EHVAC & HVDC TRANSMISSION SYSTEMS

Course Code	23EE4701A	Year	IV	Semester(s)	I
Course Category	Professional Elective-IV	Branch	EEE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Power Systems, Power Electronics
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Explain the basic concepts of EHV AC transmission, corona effects, HVDC transmission systems, converter operation, and harmonics in transmission systems. (L2)
CO2	Determine the electrostatic field, voltage gradient, bundle conductor characteristics, and corona performance in EHV AC transmission lines.(L3)
CO3	Determine the performance of HVDC transmission systems, converter operation, DC link control, and harmonic characteristics in HVDC systems.(L3)
CO4	Examine electrostatic field distribution, voltage gradients, and corona effects in EHV AC transmission systems.(L4)
CO5	Examine HVDC converter characteristics, system control, harmonic generation, and design of AC filters in HVDC transmission systems.(L4)

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1									1	2	
CO2	3	2	1	1	1							3	1
CO3	3	2	1	1	1							3	2
CO4	3	3	2	2	1							3	1
CO5	3	3	2	2	2	1						3	3

SYLLABUS		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction of EHV AC transmission** Necessity of EHV AC transmission – Advantages and problems– Power handling capacity and line losses– Mechanical considerations in line performance –Electrostatics – Field of sphere gap – Field of line charges and properties – Charge – potential relations for multi–conductors – Surface voltage	**CO1 CO2 CO4**

	gradient on conductors – Bundle spacing and bundle radius– Examples – Distribution of voltage gradient on sub conductors of bundle – Examples.	
II	**Corona effects** Power loss and audible noise (AN) – Corona loss formulae – Charge voltage diagram – Generation – Characteristics – Limits and measurements of AN – Relation between 1–phase and 3–phase AN levels – Examples – Radio interference (RI) – Corona pulses and thier generation – Properties and limits – Frequency spectrum – Modes of propagation – Excitation function – Measurement of RI, RIV and excitation functions – Examples.	**CO1** **CO2** **CO4**
III	**Basic Concepts of DC Transmission** Economics & Terminal equipment of HVDC transmission systems: Types of HVDC Links – Apparatus required for HVDC Systems – Comparison of AC &DC transmission – Application of DC Transmission System – Planning & Modern trends in DC transmission – Types of MTDC systems.	**CO1** **CO3** **CO5**
IV	**Analysis of HVDC Converters and System Control** Choice of Converter configuration – Analysis of Graetz circuit – Characteristics of 6 Pulse & 12 Pulse converters — Principal of DC Link Control – Converters Control Characteristics – Firing angle control –Constant Current and extinction angle control –Starting and stopping of DC link – Power Control.	**CO1** **CO3** **CO5**
V	**Harmonics in HVDC System** Generation of Harmonics – Characteristics harmonics – Calculation of AC Harmonics – Non Characteristics harmonics – Adverse effects of harmonics – Calculation of voltage & current harmonics – Effect of Pulse number on harmonics. Types of AC filters, Design of Single tuned filters –Design of High pass filters	**CO1** **CO3** **CO5**

Learning Resources
Text Books:
1. HVDC Power Transmission Systems: Technology and system Interactions – by K.R.Padiyar, New Age International (P) Limited, and Publishers. 2. Direct Current Transmission – by E.W.Kimbark, John Wiley & Sons. 3. EHVAC Transmission Engineering by R. D. Begamudre, New Age International (p) Ltd.
Reference Books:
1. EHVAC and HVDC Transmission Engineering and Practice – Sunil S.Rao. 2. Power Transmission by Direct Current – by E.Uhlmann, B.S.Publications 3. HVDC Transmission – J.Arrillaga.
E-Resources: 1. https://nptel.ac.in/courses/108104013 2. https://nptel.ac.in/courses/108108099