
Arabian Institute For Training

Modern Electrical Power Systems

INTRODUCTION

- Modern electrical power systems increases the efficiency of electrical power generations, transmission and distribution it also lower carbon footprint for a greener world. It includes the 'green generation' of electricity by means of renewable energy.
- In addition, the introduction and merits of the Smart Grids and Micro Grids are also discussed in the seminar. The determination and control of fault levels, active power, reactive power, voltage and frequency are essential in a modern electrical power system. Power quality issues are also addressed by modern mitigation techniques.
- This Modern Electrical Power Systems will ensure power system stability incorporating the Flexible AC Transmission System (FACTS) which has evolved to a mature technology with high power rating. This technology has wide spread application, became a top rate, most reliable one, based on power electronics. The main purpose of these systems is to supply the network as quickly as possible with inductive or capacitive reactive power that is adapted to its particular requirement, while also improving transmission quality and the efficiency of the power transmission system.

This training seminar will highlight:

- The various types of renewable energy generation, transmission and distribution
- The significance and merits of smart grids
- The importance of reactive power
- Power quality issues and mitigation methods
- The flexible AC transmission system merits

OBJECTIVES

By the end of this training course, participants will learn the:

- Alternative forms of generation and embedded generation
- Power flow optimisation 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 microprocessor relays
- Nonlinear 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

TRAINING METHODOLOGY

- Participants will receive a copy of the comprehensive course notes. The presenter will outline and discuss the topics using PowerPoint displays and videos. The course is designed to have an interactive format, to maximize delegate participation. Questions and answers are encouraged throughout and at the daily roundup sessions. Needs-based case-studies and examples will be introduced and discussed, in problem solving workshop sessions.

ORGANISATIONAL IMPACT

The course will allow delegates to interact and gain from the following:

- Shared experiences of others
- Carefully selected examples and case studies used to illustrate the material being discussed
- Emphasis given to ensure that the material is appropriate to the organisations represented
- Each delegate should leave with an awareness and understanding of the operational aspects of modern power systems
- How new technologies can assist in improving the quality and reliability of the consumers supply

PERSONAL IMPACT

- Appreciate how power is transferred efficiently across a network
- Understand how FACTS devices can provide real time support to improve network operation
- Understand how to improve the quality of the supply, dips, swells and harmonics sources
- Be familiar with diagnostic tools that lead to improved reliability including partial discharge measurement
- Deal with methods to handle higher fault levels and power demand and cable thermal rating
- Deal with the question of alternative forms of generation and CO2 emissions

WHO SHOULD ATTEND?

This training course is suitable to a wide range of professionals but will greatly benefit:

- 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

Course Outline

Introduction

- Overview of a Typical and Modern Systems covering Generation, Transmission and Distribution and the SMART Grid
- Determination of Flow of Real (P) and Reactive Power (Q)
- Characteristics and Impact of System and Transformer Fault Levels
- Control of Reactive Power & Voltage
- Control of Active Power & System Frequency
- Effects of Reactive Power Compensation on Voltage Profile
- Overview of Power System Disturbances

Current Operational Problems and System Operations

- Coping with Rising Demand for Power, Carbon Footprint Reduction and Global Warming
- Symmetrical, Asymmetrical Faults and Effects on Positive, Negative and Zero Sequence Components
- Monitoring of Plant Condition – e.g. temperature
- Power System and Substation Automation
- Increasing Problems of Heavily Loaded Systems - Stability, Voltage Dip
- Transmission Voltage Levels - Line and Cable Design, Power Loading and De-rating for Temperature Effects
- Major causes of power system failures

Emerging Technologies related to Green Renewable Energy

- Renewable Energy and the Environment - Solar Power, Geothermal Power, Wind Power, Environmental Friendly Storage Batteries
- 'Green' Generation? Is it possible on a large scale or are there stability problems?
- Demand Side Management - Remote Load Control - Minimising Demand - Optimising Transmission – Coping with Dips and Swells
- Optical Current Transducers for Protection - Optical Current Sensors Eliminate CT Saturation
- High Voltage Applications - Surge Protection, Fault Current Limiters Network Switching
- Non-linear loads - harmonics at PCC - filtering - G5/4 requirements
- Triplen harmonics and mitigation techniques

Digital Substations, FACTS and HV DC Link

- Digital Substation Architecture
- Flexibility in AC Systems (FACTS) - Static VAr Compensation - Series Controlled Capacitors
- Changing Maintenance Schedules, Remote Surveillance of Plant and the Introduction of Unmanned Substations
- Data Logging
- HV-DC Links for Stability Improvement
- Optical Cable Temperature Monitoring

Numerical Protection Relays and Functionalities; State of the Art Fault Current Limiter

- Advanced Protection and Control Techniques
- Numerical Relay and Protection Functions
- Electrical Insulation - Air and SF6 - The Problems
- Condition Monitoring of Plant
- Is - Fault Current Limiter, How to Apply
- GIS Diagnostics – Partial Discharge Techniques
- Q & A session


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