HVDC TRANSMISSION AND FACTS

PE-I: EPS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSC03	Elective	3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

This subject deals with the importance of HVDC transmission, analysis of HVDC Converters, Harmonics and Filters, Reactive power control and Power factor improvements of the system. It also deals with basic FACTS concepts, static shunt and series compensation and combined compensation techniques.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The fundamentals of FACTS Controllers,
II. The importance of controllable parameters and types of FACTS controllers & their benefits
III. Basics of HVDC Transmission system
IV. The control aspects of HVDC System

III.COURSE OUTCOMES:

After successful completion of the course, students will be able to:		
CO 1	**Explain** the basic fundamental of FACTS controllers	Understand
CO 2	**Interpret** the enhancement of stability using static shunt and series compensation	Understand
CO 3	**Model** and design of coordinating multiple FACTS controllers UPFC and IPFC using control techniques	Apply
CO 4	**Develop** the knowledge of HVDC transmission and HVDC converters and the applicability and advantage of HVDC transmission over conventional AC transmission.	Apply
CO 5	**Simplify** and solve mathematical problems related to rectifier and inverter control methods and learn about different control schemes as well as starting and stopping of DC links	Analyze

IV. SYLLABUS

MODULE –I:FACTS CONCEPTS(09)

Reactive power control in electrical power transmission, principles of conventional reactive power compensators. Introduction to FACTS, flow of power in AC parallel paths, meshed systems, basic types of FACTS controllers, definitions of FACTS controllers, brief description of FACTS controllers.

MODULE –II: STATIC SHUNT AND SERIES COMPENSATORS(09)

Shunt compensation – objectives of shunt compensation, methods of controllable VAR generation, static VAR compensators – SVC, STATCOM, SVC and STATCOM comparison. Series compensation – objectives of series compensation, thyristor switched series capacitors (TCSC), static series synchronous compensator (SSSC), power angle characteristics, and basic operating control schemes.

MODULE –III: COMBINED COMPENSATORS(09)

Unified power flow controller (UPFC) – Introduction, operating principle, independent real and reactive power flow controller and control structure.

Interline power flow controller (IPFC), Introduction to Active power filtering, Concepts relating to Reactive power compensation and harmonic current compensation using Active power filters.

MODULE –IV: HVDC TRANSMISSION(09)

HVDC Transmission system: Introduction, comparison of AC and DC systems, applications of DC transmission, types of DClinks, Layout of HVDC Converter station and various equipment's. HVDC Converters, analysis of bridge converters with and without overlap, inverter operation, equivalent circuit representation of rectifier and inverter configurations

MODULE –V: CONTROL OF HVDC SYSTEM(09)

Principles of control, desired features of control, converter control characteristics, power reversal, Ignition angle control, current and extinction angle control. Harmonics introduction, generation, ac filters and dc filters. Introduction to multiterminal DC systems and applications, comparison of series and parallel MTDC systems, Voltage Source Converter based HVDC systems

V. Text Books:

1. JArrillaga, "High Voltage Direct Transmission", Peter Peregrinus Ltd. London, 1st Edition, 1983.
2. K R Padiyar, "HVDC Power Transmission Systems", Wiley Eastern Ltd., 1st Edition, 1990.

VI. Reference Books:

1. E. W. Kimbark, "Direct Current Transmission", Vol. I, Wiley Interscience, 1st Edition, 1971.
2. Erich Uhlmann, "Power Transmission by Direct Current", B.S. Publications, 1st Edition, 2004.
3. SN Singh, "Electric Power Generation, Transmission and Distribution, PHI, New Delhi, 2nd Edition, 2008.
4. V Kamaraju, "HVDC Transmission" Tata McGraw-Hill Education Pvt Ltd, New delhi, 2nd Edition, 2011.

VII. Web References:

1. https://www.rceroorkee.in/pdf/pdfo/tee033.pdf
2. https://www.books.google.com/books?id=e24fndv2aroc
3. https://www.nptel.ac.in/syllabus/108108033

VIII Web References:

1. https://www.rceroorkee.in/pdf/pdfo/tee033.pdf
2. https://www.books.google.com/books?id=e24fndv2aroc
3. https://www.nptel.ac.in/syllabus/108108033

XI.E-Text Books:

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