

## 4/4 B.Tech. SECOND SEMESTER

EE8T2 FLEXIBLE AC TRANSMISSION SYSTEMS

Credits: 4

Lecture: 4 periods/week

Internal assessment: 30 marks

Tutorial: 1 period /week

Semester end examination: 70 marks

---

### Objectives:

- 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 :

1. Demonstrate knowledge and understanding of facts concepts and systems
2. Analyze and design reactive power compensation systems
3. Solve real and reactive power flow problems
4. Evaluate the impact of flexible AC transmission systems of modern power systems

### Unit I

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

### Unit II

Opportunities for FACTS, basic types of FACTS controllers, benefits from FACTS controllers,– Voltage and Current rating, losses and speed of switching, parameter trade-off of devices.

### Unit III

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 IV

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 V

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 VI

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 VII

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 VIII**

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 GSC, TSSC and TCSC.

#### **Learning resources**

##### **Text books:**

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