EEPE4003 FACTS AND HDVC (3-0-0)

Course Learning Objectives:
This course will enable students to:

- Evaluate the importance of HVDC transmission system, analysis of HVDC converters, and power flow control.
- Compare different control strategies in HVDC systems and HVDC breaker.
- Analyze the working of different FACTs devices and benefits of FACTS over HVDC system.
- To understand the basic operating principle of different type of Shunt and series compensator and their application towards stability and voltage regulation in power system.

Module I 7 Hours

Introduction: Comparison of AC-DC Transmission, Description and application of HVDC transmission, DC System components and their functions, Analysis with gate control with overlap less than 60 degree-operation of inverter,12-pulse converter, effect of Leakage inductance, power flow in HVDC link

Module II 7 Hours

HVDC Control, Advance Control and Protection: Principles of DC Link control-Converter control characteristics-, Steady state characteristics, ideal and actual, System control, Firing angle control-Current and extinction angle control, DC link power control, Reactive power control and VAR sources, VDCOL- control and protection- DC circuit breakers

Module III 6 Hours

FACTS Concept and General System:
Transmission interconnections, Flow of power in AC system, Power flow and dynamic stability considerations of a transmission interconnection, Relative importance of controllable parameters, Basic types of FACTS controllers, Benefits from FACTS Technology, In-perspective: HVDC or FACTS

Module IV 6 Hours

Static Shunt and Series Compensators: Static Shunt Compensators - SVC and STATCOM - operation and control of TSC, TCR, STATCOM - Compensator Control - Comparison between SVC and STATCOM - STATCOM for transient and dynamic stability enhancement.
Static Series Compensation - TSSC, TCSC and SSSC - operation and control - external system control for series compensators - SSR and its damping - static voltage and phase angle regulators.

Module V 4 Hours

UPFC and IPFC: The Unified Power Flow Controller - operation, comparison with other FACTS devices - control of P and Q - dynamic performance - Special Purpose FACTS Controllers - Interline Power Flow Controller - operation and control

Course Outcomes (CO): On completion of this course, students are able to:

CO1. Compare AC and DC transmission systems and explain the structure, components, and functions of an HVDC transmission scheme
CO2. Analyse the operation of converters with gate control, including the effect of leakage inductance and other advance power control
CO3. Explain the concept of FACTS, the flow of power in AC transmission systems, Classification of the basic types of FACTS controllers
CO4. Understand and Analyse different shunt and series thyristor based FACTS controller like SVC, TCSC
CO5. Understand the working principle VSC based FACTS technology like STATCOM, SSSC, UPFC, IPFC

Text Book(s):

1. Narain G. Hingorani and L. Gyugyi, 'Understanding FACTS', IEEE Press.
2. HVDC Transmission, S. Kamakshaiah, V. Kamaraju, The Mc- Graw Hill Companies.
3. HVDC Power Transmission Systems: Technology and system Interactions, K. R. Padiyar, New Age International (P) Limited.

Reference Book(s):

1. J. Arrillaga, Peter Pregrinu, High Voltage Direct Current Transmission.
2. HVDC and FACTS Controllers Applications of Static Converters in Power Systems, Vijay K. Sood, Kluwer Academic Publishers.