

COURSE CODE: 1152EE104	COURSE TITLE: HIGH VOLTAGE ENGINEERING	L	T	P	C
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COURSE CATEGORY:

Program Elective

PREAMBLE :

This course covers specifications of insulation materials in liquid, gas and solid case and identifies the effect of extra high voltage on the environment. This module will prepare students for effective participation in the field of high voltage power systems within the electrical engineering environment.

PREREQUISITE COURSES:

- Power System Analysis

COURSE EDUCATIONAL OBJECTIVES :

The objectives of the course are to make the students,

- Understand the principles of theory of high voltage generation and measurements
- Understand the operation of high voltage power supplies for ac, dc, and impulse voltages
- Get familiar with various applications where high voltage field is used
- Understand breakdown of HV insulation (solid, Liquid and Gas)
- Understand lightning phenomena and HV Insulation Environmental pollution.

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)
C01	Explain the principles behind generating high DC-, AC- and impulse voltages	K2
C02	Develop equivalent circuit models of the different high voltage generators	K3
C03	Perform a dynamic response analysis of high voltage measurement system	K3
C04	Compute the breakdown strength of gas-filled insulation systems with simple geometries	K2
C05	Communicate an understanding of the principles, concepts, practices relevant to the application and hazards of electrostatic charges within the high voltage field.	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					M	M			
CO3												
CO4			H		H	L	H				L	L
CO5					L			M	M		L	L

COURSE CONTENT:

UNIT I	OVER VOLTAGES AND INSULATION COORDINATIONS	9
Introduction – Historical sketch – Comparison between AC and DC transmission – Kinds of DC links – Planning and modern trends. Causes of over voltages in transmission lines; lightning and switching over voltages; effects of over - voltages on power system equipment; protection against over voltages; surge absorbers and surge diverters; shielding; insulation coordination.		
UNIT II	GENERATION OF HIGH VOLTAGES AND HIGH CURRENT	9
Generation of high AC voltages; cascaded transformers; generation of high DC voltages; Cockcroft Walton circuit and its qualitative analysis; generation of impulse and switching surges; Marx circuit; generation of high impulse current. Tripping and control of impulse generators		
UNIT III	MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS	9
Measurement of AC, DC impulse and switching surges using sphere gaps, peak voltmeters, potential dividers and high speed CRO, op to Electronics method; Fiber optic method; RIV and corona measurements; partial discharge; dielectric loss measurement using bridges.		
UNIT IV	ELECTRICAL BREAKDOWN IN GASES, SOLIDS AND LIQUIDS	9
Ionization processes - Townsend & Streamer theory - the sparking voltage - Paschen's law - Time lag for breakdown - Breakdown in non-uniform fields and corona discharges. Conduction and breakdown in pure and commercial liquids and solids dielectrics		
UNIT V	HIGH VOLTAGE TESTING PRACTICES	9
BS/IEC/VDE specification for testing; correction factor; high voltage testing of power apparatus; corona and RIV testing measurement; Non destructive insulation tests; sources and hazards of EMI and EMC; EMI/EMC testing practice; corona and ESD testing techniques.		
TOTAL: 45 PERIODS		
TEXT BOOKS:		
<ol style="list-style-type: none"> 1. C.L. wadwa “ High voltage engineering “ New Age International P.Ltd. reprint 2001. (Unit I, II, III, IV,V) 2. M.S.Naidu and N.Kamaraju, "High voltage Engineering" Tata Mc Graw Hill publishing company, New Delhi, 1983 3. Subir Ray, “ An introduction to High voltage Engineering”, PHI Learning private ltd 2004. 4. John Kuffel and Peter Kuffel, “ High voltage engineering fundamentals”, second edition, Elsevier. 		