Training Course on Flexible AC Transmission Systems (FACTS) Devices

Professional Development Training Course Outline

Category	Engineering	**Duration**	10 Days
Base Fee	$3,000 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

Introduction

As power systems become increasingly complex with rising energy demand and high penetration of renewable energy sources, Flexible AC Transmission Systems (FACTS) devices offer transformative solutions for enhancing grid stability, power flow control, voltage regulation, and transmission capacity utilization. FACTS technologies, such as SVCs, STATCOMs, TCSCs, and UPFCs, provide dynamic support to optimize system performance and mitigate challenges like line congestion, voltage instability, and power oscillations.

Training Course on Flexible AC Transmission Systems (FACTS) Devices delivers in-depth knowledge on the design, configuration, and application of FACTS devices in modern electrical power systems. Through detailed modules enriched with case studies, simulation practices, and real-world utility experiences, participants will learn how FACTS devices contribute to the resilience, efficiency, and sustainability of smart grids. This course empowers energy professionals to strategically implement FACTS for improved system control, flexible operation, and enhanced power system economics.

Programme Curriculum

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Course Objectives

1. Understand the fundamentals and classifications of FACTS devices
2. Explain the role of FACTS in improving power system stability and flexibility
3. Analyze the operational principles of SVC, STATCOM, TCSC, and UPFC
4. Apply simulation tools to model and assess FACTS performance
5. Evaluate the benefits of FACTS in voltage and reactive power control
6. Design optimal placement strategies for FACTS devices
7. Interpret case studies of FACTS implementation in real networks
8. Integrate FACTS with renewable energy systems
9. Explore the use of FACTS in congestion management and loss reduction
10. Examine protection and coordination strategies for FACTS-equipped systems
11. Understand economic considerations and ROI in FACTS deployment
12. Address technical challenges and maintenance of FACTS devices
13. Explore trends in digital control, AI integration, and grid modernization

Organizational Benefits

1. Enhanced system reliability and voltage stability
2. Increased power transfer capability without new lines
3. Optimized use of existing transmission infrastructure
4. Minimized transmission losses and improved efficiency
5. Better integration of intermittent renewable sources
6. Reduced need for generation rescheduling or load shedding
7. Improved decision-making through data-driven control
8. Strengthened technical competencies within the workforce
9. Cost savings from congestion management and deferred investments
10. Alignment with smart grid and digital transformation goals

Target Participants

- Power system engineers and planners
- Grid operators and system controllers

- Transmission and distribution professionals
- Renewable energy integration specialists
- Utility project managers
- Power electronics engineers
- SCADA and automation engineers
- Academics and researchers in electrical engineering

Course Outline

Module 1: Introduction to FACTS Technologies

1. Definition and need for FACTS
2. AC transmission challenges and solutions
3. Classification: Series, shunt, and combined types
4. Advantages over traditional compensation
5. Case Study: Indian National Grid FACTS Adoption

Module 2: Power Electronics in FACTS Devices

1. Role of thyristors and IGBTs
2. Converter topologies and switching
3. Dynamic response and control
4. Losses and thermal design
5. Case Study: ABB FACTS Devices in Europe

Module 3: Static VAR Compensator (SVC)

1. Operating principles of SVC
2. Components: Thyristor-controlled reactors, capacitors
3. Voltage regulation and dynamic response
4. SVC modeling and control strategies
5. Case Study: Hydro-Québec SVC Deployment

Module 4: Static Synchronous Compensator (STATCOM)

1. Fundamentals of STATCOM operation
2. V-I characteristics vs. SVC
3. Voltage support during faults
4. Control schemes and synchronization
5. Case Study: STATCOMs in Texas Wind Integration

Module 5: Thyristor Controlled Series Capacitor (TCSC)

1. TCSC structure and function
2. Power flow and damping oscillations
3. Mitigating SSR (subsynchronous resonance)
4. Control logic and stability impact
5. Case Study: TCSC in the Western US Power Grid

Module 6: Unified Power Flow Controller (UPFC)

1. UPFC configuration and benefits
2. Active and reactive power flow control
3. Series-shunt compensation in UPFC
4. VSC-based UPFC technology
5. Case Study: China’s 3 Gorges – Shanghai UPFC System

Module 7: Simulation and Modeling of FACTS

1. Modeling with MATLAB/Simulink
2. Using PSCAD for FACTS simulations
3. Load flow and stability studies
4. Real-time digital simulation (RTDS)
5. Case Study: Simulation of SVC Impact on Transient Stability

Module 8: Optimal Siting and Sizing of FACTS

1. Criteria for placement decisions
2. Power flow sensitivity analysis
3. Genetic algorithms and AI in optimization

4.Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
21 Sep 2026	02 Oct 2026	Online	$2,000
21 Sep 2026	02 Oct 2026	Physical	$3,000
21 Sep 2026	02 Oct 2026	Physical	$0
21 Sep 2026	02 Oct 2026	Physical	$0
21 Sep 2026	02 Oct 2026	Physical	$0
21 Sep 2026	02 Oct 2026	Physical	$0
21 Sep 2026	02 Oct 2026	Physical	$0
21 Sep 2026	02 Oct 2026	Physical	$0

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