

<b>Course Title</b>	<b>EHVAC &amp; HVDC Transmission</b>
<b>Course Code</b>	<b>EPS203</b>
<b>Course Credit</b>	Lecture : 04
	Practical : 00
	Tutorial : 01
	Total : 05

**Course Objective**

**The objective of the course is to:**

Elicit the advantages of EHV AC transmission systems. Mould students to acquire knowledge about HVDC Transmission systems. This course gives idea about modern trends in HVDC Transmission and its application, Understand about the overvoltage and its effects on power system. Complete analysis of harmonics and basis of protection for HVDC Systems.

**Detailed Syllabus**

<b>Sr. No.</b>	<b>Name of chapter &amp; Details</b>	<b>Hours Allotted</b>
<b>Section – I</b>		
1	<b>Introduction to EHV Transmission Comparison of AC and DC Transmission Systems:</b> Parameters of EHV Lines, Resistance of conductors, Bundle conductors, Inductance of EHV Line configurations line capacitance, Sequence Inductance and capacitance, Line parameters for modes of propagation, resistance and Inductance of Ground returns	8
2	<b>Voltage Gradient of conductors:</b> Field of sphere gap, Field of line charges and their properties, Charge – potential relations for multi-conductor lines, Surface voltage gradient and conductors without and with ground wires consideration, Gradient factors, Distribution of voltage gradient on sub-conductors of bundle	8
3	<b>Corona effects &amp; Noise:</b> Power loss and Audible Noise, Corona loss, Charge- Voltage diagram, Attenuation of traveling waves Audible, Noise Generation, Characteristics and its limitation, Measurement, meters, 1-phase and 3-phase AN levels	8
4	<b>Over voltage in EHV systems caused by switching operations:</b> Origin of over voltage and their types, Short circuit current and circuit breaker, Recovery voltage and the circuit breaker, Over voltage caused by interruption of inductive current, Interruption of capacitive currents, Ferro resonance over voltage, Calculation of switching surges single	6

	phase equivalents, Distributed parameter line energized by source, Generalized equations for single phase representation, Generalised equation of three phase systems, Inverse Fourier transform for the general case, Reduction of switching surges on EHV systems.	
<b>Section – II</b>		
5	<b>H.V.D.C. Transmission:</b> General considerations, Power Handling Capabilities of HVDC Lines, Basic Conversion principles, Static converter configuration	<b>10</b>
6	<b>Static Power Converters:</b> 3-pulse, 6-pulse and 12-pulse converters, Converter station and Terminal equipment, Commutation process, Rectifier and inverter operation	<b>8</b>
7	<b>HVDC Link:</b> Control of HVDC link, Converter control characteristics, Firing angle control and extinction angle control, Comparison between AC and DC transmissions, Applications of HVDC transmission, Power modulation and power control of HVDC lines, Multi-terminal DC links and systems Series, parallel and series parallel systems, their operation and control	<b>8</b>
8	<b>Transient over voltages &amp; Harmonics in HVDC systems:</b> Over voltages due to disturbances on DC side, Over voltages due to DC and AC side line faults, Introduction to harmonics – generation of harmonics – design of AC filters – DC filters – carrier frequency and RI noise	<b>4</b>
<b>Instructional Method and Pedagogy:</b>		
<ul style="list-style-type: none"> <li>• Lectures will be conducted with the aid of multi-media projector, black board, Transparencies etc.</li> <li>• Assignments and Exercise will be given to the students for each unit/topic and will be evaluated at regular interval.</li> <li>• Surprise tests/Quizzes/Seminar/Tutorials will be conducted.</li> <li>• Self study assignments, seminar from students can be conducted</li> </ul>		
<b>Students Learning Outcomes:</b>		
<p>At the end of the course students will be able</p> <ul style="list-style-type: none"> <li>• To understand the basic concepts of EHV AC and HVDC transmission.</li> <li>• To identify the electrical requirements for HVDC lines.</li> <li>• To identify the components used in AC to DC conversion.</li> <li>• To understand the operation of HVDC conversion technology.</li> <li>• To understand the fundamental requirements of HVDC transmission line design.</li> <li>• To identify factors affecting AC-DC transmission.</li> </ul>		

**Reference Books/Text book:**

1. Begemudre R.D., "EHVAC Transmission Engineering – Willy Eastern Ltd.
2. Padiyar K.R., "HVDC Power Transmission Systems" – New age International Ltd.
3. Rao S., "EHV AC & HVDC Transmission Systems" - Khanna Pub.
4. Arrilaga, J., „High voltage direct current transmission", peter pereginver Ltd., London, U.K.1983
5. Kimbark, E.W., „Direct current transmission-vol.1", Wiley Interscience, New York, 1971.

**Additional Resources:**

[www.sciencedirect.com](http://www.sciencedirect.com)  
[www.delnet.nic.in](http://www.delnet.nic.in)