optical Current Transducers for Protection - optical current sensors eliminate CT saturation
- High Voltage Applications - Surge protection, current limiters network switching, etc
- Non linear loads - harmonics at PCC - filtering - G5/4 requirements

Advances in control and monitoring

- Power Electronics Applied to Power Systems
- Flexibility in AC Systems - static VAr Compensation - series controlled capacitors
- Changing maintenance schedules, remote surveillance of plant and the introduction of unmanned substations
- Data logging

Making the system work harder

- HC-DC Links for stability improvement
- Power Dynamics Management - the low frequency oscillation
- Advanced protection and Control Techniques
- Is - Fault Current Limiter - how to apply
- GIS diagnostics - partial discharge techniques
- Optical cable temperature monitoring
- SCADA and artificial intelligence systems for fault diagnostics

System protection

- Digital and Micro Processor Protection
- Electrical Insulation - Air and SF6 - the problems
- Condition Monitoring of Plant
- Appendix - Characteristics of a Power Network - Review for the Future

Note: Case studies will be undertaken where appropriate

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

Course Certificate:

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

Course Fees:

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

Course Timings:

Daily Course Timings:

08:30 - 08:50	Morning Coffee/Tea
08:50 - 10:20	First Session
10:20 - 10:40	Recess (Coffee/Tea/Snacks)
10:40 - 12:20	Second Session
12:20 - 12:40	Recess (Coffee/Tea/Snacks)
12:40 - 14:30	Last Session