FLEXIBLE AC TRANSMISSION SYSTEMS

PEC-V: EPS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB23	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW

This course introduces the application of a variety of high power-electronic controllers foractive and reactive power in transmission lines. Students are exposed to the basics, modelingaspects, control and scope for different types of FACTS controllers.

II. OBJECTIVES:

This course should enable the students to:

I. Understanding of uncompensated lines and their behavior under heavy loadingconditions.
II. Explain the concept and importance controllable parameters of FACTScontrollers.
III. Describe the objectives of Shunt compensation, and basic operation of SVC andSTATCOM.
IV. Analyze the functioning of series controllers like GCSC, TSSC and TCSC.

III. COURSEOUTCOMES:

After successful completion of the course, students will be able to:		
CO 1	Recall the basics of power transmission capability and role of power electronic converters in transmission interconnections	Understand
CO 2	Identify the suitable VSC and CSC for high pulse operation of FACTS controllers	Apply
CO 3	Interpret the impact of shunt compensation on voltage stability, transient stability and power oscillation damping.	Apply
CO 4	Evaluate the performance of SVC and STATCOM to see how they are involved in enhancing the dynamic performance and transient stability	Analyze
CO 5	Model the static synchronous compensator, series compensators GSC, TSSC and TCSC for improving the power systems dynamics	Apply
CO 6	Recall the basics of power transmission capability and role of power electronic converters in transmission interconnections	Evaluate

IV. SYLLABUS

UNIT-I	FACTS CONCEPTS	Classes: 09

Transmission interconnections power flow in an ac system, loading capability limits, dynamic stability considerations, importance of controllable parameters basic types of FACTS controllers, benefits from FACTS controllers.

UNIT-II	VOLTAGE SOURCE CONVERTERS	Classes: 09

Single phase three phase full wave bridge converters 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, and comparison of current source converters with voltage source converters.

UNIT-III	STATIC SHUNT COMPENSATION	Classes: 09

Objectives of shunt compensation, mid-point voltage regulation voltage instability prevention, improvement of transient stability, Power oscillation damping.

Methods of controllable VAR generation, variable impedance type static VAR generators switching converter type VAR generators hybrid VAR generators.

UNIT-IV	SVC AND STATCOM	Classes: 09
Regulation and slope transfer function and dynamic performance, transient stability enhancement and power oscillation damping operating point control and summary of compensator control.		
UNIT-V	**STATIC SERIES COMPENSATORS**	**Classes: 09**
Concept of series capacitive compensation, improvement of transient stability, power oscillation damping and functional requirements of GTO thyristor controlled series capacitor (GSC), thyristor switched series capacitor (TSSC), and thyristor controlled series capacitor (TCSC)Control schemes for GSC TSSC and TCSC.		

Text Books:

1. Hingorani H G and Gyugyi. L "Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems" New York, IEEE Press, 1st Edition, 2000.
2. PadiyarKR,"FACTSControllersinPowerTransmissionandDistribution"NewAgeInt.Publishers, 2nd Edition, 2007.

Reference Books:

1. Zhang, Xiao-Ping, Rehtanz, Christian, Pal, Bikash "Flexible AC Transmission Systems: Modeling and Control", Springer, 1st Edition,2012.
2. Yong-Hua Song, Allan Johns, "Flexible AC Transmission Systems", IET, 1st Edition, 1999.

Web References:

1. https://www.researchgate.net
2. https://www.aar.faculty.asu.edu/classes
3. https://www.facstaff.bucknell.edu/
4. https://www.electrical4u.com

E-Text Books:

1. https://www.site.uottawa.ca
2. https://www.galerybooks.com
3. https://www.jntubook.com/
4. https://www.freeengineeringbooks.com