

**1. OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS 6**

Causes of over voltages and its effects on power system – Lightning, switching surges and temporary over voltages – protection against over voltages – Bewley's lattice diagram.

**2. ELECTRICAL BREAKDOWN IN GASES, SOLIDS AND LIQUIDS 10**

Gaseous breakdown in uniform and non-uniform fields – Corona discharges – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids – Breakdown Mechanisms in solid and composite dielectrics.

**3. GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS 10**

Generation of High DC, AC, impulse voltages and currents. Tripping and control of Impulse generators.

**4. MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS 10**

Measurement of High voltages and High currents – Digital techniques in high voltage Measurement.

**5. HIGH VOLTAGE TESTING & INSULATION COORDINATION 9**

High voltage testing of electrical power apparatus – Power frequency, impulse voltage and DC testing – International and Indian standards – Insulation Coordination.

**TOTAL: 45 PERIODS**

**TEXT BOOK**

1. M. S. Naidu and V. Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, 3rd Edition, 2004.

**REFERENCES**

1. E. Kuffel and W. S. Zaengel, 'High Voltage Engineering Fundamentals', Pergamon Press, Oxford, London, 1986.
2. E. Kuffel and M. Abdullah, 'High Voltage Engineering', Pergamon Press, Oxford, 1970.
3. L. L. Alston, Oxford University Press, New Delhi, First Indian Edition, 2006.

## **EE 2353 - HIGH VOLTAGE ENGINEERING**

### **DESCRIPTION:**

The numerical definition of high voltage depends on the context of the discussion. Two factors considered in the classification of a "high voltage" are the possibility of causing a spark in air and the danger of electric shock by contact or proximity. The definitions may refer to the voltage either between two conductors of a system or between any conductor and ground.

In electric power transmission engineering, high voltage is usually considered any voltage over approximately 35,000 volts. This is a classification based on the design of apparatus and insulation.

The International Electrotechnical Commission and its national counterparts (IET, IEEE, VDE, etc.) define high voltage circuits as those with more than 1000 V for alternating current and at least 1500 V for direct current, and distinguish it from low voltage (50–1000 V AC or 120–1500 V DC) and extra-low voltage (<50 V AC or <120 V DC) circuits. This is in the context of building wiring and the safety of electrical apparatus.

The general public may consider household mains circuits (100–250 V AC), which carry the highest voltages they normally encounter, to be high voltage.

The definition of extra high voltage (EHV) depends on the context of the discussion. In electric power transmission engineering this refers to equipment designed for more than 345,000 volts between conductors. In electronics systems, a power supply that provides greater than 275,000 volts is known as an "EHV Power Supply". It is often used in experiments in physics

### **OBJECTIVE:**

- i. To understand the various types of over voltages in power system and protection methods.
- ii. Generation of over voltages in laboratories.
- iii. Measurement of over voltages.
- iv. Nature of Breakdown mechanism in solid, liquid and gaseous dielectrics.
- v. Testing of power apparatus and insulation coordination.

**SARDAR RAJA COLLEGE OF ENGINEERING**  
**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**  
**MICRO LESSON PLAN**

No of hours	LECTUR TOPICS	Text / Ref. book and Page No
<b>Unit 1</b> <b>(OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS)</b>		
1-3	Causes of over voltages and its effects on power system	T 1
4	Lightning and Switching Surges of Temporary over voltages	T 1
5	Protection against over voltages (AV CLASS)	T 1
6	Bewley's lattice diagram and problem	T 1
<b>Unit 2</b> <b>ELECTRICAL BREAKDOWN IN GASES, SOLIDS AND LIQUIDS</b>		
1	Gaseous breakdown in uniform	T 1
2	Gaseous breakdown in non-uniform fields and Corona Discharges (AV CLASS)	T 1
3	Vacuum breakdown	T 1
4-5	Conduction and breakdown in Pure Liquids	T 1
6	Conduction and breakdown in Commercial Liquids	T 1
7-8	Breakdown mechanisms in solid dielectrics	T 1
9-10	Breakdown mechanisms in composite dielectrics	T 1
<b>UNIT- 3</b> <b>GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS</b>		
1-3	Generation of High Voltage DC	T 1
4-6	Generation of High Voltage AC	T 1
7	Generation of High impulse voltages (AV CLASS)	T 1
8-9	Generation of High Currents	T 1
10	Tripping and Control of impulse Generators	T 1
<b>UNIT- 4</b> <b>MEASUREMENTS OF HIGH VOLTAGES AND HIGH CURRENTS</b>		
1-4	Measurement of High voltages(AC & DC voltages)	T 1

5-8	Measurement of High currents (DC & Impulse)	T 1
9-10	Digital techniques in high voltage measurement (AV CLASS)	T 1
<b>UNIT- 5</b> <b>HIGH VOLTAGE TESTING &amp; INSULATION COORDINATION</b>		
1-3	High voltage testing of electrical power apparatus ( bushing, insulator)	T 1
4-6	High voltage testing of electrical power apparatus (isolators and Circuit Breaker)	T 1
7	High voltage testing of electrical power apparatus (Cable, Transformer and surge arresters) (AV CLASS)	T 1
8	Power frequency, impulse voltage and DC testing	T 1
9	International and Indian standards of insulation co-ordination	T 1

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