FLEXIBLE ALTERNATING CURRENT TRANSMISSION SYSTEMS

VIII Semester: EEE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEE524	Professional Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The students will try to learn:

1. The concepts, types, and applications of FACTS controllers in power transmission systems.
2. The need of Static VAR compensators in regulating the voltage profile in load flow studies.
3. The various control strategies and functioning of series and shunt compensators to improve the power quality.
4. The importance of compensation and coordination of FACTS controller in transmission systems.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

1. **Recall** the basics of power transmission network for stable operation of power systems.
2. **Demonstrate** the series and shunt compensation for power transfer capability.
3. **Identify** the control strategy and algorithm for specific FACTS controllers.
4. **Interpret** the transient stability enhancement using shunt controllers.
5. **Select** the static var compensator for regulating the voltage of transmission system.
6. **Evaluate** various control schemes of series compensators for improving the power quality.
7. **Model** the Thyristor Controlled Series Capacitor (TCSC), Gate Controlled Series Capacitor (GCSC) for load flow studies.
8. **Examine** the static synchronous compensator for improving the power systems dynamics.
9. **Analyze** the Unified Power Flow Controller (UPFC) and Interline Power Flow Controller (IPFC) for load flow and transient stability studies.
10. **Develop** the coordinating schemes with the multiple FACTS controllers for reactive power compensation.

UNIT-I	INTRODUCTION

FACTS Controllers: Review of basics of power transmission networks, control of power flow in AC transmission line, analysis of uncompensated AC transmission line, passive reactive power compensation, effect of series and shunt compensation at the midpoint of the line on power transfer, need for FACTS controllers, types of FACTS controllers.

UNIT-II	STATIC VAR COMPENSATOR (SVC)

Static VAR compensator: Configuration of static VAR compensator, voltage regulation by static VAR compensator, modeling of static VAR compensator for load flow analysis, modeling of static VAR compensator for stability studies, design of static VAR compensator to regulate the midpoint voltage of SMIB system, applications, transient stability enhancement and power oscillation damping of single machine infinite bus system with static VAR compensator connected at the midpoint of the line.

UNIT-III	THYRISTOR AND GTO THYRISTOR CONTROLLED SERIES CAPACITORS (TCSC and GCSC)
Series compensator: Concepts of controlled series compensation, operation of thyristor controlled series capacitor and gate turn off thyristor controlled series capacitor, analysis of TCSC. GCSC modeling of TCSC and GCSC for load flow studies, modeling TCSC and GCSC for stability studies, applications of TCSC and GCSC.	
UNIT-IV	**VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS**
Static synchronous compensator (STATCOM), static synchronous series compensator (SSSC), operation of STATCOM and SSSC power flow control with STATCOM and SSSC, modeling of STATCOM and SSSC for power flow and transient stability studies, operation of unified and interline power flow controllers (UPFC and IPFC) modeling of UPFC and IPFC for load flow and transient stability studies, applications.	
UNIT-V	**CONTROLLERS AND THEIR COORDINATION**
FACTS controller interactions: SVC, SVC interaction, co ordination of multiple controllers using linear control techniques, quantitative treatment of control co ordination.	

Text Books:

1. K R Padiyar," FACTS Controllers in Power Transmission and Distribution", New Age International (P) Ltd., Publishers, 1st Edition, 2008.
2. Narain G Hingorani, Laszio Gyugyl, "Understanding FACTS Concepts and Technology of Flexible AC Transmission System", Standard Publishers, 1st Edition, 2001.

Reference Books:

1. Mohan Mathur, R Rajiv K Varma, "Thyristor – Based FACTS controllers for Electrical Transmission Systems", IEEE press and John Wiley & Sons, 1st Edition, 2002.
2. K Sood, "HVDC and FACTS controllers - Applications of Static Converters in Power System", Kluwer Academic Publishers, 1st Edition, 2004.

Web References:

1. https://www.researchgate.net
2. https://www.electrical4u.com.
3. https://www.iare.ac.in

E- Text Books:

1. https://www.jntubook.com/
2. https://www.freeengineeringbooks.com.