

EXTRA HIGHVOLTAGE AC TRANSMISSION

VIII Semester: EEE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEE504	Core	L	T	P	C	CIA	SEE	Total
		3	--	-	3	30	70	100
Contact Classes: 45		Tutorial Classes: 15		Practical Classes: Nil			Total Classes: 60	

OBJECTIVES:

The course should enable the students to:

- I Illustrate basic concepts of extra high voltage AC transmission and understand the need for it.
- II Outline the line and ground reactive parameters and voltage gradients of conductors.
- III Describe effects of corona and methods of associated measurement.
- IV Associate the knowledge of electro static field theory and traveling wave theory.
- V Select voltage control methods for extra high voltage AC transmission system.

COURSE OUTCOMES(COs):

- CO1:** Student can learn about the trends in EHV AC transmission
CO2: Student can calculate the line inductance and capacitance of bundle conductors.
CO3: Student understands the effect of Corona and radio interference..
CO4: Explore the concept of Electro static field and the travelling wave theory
CO5: Student can analyze compensated devices for voltage control.

COURSE LEARNING OUTCOMES(CLO'S):

1. Student shall learn the necessity of EHVAC Transmission.
2. Student will come to know the advantages and problems in EHVAC Transmission.
3. Student learns the power handling capability and line losses in EHVAC Transmission.
4. Student understands the concept of bundle conductors.
5. Student can calculate line inductance.
6. Student can calculate line capacitance.
7. Student learns the concept of sequence inductance and sequence capacitance.
8. Student learns the concept of sequence inductance and sequence capacitance
9. Student learns different modes of propagation and ground return.
10. Student can calculate gradient of bundle conductors.
11. Student can solve various design examples.
12. Student learns about the concept of power loss and audible noise due to Corona.
13. Student can derive the formula for corona loss
14. Student can understand the relationship between single phase and three phase audible noise levels
15. Student learns the concept of radio interference.
16. Student can calculate electrostatic field of EHV transmission lines.
17. Understand the effect of electrostatic field on humans, animals and plants.
18. Student can estimate the electrostatic induction in un-energized circuit of double, circuit line
19. Student can derive travelling wave expression and its solution
20. Student learns about source of excitation and terminal conditions.
21. Student learns about power circle diagram and its uses.
22. Student understands the concept of synchronous condenser.
23. Student learns the concept of static VAR compensation.

UNIT - I	INTRODUCTION	Classes: 08
<p>Necessity of EHV AC transmission – advantages and problems–power handling capacity and line losses-mechanical considerations – resistance of conductors – properties of bundled conductors – bundle spacing and bundle radius- Examples.</p> <p>Line and ground reactive parameters: Line inductance and capacitances – sequence inductances and capacitances – modes of propagation – ground return – Examples.</p>		
UNIT - II	VOLTAGE GRADIENTS OF CONDUCTORS:	Classes: 10
<p>Electrostatics – field of sphere gap – field of line charges and properties – charge – potential relations for multi-conductors – surface voltage gradient on conductors – distribution of voltage gradient on sub-conductors of bundle – Examples.</p>		
UNIT - III	CORONA EFFECTS	Classes: 10
<p>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 generation, properties, limits – frequency spectrum – modes of propagation – excitation function – measurement of RI, RIV and excitation functions – Examples.</p>		
UNIT - IV	ELECTRO STATIC FIELD	Classes: 08
<p>calculation of electrostatic field of EHV/AC lines – effect on humans, animals and plants – electrostatic induction in unenergised circuit of double-circuit line – electromagnetic interference-Examples.</p> <p>Traveling wave theory: Traveling wave expression and solution- source of excitation- terminal conditions- open circuited and short-circuited end- reflection and refraction coefficients-Lumped parameters of distributed lines-generalized constants-No load voltage conditions and charging current</p>		
UNIT - V	VOLTAGE CONTROL	Classes: 09
<p>Power circle diagram and its use – voltage control using synchronous condensers – cascade connection of shunt and series compensation – sub synchronous resonance in series capacitor – compensated lines – static VAR compensating system</p>		
Text Books:		
<ol style="list-style-type: none"> 1. EHVAC Transmission Engineering by R. D. Begamudre, New Age International (p) Ltd. 2. HVAC and DC Transmission by S. Rao 3. Padiyar K.R., “HVDC Power Transmission Systems” -New age International Ltd.. 		
Reference Books:		
<ol style="list-style-type: none"> 1. Arrilaga, J, “High voltage direct current transmission”, peter pereginver Ltd., London, U.K.1983 2. Kimbark, E.W, “Direct current transmission-vol.1”, Wiley Interscience, New York, 1970.. 		
Web References:		
<ol style="list-style-type: none"> 1. https://www.ae.pwr.wroc.pl/filez/20110606092353_HEV.pdf 2. https://www.afdc.energy.gov/pdfs/52723.pdf 3. https://www.leb.eei.uni-langen.de/winterakademie/2010/report/content/course03/pdf/0308.pdf 		
E-Text Books:		

1. https://www.ae.pwr.wroc.pl/filez/20110606092353_HEV.pdf
2. <https://www.afdc.energy.gov/pdfs/52723.pdf> 5. [https://www.leb.eei.uni-](https://www.leb.eei.uni-langen.de/winterakademie/2010/report/content/course03/pdf/0308.pdf)
3. [langen.de/winterakademie/2010/report/content/course03/pdf/0308.pdf](https://www.leb.eei.uni-langen.de/winterakademie/2010/report/content/course03/pdf/0308.pdf)