

COURSE CODE: 1152EE112	COURSE TITLE: <b>FLEXIBLE AC TRANSMISSION SYSTEMS</b>	L	T	P	C
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**COURSE CATEGORY:**

Program Elective

**PREAMBLE :**

This subject will describe about basic concepts, different types, scope and applications of FACTS controllers in power transmission system

**PREREQUISITE COURSES:**

- o Power electronics & Drives

**RELATED COURSES:**

- o Electric Circuit Theory, Power System, Power electronics, Digital electronics

**COURSE EDUCATIONAL OBJECTIVES :**

The objectives of the course are to make the students,

- To know the importance of compensation in transmission lines and the concepts of FACTS devices.
- To illustrate the design, modeling and applications of SVC.
- To learn the operation, modes, modeling and applications of TCSC.
- To study the principle, characteristics, modeling and applications of STATCOM and SSSC.
- To summarize about the importance in coordination of FACTS controllers.

**COURSE OUTCOMES :**

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

CO Nos.	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Explain the basic fundamental of FACTS controllers	K2
CO2	Summarize about Static VAR Compensators	K2
CO3	Explain about Modeling, Operation and control strategies of Static series compensation-SVC	K2
CO4	Explain the voltage source based FACTS controllers	K2
CO5	Explain the modeling and design of Coordinating multiple FACTS controllers using control techniques	K2

**CORRELATION OF COs AND POs**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M										L	L
CO2		H	H					M	M			
CO3		H										
CO4			H		H	L	H				L	L
CO5		L			L			M	M		L	L

<b>COURSE CONTENT:</b>		
<b>UNIT I</b>	<b>INTRODUCTION TO FACTS</b>	<b>9</b>
Reactive power control in electrical power transmission lines –Uncompensated transmission line - Power Flow in AC System – relative - importance of controllable parameter – opportunities for FACTS – possible benefits for FACTS.		
<b>UNIT II</b>	<b>STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS</b>	<b>9</b>
Need for compensation – introduction to shunt & series compensation – objectives of shunt & series compensation – configuration & operating characteristics, Static shunt compensators: SVC - Operation and control.		
<b>UNIT III</b>	<b>SERIES COMPENSATION AND APPLICATIONS</b>	<b>9</b>
Static series compensation: TSSC - Modeling, Operation and control, Different modes – Variable reactance model –Applications: Improvement of the system stability limit – Enhancement of system damping.		
<b>UNIT IV</b>	<b>VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS</b>	<b>9</b>
Static Synchronous Compensator (STATCOM) – Principle of operation – V-I Characteristics - Applications: Steady state power transfer-Enhancement of transient stability - Prevention of voltage instability - SSSC-operation of SSSC and the control of power flow –Modeling of SSSC in load flow and transient stability studies.		
<b>UNIT V</b>	<b>CO-ORDINATION OF FACTS CONTROLLERS</b>	<b>9</b>
Introduction to Unified Power Flow Controller (UPFC) & Interline Power Flow Controller (IPFC) – basic operating principles UPFC – introduction to sub synchronous Resonance - Coordination of multiple controllers using linear control techniques. Introduction to SCADA and security monitoring.		
<b>TOTAL: 45 PERIODS</b>		
<b>TEXT BOOKS:</b>		
<ol style="list-style-type: none"> <li>1. Narain G. Hingorani and Laszlo Gyugyi, “Understanding FACTS – Concepts and Technology of Flexible AC Transmission Systems”, Standard Publishers, New Delhi, 2001.</li> <li>2. R. Mohan Mathur and Rajiv K. Varma, “Thyristor Based FACTS Controller for Electrical Transmission Systems”, Wiley Inter science Publications, 2002</li> </ol>		
<b>REFERENCE BOOKS:</b>		
<ol style="list-style-type: none"> <li>1. Padiyar K.R.,” FACTS Controllers in Power Transmission and Distribution”, New Age International (P) Limited, Publishers, New Delhi, 2008.</li> <li>2. Narain G. Hingorani, “Flexible AC Transmission”, IEEE Spectrum, April 1993, 40-45</li> <li>3. Narain G. Hingorani, “High Power Electronics in Flexible AC Transmission”, IEEE Power Engineering Review, 1998.</li> <li>4. Elinar V. Larsen, Juan J Sanchez – Gasca Joe H. Chow, “Concepts for design of FACTS controllers to damp power swings”, IEEE Transactions on Power Systems, Vol. 10, No. 2, May.1995.</li> <li>5. Miller. T.J.E., Reactive Power Control in Electric System, John Wiley &amp; Sons, 1997.</li> <li>6. Dubey G.K., Thyristorized Power Controller, New Age international (P) Ltd.New Delhi 2001.</li> </ol>		

7. Song, Y.H. and Allan T. Johns, "Flexible ac transmission systems (FACTS)", Institution of Electrical Engineers Press, London, 1999.

