BEELE 704 T- HIGH VOLTAGE ENGINEERING

Learning Objectives	Learning Outcomes
Student will learn the various concepts of high voltage engineering such as breakdown mechanism, lightning and switching overvoltage, travelling waves etc. Student will also learn measurement and calculation of high voltage and current using different tests.	Students has understood breakdown mechanism in solid liquid and gaseous medium lightening and switching over-voltages and insulation coordination different methods of generation and measurement of high voltage and currents in laboratory different methods of non destructive and High Voltage testing of apparatus.

Unit 1 : Breakdown mechanism in Di-electric : Ionization process*;* Townsend's criterion for B.D. Break down in electro-negative gases, Time-lag for B.D.; Streamer theory for B.D in gases, Paschen's law; B.D in non-uniform field. Corona discharges and introduction of corona post B.D. phenomenon and applications, Practical considerations in using gases for insulation purpose; vacuum insulation, Liquid as insulators, conduction and B.D. in pure and commercial liquids. Intrinsic, electromechanical &.thermal B.D., B.D. of solid di-electrics in practice; B.D. in composite dielectrics.

Unit 2: Lighting and switching over voltages; Mechanism of lightening, types of strokes, parameter and characteristics of lightening strokes, characteristics of switching surges; power frequency over voltages. control of O.V. due to switching. Protection of lines by ground wires, protection by lightning Arrester, gap type and sapless L.A.., selection of L.A. ratings, surge-absorbers.

Unit 3: Traveling waves and Insulation coordination; Traveling waves' on transmission lines, Classification of lines attenuation and distortion of traveling waves, reflection and transmission of waves, behavior of rectangular waves at transition points. Introduction to insulation coordination, associated terms, impulse waveform. Introduction to BIL Reduced BIL and SIL.

Unit 4: Generation of high voltage and. Currents: Generation of High D.C voltages by rectifiers, voltage doubler and multiplier, circuits (Derivations and expression 'not required), electrostatic machines, Generation of high AC voltages by Cascade transformers, Resonant transformers, generation high frequency AC high voltage. Generation of impulse voltages: Standard impulse wave shapes, analyses of model and commercial impulse generation circuits, wave shape contro1 Marx circuit, tripping and control of impulse generation, generation of switching surges generation of impulse current.

Unit 5: -Measurement of high voltage and current: Measurement of high AC and DC voltage by micro ammeter, generating voltmeter resistance and capacitance potential divider, series impedance voltmeter CVT, Magnetic type potential transformers, electrostatic voltmeter. Peak reading AC voltmeter. Sphere gap arrangement. Measurement of impulse voltage by' potential dividers and peak reading voltmeters. Measurement of High AC DC current; measurement of high frequency and impulse current by resistive shunt (Bifilar strip shunt only,)

Unit 6: Non destructive and high voltage testing of electrical apparatus; Non destructive testing Measurement of DC Resistivity, measurement of Dielectric constant and loss-factor *(low* and power frequency only), Schering bridge for high charging circuits, for high dissipation factor for three terminal measurement, transformer ratio arm bridges, partial discharge measurements by straight detectors & by balance detectors , calibration of detectors, discharge detection *in* power cables. High voltage testing. Testing of insulators, bushings, Isolators, circuit. breakers, cables, transformer, lightning arresters and power capacitors.

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
High Voltage Engineering	M.S. Naidu and V Kamaraju	TMG
High Voltage Engineering	C.L.Wadhwa	New Age International
EHV AC Transmission	Begamudre	New Age international Publisher
Reference Books		
Advances In high Voltage Engineering	A.Haddat and D. Warne	IET