

M.TECH SECOND SEMESTER

EEPC2T2

FACTS CONTROLLERS

Credits: 4

Lecture: 4 periods/week

Internal assessment: 30 marks
Semester end examination: 70 marks

Objective:

- To understand the need for FACTS
- To learn shunt and series compensation techniques
- To learn about controlled voltage and Phase angle regulator
- To learn concept of VSC and CSC and 12,24 and 48 pulse transformer configuration

Learning outcomes: After completing this course

- Student understands the need for interconnecting power system and the application of FACTS devices
- Student learn about various high power devices characteristics to use them in FACTS device.
- Student gains basic knowledge corresponding to various converter configurations and the transformer interconnections for various pulse configurations.
- Student understands the main objectives of shunt compensation and various methods to generate or control the reactive power.
- Student learn about operating characteristics of various FACTS devices like SVC, STATCOM, GSC, TSSC & TCSC.

Unit 1 : Transmission interconnections, power flow in an AC System, loading capability limits, Power flow and Dynamic stability considerations, importance of controllable parameters.

Unit 2 : Opportunities for FACTS, basic types of FACTS controllers, benefits from FACTS controllers, Requirements and Characteristics of High Power devices – Voltage and Current rating, losses and speed of switching, parameter trade-off of devices.

Unit 3 : Basic concept of Voltage source converter, Single phase full wave bridge converter, Single phase-leg (pole) operation, Square-wave voltage harmonics for a single phase Bridge, 3 Phase full wave bridge converter.

Unit 4 : Transformer connections for 12 pulse, 24 and 48 pulse operation. Three level voltage source converter, pulse width modulation converter, basic concept of current source converters, comparison of current source converters with voltage source converters.

Unit 5 : Objectives of shunt compensation, mid point voltage regulation for line segmentation, End of line voltage support to prevent voltage instability, improvement of transient stability, Power oscillation damping.

Unit 6 : Methods of controllable var generation: variable impedance type static var generators – TCR and TSR, TSC, FC-TCR, TSC-TCR, switching converter type var generators, hybrid var generators.

Unit 7 : SVC and STATCOM : The regulation and slope transfer function and dynamic performance, transient stability enhancement and power oscillation damping, operating point control and summary of compensation control.

Unit 8 : Static series compensators : Concept of series capacitive compensation, improvement of transient stability, power oscillation damping, functional requirements. GTO thyristor controlled series capacitor

(GSC), thyristor switched series capacitor (TSSC), and thyristor controlled series capacitor (TCSC), control schemes for GCSC, TSSC and TCSC.
UPFC and IPFC-Principles and applications.

Reference Book:

1. "Understanding FACTS " N.G.Hingorani and L.Guygi, IEEE Press.
Indian Edition--Standard Publications, 2001.
1. "Flexible a c transmission system (FACTS)" Edited by YONG HUE SONG and ALLAN T JOHNS, Institution of Electrical Engineers, London.