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Course Name

Reactive Power Management & Power Factor Correction

Sector Name

Electrical Engineering

Document Type

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Reactive Power Management & Power Factor Correction

Course Introduction

In an ideal AC power system, the voltage and frequency at every supply point would be constant and free from harmonics, and the power factor would be unity. Most Industrial loads have lagging power factors. That is, they absorb reactive power. The load current, therefore, tends to be larger than is required to supply the real power alone. Only the real power is ultimately useful in energy conversion, and the excess load current represents a waste to the consumer, who has to pay not only for the excess cable capacity to carry it but also for the excess joule loss produced in the supply cables.

The supply utilities also have good reasons for not transmitting unnecessary reactive power from generators to loads. Their generators and distribution networks cannot be used at full efficiency, and the control of voltage in the supply system can become more difficult. Supply tariffs to industrial consumers almost always penalize low power factor loads.

Most AC power systems are three-phase and are designed for balanced operation. Unbalanced operation gives rise to components of current in the wrong phase sequence (i.e., negative and zero sequence components). Such components can have undesirable effects, including additional losses in motor and generator units,

oscillating torque in AC machines, increased ripple reactive in rectifier, malfunctions of several types of equipment, saturation of transformers, and excessive neutral currents.

The load compensation improves the phase balancing and power factor correction of unsymmetrical loads. Many utilities need this particular course, which covers the illustration of the main concepts of reactive power management using actual case studies.

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Target Audience

- ✓ Power system protection engineers
- ✓ System planners
- ✓ Technical staff responsible for Smart Grid integration into power system monitoring and control

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Learning Objectives

- ✓ Understanding the main concepts of the management of reactive power
- ✓ How to improve the quality of supply in an AC power system
- ✓ How to use the generators, distribution networks, and equipment at full efficiency
- ✓ To know how to select, calculate, and connect the reactive power compensator to improve the power factor, the voltage regulation, and the load balancing in the utilities and industrial networks.
- ✓ To know the problems that appear due to the use of compensation equipment and how to mitigate those problems

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Course Outline

✓ DAY 01

Module (01) Introduction Definitions

- ✓ Practical considerations
- ✓ Loads requiring compensation

Module (02) Reactive/Reactive Power

- ✓ Relation between active power & reactive power
- ✓ Problems appear due to a shortage of active & reactive power
- ✓ Production and absorption of reactive power

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Course Outline

✓ Day 02

Module (03) Means of Reactive Power Compensation (Theory & Application)

- ✓ Shunt reactors
- ✓ Shunt capacitors
- ✓ Series Controlled capacitors
- ✓ Synchronous condensers
- ✓ Static VAR compensator (SVC)
- ✓ Flexibility in AC Systems (FACTS)

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Course Outline

✓ Day 03

Module (04) Power Factor Correction Voltage Regulations

- ✓ Importance of P.F. correction
- ✓ Problems appear due to low power factor
- ✓ Technical & economical benefits
- ✓ Numerical Example

Module (05) Capacitor Banks

- ✓ Methods of Correction
- ✓ Design Criteria & Selection
- ✓ Procurement & Maintenance Cost

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Course Outline

✓ Day 04

Module (06) Fixed Capacitor Banks

- ✓ Locations & Connections
- ✓ Automatic Capacitor Banks
- ✓ The VAR Regulators
- ✓ Measurement & Adjustment of Cost
- ✓ Adjustment Steps
- ✓ Contactor and Fuses

Module (07) Unsymmetrical Loads

- ✓ Positive-, negative-, and zero- sequence components
- ✓ Effect of unbalanced operation on electrical load

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Course Outline

✓ Day 05

Module (08) Power Measurements

- ✓ Wave Analysis
- ✓ Influence of Harmonics and Resonance
- ✓ Protection against Resonance

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Confirmed Sessions

FROM	TO	DURATION	FEES	LOCATION
Dec. 20, 2026	Dec. 24, 2026	5 days	4250.00 $	Oman , Salalah
Jan. 10, 2027	Jan. 14, 2027	5 days	4250.00 $	KSA , Riyadh
May 24, 2027	May 28, 2027	5 days	5950.00 $	switzerland , Geneva
Sept. 28, 2026	Oct. 2, 2026	5 days	4250.00 $	UAE , Abu Dhabi
Dec. 28, 2026	Jan. 1, 2027	5 days	4250.00 $	UAE , Dubai

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