



INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
 Dundigal, Hyderabad - 500 043

ELECTRICAL AND ELECTRONICS ENGINEERING

TUTORIAL QUESTION BANK

Course Title	High Voltage Engineering				
Course Code	AEE015				
Programme	B.Tech				
Semester	VII	EEE			
Course Type	Core				
Regulation	IARE - R16				
Course Structure	Theory			Practical	
	Lectures	Tutorials	Credits	Laboratory	Credits
	3	1	4	3	2
Chief Coordinator	Mr. G. Kranthi Kumar, Assistant Professor				
Course Faculty	Mr. G. Kranthi Kumar, Assistant Professor				

COURSE OBJECTIVES:

The course should enable the students to:

I	Understand the various types of over voltages in power system and protection methods.
II	Analyze nature of breakdown mechanism in solid, liquid and gaseous dielectrics.
III	Demonstrate generation of higher voltages and currents in laboratories for testing purposes.
IV	Measure over voltages using various advanced techniques.
V	Design and test the power apparatus and insulation coordination.

COURSE OUTCOMES (COs):

CO 1	Describe the causes of over voltages and its effect and protection against over voltages by using protecting devices.
CO 2	Explain the different types breakdown process used in power system protection
CO 3	Construct the Generation of high voltages and currents and controlling of impulse generators
CO 4	Measure the high voltages and currents in power system by using different types of instruments and digital techniques.
CO 5	Use Analysing the high voltage apparatus in power system using BIL and international standards and insulation level.

COURSE LEARNING OUTCOMES:**Students, who complete the course, will have demonstrated the ability to do the following:**

AEE015.01	Study the effect of over voltage on power system and causes
AEE015.02	Check the causes which lead to over surges and over currents in power system.
AEE015.03	Identify the methods for protection against over voltages in power system.
AEE015.04	Discuss different phenomenon which leads to break down of gas insulation medium and specify the particular gas any power system apparatus.
AEE015.05	Explain the various methods which causes breakdown in liquid dielectric medium and their importance in power System protection.
AEE015.06	Illustrate the process which decreases the breakdown strength of solid insulating mediums and their application in power system.
AEE015.07	Design the networks for generation of high direct current Voltages and high alternating current voltages.
AEE015.08	Measure the value of high direct current voltages, high alternating current voltages, impulse voltage and current after generation..
AEE015.09	Analyze tripping and control of impulse generator.
AEE015.10	Determine the process which leads to over voltage and lightning phenomenon on power system equipment.
AEE015.11	Study the insulation co-ordination in safe operation of extra high voltage power system.
AEE015.12	Calculate the DC resistivity, loss factor and dielectric constant of different insulation mediums used in power system protection.
AEE015.13	Identify the difference between type test and routine test used to understand withstand capability of insulation system in power system.
AEE015.14	Examine the power system equipment like insulators, bushings, isolators and circuit breakers for their breakdown strength.
AEE015.15	Investigate the power system equipment like cable, transformers and surge arresters of their dielectric strength.
AEE015.16	Understand importance of high voltage engineering, Insulation technology, generation, measurement and testing related to high voltage power system.
AEE015.17	Explore the knowledge and skills of employability to succeed in national and international level competitive examinations.

UNIT-I

OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS

Part – A (Short Answer Questions)

S No	QUESTIONS	Blooms Taxonomy Level	Course Outcomes	Course Learning Outcomes (CLOs)
1	What are the types of over voltages?	Understand	CO1	AEE015.01
2	State the parameters and the characteristics of the lightning stroke?	Understand	CO1	AEE015.02
3	Mention the various regions of cloud.	Understand	CO1	AEE015.02
4	State the factors influencing the lightning induced voltage on transmission lines.	Understand	CO1	AEE015.02
5	Mention the different theories of charge formation.	Remember	CO1	AEE015.02
6	State the attenuation and distortion of travelling waves.	Remember	CO1	AEE015.02
7	What are surge arresters?	Remember	CO1	AEE015.01
8	List the drawbacks of expulsion type L.A.	Remember	CO1	AEE015.01
9	What are switching over voltages?	Remember	CO1	AEE015.01
10	Name the various methods for protection of Transmission lines against lightning over voltages.	Remember	CO1	AEE015.03
11	Why protection is needed for power system.	Understand	CO1	AEE015.01
12	How is the external over voltages caused?	Understand	CO1	AEE015.01
13	What is lightning phenomenon?	Understand	CO1	AEE015.02
14	What is surge absorber?	Understand	CO1	AEE015.02
15	Define surge diverter?	Understand	CO1	AEE015.02
16	What is lightning?	Understand	CO1	AEE015.01
17	Classify the lightning arrestor?	Understand	CO1	AEE015.01
18	What are the internal causes of over voltages?	Understand	CO1	AEE015.02
19	What is the difference between lightning arrestor and surge diverter?	Understand	CO1	AEE015.02
20	How do over voltages occur?	Understand	CO1	AEE015.02

Part – B (Long Answer Questions)

1	What is surge absorber? How do they differ from surge diverter?	Understand	CO1	AEE015.01
2	Explain the mechanism of lightning strokes including high over voltages on transmission line.	Understand	CO1	AEE015.02
3	Explain the process for power frequency over voltages.	Understand	CO1	AEE015.01
4	Explain different methods employed for lightning protection.	Understand	CO1	AEE015.01
5	Explain various methods to control switching over voltages.	Understand	CO1	AEE015.02
6	Explain with sketch the various theories of charge generation and discharging a thunder cloud?	Understand	CO1	AEE015.03
7	Explain clearly with neat diagram different types of lightning arresters?	Understand	CO1	AEE015.02
8	Explain how over voltages are generated in power system?	Understand	CO1	AEE015.03
9	Explain temporary over voltages in power systems?	Understand	CO1	AEE015.03
10	Explain the Mechanism of generation of switching over voltage	Understand	CO1	AEE015.02
11	Explain the causes for power frequency over voltage in a system?	Understand	CO1	AEE015.01
12	Brief over view of lightning and surge protection.	Understand	CO1	AEE015.01
13	Explain the various external and internal causes for over voltages on transmission lines.	Understand	CO1	AEE015.01
14	How are travelling waves attenuated in practice on over head lines? Explain.	Remember	CO1	AEE015.01
15	Explain how a ground wire can protect as a shield against direct strokes for overhead lines.	Remember	CO1	AEE015.01
16	Distinguish between surge diverters and surge arrestors.	Remember	CO1	AEE015.01
17	Explain the working of valve type lightning arrestor.	Remember	CO1	AEE015.01

18	With a neat sketch explain the working principle of an expulsion type lighting arrestor.	Remember	CO1	AEE015.01
19	What is a lighting protection system? How it will work.	Understand	CO1	AEE015.01
20	Explain corona discharge and effects.	Understand	CO1	AEE015.01
Part – C (Analytical Questions)				
1	A Surge of 10kv magnitude travels along a cable towards its junction with an over head line. The inductance and capacitance of the cable and over headline are respectively 0.18mH,0.24mF,AND 0.9mH,0.0072uF per km. Find the voltage rise at the junction due to the surge.	Understand	CO1	AEE015.01
2	A Cable has an inner conductor of radius 0.48×10^{-2} m inside a sheath of inner radius 1.56×10^{-2} m.find the values of inductance and capacitance per meter length, the surge impedance of the cable and the velocity of propagation of the wave if the relative permittivity of the cable insulation $\epsilon_r=4$	Understand	CO1	AEE015.01
3	A surge of 600kv travels along line with surge impedance $Z_1=450\Omega$. The line is connected to a cable of 1.2 km length. The inductance of the cable is $25\mu H$ and the capacitance of the cable is $0.150\mu F$.the far end of the cable is connected to a transformer of surge impedance 980Ω . Find the surge voltage distribution $10\mu sec$ after the surge has arrived at the line-cable junction.	Understand	CO1	AEE015.01
4	Two stations are connected together by an underground cable having a surge impedance of 50Ω connected to an overhead line of surge impedance 500Ω . If a surge wave of 100kv amplitude travels along the cable towards the junction of the cable and line, determine the value of the reflected and refracted voltages and current waves at the junction.	Understand	CO1	AEE015.02
5	A cable with surge impedance of 90Ω is terminated in two parallel connected over head lines having surge impedances 500Ω and 800Ω respectively. If a steep fronted voltage wave of 5kv travels along the cable find the voltages and currents in the cable and over head lines immediately after the travelling wave reaches the junction of cable and overhead lines. The travelling voltage wave is infinite in length.	Understand	CO1	AEE015.02
6	A surge of 12kv magnitude travels along a cable towards its junction with an over head line. The inductance and capacitance of the cable and overhead line are respectively 0.185mH and 0.25uF and 0.91mH and 0.0073uF per km. Find the voltage rise at the junction due to the surge.	Understand	CO1	AEE015.01
7	A Three phase line has conductors each of radius 1.0cm spaced at the corners of equilateral triangle of side 2.5m each. if dielectric strength of air is 30 kv/cm,determine the critical descriptive voltage at which corona will occur. Take relative air density factor=0.96 and irregularity factor=0.94	Understand	CO1	AEE015.04
8	Determine the descriptive critical voltage and the visual critical voltage for the local and general corona on a three phase over head transmission line consisting of three stranded copper conductors spaced 2.5m apart at corners of equilateral triangle. air temperature and pressure are $21^\circ C$ and 73.5 cm of Hg, respectively. Conductor diameter is 1.8 cm, irregularity factor 0.85 and surface factor 0.7 for local and general corona 0.7 and 0.8, respectively. Breakdown strength of air is $21.1(kv)/r.m.s/cm$.	Understand	CO1	AEE015.04
9	A Three phase ,220kv, 50Hz transmission line has equilateral triangle spacing of side 2m. The conductor diameter is 3.0cm. the air density and irregularity factor is 0.93 and 0.83 respectively. Find the descriptive critical voltage and corona loss per km. assume any data	Understand	CO1	AEE015.04

10	Three phase line has conductors each of radius 2.0cm spaced at the corners of equilateral triangle of side 3.5m each. if dielectric strength of air is 30 kv/cm, determine the critical disruptive voltage at which corona will occur. Take relative air density factor=0.96 and irregularity factor=0.94	Understand	CO1	AEE015.04
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UNIT - II

DIELECTRIC BREAKDOWN

Part – A (Short Answer Questions)

1	Define treeing	Understand	CO2	AEE015.06
2	Explain tracking	Understand	CO2	AEE015.06
3	State paschen's law	Understand	CO2	AEE015.04
4	Give the statement of Townsend's criteria.	Remember	CO2	AEE015.04
5	Explain primary ionization process.	Understand	CO2	AEE015.04
6	Explain secondary ionization process.	Understand	CO2	AEE015.04
7	Define mean free path.	Remember	CO2	AEE015.04
8	Discuss the effect of photo ions on breakdown of insulation medium.	Understand	CO2	AEE015.04
9	Write the expression for breakdown in gas insulation medium from Townsend's criteria.	Understand	CO2	AEE015.04
10	Differentiate between formative and statistical time.	Remember	CO2	AEE015.04
11	Draw the pd curve from paschen's law.	Remember	CO2	AEE015.04
12	Give the classification of liquid dielectrics.	Remember	CO2	AEE015.05
13	State the characteristics of liquid insulations.	Remember	CO2	AEE015.05
14	Draw the purification cycle of commercial liquid.	Understand	CO2	AEE015.05
15	The force experienced by solid particles in liquid according to suspended particle theory.	Remember	CO2	AEE015.05
16	Give the properties of composite dielectric.	Remember	CO2	AEE015.06
17	Give the examples of solid dielectric.	Remember	CO2	AEE015.06
18	Discuss partial discharge phenomenon in solid insulation medium.	Understand	CO2	AEE015.06
19	Explain how the temperature affects the breakdown strength of solid dielectrics.	Understand	CO2	AEE015.06
20	Define wave front time and wave tail time.	Remember	CO2	AEE015.04

Part – B (Long Answer Questions)

1	Explain the difference between photo ionization and photo electric emission.	Understand	CO2	AEE015.04
2	Explain pure and commercial liquids.	Understand	CO2	AEE015.05
3	Define Townsend's primary and secondary ionization co-efficient and also explain breakdown criteria.	Understand	CO2	AEE015.04
4	Explain the two conditions for collision of atom and electron for ionization process.	Understand	CO2	AEE015.04
5	Discuss the breakdown phenomenon occurs in composite dielectrics.	Understand	CO2	AEE015.06
6	Explain thermal breakdown in solid insulation.	Understand	CO2	AEE015.06
7	State Paschen's law and explain clearly.	Understand	CO2	AEE015.04
8	Derive the Townsend's current growth equation.	Understand	CO2	AEE015.04
9	Explain the breakdown of solid dielectrics due to treeing and tracking.	Understand	CO2	AEE015.06
10	Write short notes on various theories of breakdown in liquid dielectric mediums.	Understand	CO2	AEE015.05
11	Explain various ionization processes in gaseous dielectrics.	Understand	CO2	AEE015.04
12	Explain the mechanism of break down in composite dielectric.	Understand	CO2	AEE015.06
13	Explain the Townsend's criteria for spark.	Understand	CO2	AEE015.06
14	Discuss in detail, about break down of vacuum medium.	Remember	CO2	AEE015.05
15	Discuss the current growth phenomenon in a gas subjected to uniform and non uniform dielectric field.	Understand	CO2	AEE015.04

16	Describe the mechanism of short term break down of composite dielectric.	Understand	CO2	AEE015.05
17	What are the factors that influence conduction in pure liquid dielectric and commercial liquid dielectric.	Remember	CO2	AEE015.05
18	Explain briefly the various theories of breakdown in liquid dielectric.	Understand	CO2	AEE015.05
19	Discuss about the properties of composite dielectrics.	Understand	CO2	AEE015.05
20	Explain various process in electric breakdown in vacuum.	Understand	CO2	AEE015.06
Part – C (Analytical Questions)				
1	What will be the breakdown strength of air be for small gaps(1mm)and large gaps(20cm) under uniform field conditions and standard atmospheric conditions?	Understand	CO2	AEE015.04
2	A Solid specimen of dielectric has a dielectric constant of 4.2,and $\tan\delta=0.001$ a frequency of 50hz. if it is subjected to an alternating field of 50kv/cm, calculate the heat generated in the specimen due to the dielectric loss.	Understand	CO2	AEE015.04
3	Explain the streamer theory of gas insulation.	Understand	CO2	AEE015.06
4	Explain the partial discharge phenomenon in solid insulations.	Understand	CO2	AEE015.06
5	Explain different ionization process leading to breakdown in gas.	Understand	CO2	AEE015.06
6	Differentiate between short term breakdown and from long term breakdown in composite Di-electric.	Understand	CO2	AEE015.06
7	What are the breakdown mechanisms involving in solid electric breakdown?	Understand	CO2	AEE015.05
8	Discuss the characteristics of liquid di-electric.	Understand	CO2	AEE015.06
9	List out the problems caused by corona discharge.	Understand	CO2	AEE015.04
10	What are treeing and trenching? Explain clearly the two processes.	Understand	CO2	AEE015.06
UNIT – III				
Generation of High Voltages & Currents				
Part – A (Short Answer Questions)				
1	Write different forms of high voltage generation.	Remember	CO3	AEE015.07
2	Draw half wave rectifier circuit for high DC voltage neration.	Remember	CO3	AEE015.07
3	Draw full wave rectifier circuit for high DC voltage generation.	Remember	CO3	AEE015.07
4	Draw voltage doubler circuit for high DC voltage generation.	Remember	CO3	AEE015.07
5	Draw COCKROFT WALTON circuit used to generate high DC voltage.	Remember	CO3	AEE015.07
6	Write the expression of output from COCKROFT WALTON circuit.	Remember	CO3	AEE015.07
7	Write the expression for optimum number of stages for minimum voltage drop in COCKROFT WALTON circuit.	Remember	CO3	AEE015.07
8	Draw the cascade transformer for the generation of high AC voltage.	Remember	CO3	AEE015.07
9	Draw the resonant transformer for the generation of high AC voltage.	Remember	CO3	AEE015.07
10	Draw the multi stage impulse generator for the generation of high Impulse voltage.	Remember	CO3	AEE015.07
11	Define peak to peak ripple for the high DC voltage generation.	Remember	CO3	AEE015.07
12	In COCKROFT WALTON circuit $V_{max} = 125V$, operating frequency = 150Hz, $C = 0.05\mu F$ and load current is 5mA, determine optimum number of stages.	Understand	CO3	AEE015.07
13	In COCKROFT WALTON circuit $V_{max} = 125V$, operating frequency = 150Hz, $C = 0.05\mu F$ and load current is 5mA, calculate output voltage at optimum number of stages.	Understand	CO3	AEE015.07
14	In COCKROFT WALTON circuit $V_{max} = 125V$, operating frequency = 150Hz, $C = 0.05\mu F$ and load current is 5mA, measure voltage regulation.	Understand	CO3	AEE015.07
15	Define the front and tail times of impulse wave.	Remember	CO3	AEE015.07

16	What are the disadvantages of half wave rectifier circuit?	Remember	CO3	AEE015.07
17	What are the advantages of series resonance circuit?	Remember	CO3	AEE015.08
18	Mention the necessity of generating high voltage dc.	Remember	CO3	AEE015.08
19	What are the advantages of cascaded transformer units for HVAC Generation?	Remember	CO3	AEE015.07
20	Define statistical time lag and formative time lag.	Remember	CO3	AEE015.07
Part – B (Long Answer Questions)				
1	Draw and explain Tesla coil for the generation high AC voltage..	Understand	CO3	AEE015.07
2	Explain different methods to produce switching voltages for testing at laboratories.	Understand	CO3	AEE015.07
3	Explain full wave and half wave rectifier circuits to generate high DC voltage.	Understand	CO3	AEE015.07
4	Explain voltage doubler circuits to generate high DC voltage.	Understand	CO3	AEE015.07
5	Draw and explain the principle of Vandegraff generator used for the generation of high DC voltage.	Understand	CO3	AEE015.07
6	Draw and explain COCKROFT WALTON circuit for the generation of high DC voltage.	Understand	CO3	AEE015.07
7	Draw and explain cascade transformer to generate high AC voltage.	Understand	CO3	AEE015.07
8	Draw and explain multi stage impulse generator for the generation of high Impulse voltage..	Understand	CO3	AEE015.07
9	Analyze various impulse generator circuit and explain effect of circuit inductance and small resistance on them.	Understand	CO3	AEE015.07
10	Explain with diagrams, different types of rectifier circuits for producing high dc voltages.	Understand	CO3	AEE015.07
11	Explain the different schemes for cascade connection of transformer for producing very high AC voltages .	Understand	CO3	AEE015.08
12	What is a Tesla coil? how are damped high-frequency oscillations obtained from Tesla coil?	Understand	CO3	AEE015.08
13	What is a trigatron gap? Explain its functions and operation.	Understand	CO3	AEE015.08
14	Explain the operation of vande graff generator from the electro-static principle.	Understand	CO3	AEE015.07
15	Explain the cascaded transformer method of HVAC Generation.	Understand	CO3	AEE015.07
16	Explain the operation of basic impulse generator.	Understand	CO3	AEE015.07
17	Explain the working principle of cockroft-walton voltage multiplier circuit.	Understand	CO3	AEE015.07
18	Derive expression for damped high frequency oscillations obtained from a tesla coil.	Understand	CO3	AEE015.07
19	What is cascaded transformer? Explain Why cascading is done.	Understand	CO3	AEE015.07
20	Explain tripping and control of impulse generators with Trigatron gap arrangements’.	Understand	CO3	AEE015.07
Part - C (Analytical Questions)				
1	A COCKROFT WALTON circuit with 8 stages with all equal capacitance of 0.05 μ F. The supply transformer secondary voltage is 125KV ata frequency of 150Hz. If the load current to be supplied is 5mA. Calculate ripple percentage, voltage regulation and optimum number of stages for minimum regulation.	Understand	CO3	AEE015.07
2	An impulse generator has 8 stages with each condenser rated for 0.16 μ F and 125KV. The load capacitor available is 1000PF. Find the series resistance and the damping resistance needed to produce 1.2/50 μ s impulse wave. measure the maximum output voltage of the generator, if the charging voltage in 12KV.	Understand	CO3	AEE015.07
3	A 12 stages impulse generator has 0.12 μ F condenser rated for 200KV. The wave front and wave tail resistance connected are 1.25K ohms and 4K ohms respectively. If the load condenser is 1000PF. Find the wave front and wave tail times of the impulse wave produced.	Understand	CO3	AEE015.07

4	Calculate the peak current and wave shape of the output current of the generator having the total capacitance of 53 μ F. the charging voltage is 200KV, circuit inductance 1.47mH and the dynamic resistance of the objects is 0.05 ohms.	Understand	CO3	AEE015.07
5	Describe the simple voltage doubler circuit operation.	Understand	CO3	AEE015.07
6	What is the principle behind the electrostatic method of energy conversion.	Understand	CO3	AEE015.07
7	Draw a typical impulse current generator circuit.	Understand	CO3	AEE015.07
8	Summarize the basic principle of operation of an electrostatic generator.	Understand	CO3	AEE015.07
9	What is the principle of operation of resonant transformer?	Understand	CO3	AEE015.07
10	A 8-Stage impulse generator has 0.12 micro farad capacitor rated 167KV. What is the maximum discharge energy? If it has produce 1/50 micro second wave form across a load capacitor of 15000 pf find the front and tail timings.	Understand	CO3	AEE015.07

UNIT- IV

Measurement of high voltages and high currents

Part – A (Short Answer Questions)

1	Mention the techniques used in impulse current measurements.	Understand	CO4	AEE015.10
2	State the advantages of Sphere gaps?	Understand	CO4	AEE015.10
3	Give the advantages of electrostatic voltmeter.	Remember	CO4	AEE015.10
4	List out the limitations of generating voltmeters.	Understand	CO4	AEE015.10
5	What is the effect of dust particles on the measurement using sphere gaps?	Remember	CO4	AEE015.10
6	Explain the basic principle of Hall generator.	Remember	CO4	AEE015.11
7	Define CVT?	Remember	CO4	AEE015.11
8	What is the effect of nearby earthed objects on the measurements using sphere gaps?	Remember	CO4	AEE015.11
9	Give the advantages of generating voltmeters.	Understand	CO4	AEE015.10
10	What are the drawbacks of series resistance micro ammeter technique in HVAC measurements?	Understand	CO4	AEE015.11
11	What are the different types of resistive shunts used for impulse current measurements?	Remember	CO4	AEE015.10
12	What is the principle behind the operation of generating voltmeter?	Remember	CO4	AEE015.10
13	What are the advantages of generating voltmeter?	Understand	CO4	AEE015.10
14	Explain the porosity test on insulators.	Remember	CO4	AEE015.10
15	What are merits of choosing digital techniques for high voltage measurement?	Remember	CO4	AEE015.10
16	State the advantages of using ragowski coil for measurement of high frequency AC.	Understand	CO4	AEE015.10
17	Why are the capacitive voltage dividers preferred for high AC Measurement?	Remember	CO4	AEE015.11
18	What is the effect of nearby earthed objects on the measurements using sphere gaps?	Remember	CO4	AEE015.11
19	How the stray effect reduced resistive shunt type of measurement?	Remember	CO4	AEE015.11
20	State the disadvantages of CVT method of measurement?	Remember	CO4	AEE015.10

Part – B (Long Answer Questions)

1	Explain with neat diagram the principle of operation of an electrostatic voltmeter.	Understand	CO4	AEE015.10
2	Give the schematic arrangement of an impulse potential divider with an oscilloscope connected for measuring impulse voltages.	Understand	CO4	AEE015.11
3	What is CVT? Explain how CVT can be used for high voltage ac measurement.	Understand	CO4	AEE015.10
4	Describe the construction, principle of operation of a Generating voltmeter and give its applications and limitations	Understand	CO4	AEE015.10

5	Describe the construction of uniform field spark gap and discuss its advantages and disadvantages for high voltage measurements.	Understand	CO4	AEE015.10
6	Explain in detail various techniques for the measurement of high DC voltages.	Understand	CO4	AEE015.11
7	Give the basic circuit for measuring the peak voltage of a) ac voltage and b) impulse voltage	Remember	CO4	AEE015.10
8	Describe the generating voltmeter used for measuring high dc voltages.	Remember	CO4	AEE015.11
9	Compare the use of uniform field electrode spark gap and sphere gap for measuring peak values of voltages.	Understand	CO4	AEE015.12
10	Why are capacitance voltage dividers preferred for high ac voltage measurements?	Remember	CO4	AEE015.13
11	Explain the construction, operation of electrostatic voltmeter.	Understand	CO4	AEE015.10
12	Explain any two methods to measure high impulse current.	Understand	CO4	AEE015.10
13	Explain digital peak voltmeter.	Understand	CO4	AEE015.11
14	Explain the operation of hall effect generator for measuring high DC currents.	Understand	CO4	AEE015.10
15	Discuss the factors influencing the spark over voltage on sphere gaps.	Understand	CO4	AEE015.11
16	Tabulate the various methods of high AC and DC voltage and current measurement.	Understand	CO4	AEE015.10
17	Discuss various methods of measuring high impulse currents.	Understand	CO4	AEE015.10
18	Describe the construction of uniform field spark gap.	Understand	CO4	AEE015.11
19	What are the requirements of a sphere gap for measurement of high voltages?	Understand	CO4	AEE015.10
20	Draw a simplified equivalent circuit resistance potential divider and discuss its step response?	Understand	CO4	AEE015.11
Part – C (Analytical Questions)				
1	A generating voltmeter has to be designed so that it can have a range from 20 to 200kv dc if the indicating meter reads a minimum current of $2\mu\text{A}$ and maximum current of $25\mu\text{A}$, what should the capacitance of the generating voltmeter be?	Remember	CO4	AEE015.10
2	A rogowski coil is to be designed to measure impulse currents of 10kA having a rate of change of current of 10^{11} A/S. The current is ready by a TVM as a potential drop across the integrating circuit connected to the secondary .Estimate the values of mutual inductance ,resistance, and capacitance to be connected ,if the meter reading is to be 10v for full scale deflection.	Remember	CO4	AEE015.11
3	What is capacitance voltage transformer? Explain with Phasor diagram how a tuned capacitance voltage transformer can be used for voltage measurements in power systems.	Remember	CO4	AEE015.14
4	Explain the principle and construction of an electrostatic voltmeter for very high voltages.	Remember	CO4	AEE015.15
5	Explain how a sphere gap can be used to measure the peak value of voltages.	Remember	CO4	AEE015.10
6	Explain the different methods of high current measurements with their relative merits and demerits.	Understand	CO4	AEE015.11
7	Describe construction, principle operation of generating voltmeter and give its applications.	Remember	CO4	AEE015.11
8	What are the conditions to be satisfied by potential divider for impulse work?	Remember	CO4	AEE015.14
9	What is the significance of atmospheric correction factor in HV Testing?	Remember	CO4	AEE015.15
10	How a sphere gap can be used to measure the peak value of high voltage?	Remember	CO4	AEE015.10

UNIT - V

HIGH VOLTAGE TESTING AND INSULATION COORDINATION

Part - A (Short Answer Questions)

1	What are the necessities of High voltage testing?	Remember	CO5	AEE015.13
2	What is the specialty of HV Testing?	Remember	CO5	AEE015.12
3	What is disruptive discharge voltage?	Remember	CO5	AEE015.12
4	What is Flashover?	Understand	CO5	AEE015.12
5	What is Puncture?	Remember	CO5	AEE015.12
6	What are self restoring and Non self restoring insulation?	Remember	CO5	AEE015.13
7	What is withstand voltage.	Remember	CO5	AEE015.13
8	What is withstand voltage 50% Flashover voltage.	Remember	CO5	AEE015.13
9	What is withstand voltage 100% Flashover voltage	Remember	CO5	AEE015.12
10	What is meant by insulation co-ordination in EHV power system?	Remember	CO5	AEE015.13
11	Define AC Test Voltage	Remember	CO5	AEE015.13
12	Define Impulse voltage	Remember	CO5	AEE015.13
13	How are the Testing of insulators classified	Remember	CO5	AEE015.13
14	What are the various High voltage Tests done on insulators	Remember	CO5	AEE015.13
15	Distinguish between power frequency and impulse tests.	Remember	CO5	AEE015.13
16	What are the various HV Test done on Bushings?	Understand	CO5	AEE015.14
17	What are the various HV Tests done one circuit Breakers?	Remember	CO5	AEE015.15
18	What are the various Tests (HV Tests) done on surge diverters	Remember	CO5	AEE015.16
19	What is system protection level and its selection depend on what factors?	Understand	CO5	AEE015.14
20	What is BIL?	Understand	CO5	AEE015.14

Part - B (Long Answer Questions)

1	(a)How are the protective devices chosen for the optimal insulation level is a power system (b)Explain the following terms:- (i)Withstand voltage (ii)Flashing voltage (iii)50% flashing voltage	Understand	CO5	AEE015.14
2	Explain the impulse testing procedure for insulators	Understand	CO5	AEE015.13
3	Explain the need for high voltage testing of (i) Electrical apparatus (ii) Mention the different types of nature of test conductors. (iii)Discuss the arrangement with detailed procedure for conducting with respect to withstand test and state specification for water used in such tests.	Understand	CO5	AEE015.15
4	Explain the synthetic testing of circuit breakers.	Understand	CO5	AEE015.12
5	What are the tests done on cables? How samples (i) are prepared? Explain any two tests	Understand	CO5	AEE015.15
6	Explain long duration impulse current test and operating duty cycle test on surge diverters	Understand	CO5	AEE015.15
7	Explain the different power frequency tests on bushings? Mention the procedure for testing? Discuss the various tests carried out in a CB at HV labs.	Understand	CO5	AEE015.14
8	Explain the significance of impulse tests? Briefly explain the impulse testing of insulators.	Remember	CO5	AEE015.13
9	Explain the different electrical tests done on isolators and circuit breakers.	Remember	CO5	AEE015.13
10	Explain the partial discharge test on high voltage cables.	Analyze	CO5	AEE015.15
11	Explain with a neat diagram of synthetic testing of circuit breakers.	Understand	CO5	AEE015.13
12	What is meant by 50% descriptive discharge as applied to impulse voltage.	Understand	CO5	AEE015.13
13	With neat diagram explain the various HV testing's carried out an insulator and bushings?	Understand	CO5	AEE015.14
14	Explain in sequence the various high voltage tests being carried out in a power transformer?	Understand	CO5	AEE015.15
15	Discuss the different aspects of insulation design and insulation co-ordination adopted for EHV systems.	Understand	CO5	AEE015.16

16	Explain the procedure for constructing volt-time curves with neat sketch.	Understand	CO5	AEE015.14
17	Explain the various tests conducted in high voltage insulator.	Understand	CO5	AEE015.13
18	Explain the tests conducted on high voltage cables.	Understand	CO5	AEE015.13
19	Discuss the different high voltage tests conducted on bushings.	Understand	CO5	AEE015.14
20	Explain the following: i)Flash over voltage ii)Withstand voltage iii)impulse voltage iv)creeping distance.	Understand	CO5	AEE015.15
Part - C (Analytical Questions)				
1	Explain the terms: (i) With stand voltage (ii) Flash over voltage (iii) 50% flash over voltage (iv) Wet and dry power frequency tests	Understand	CO5	AEE015.12
2	Explain the following terms used in HV testing as per the standards: (i) Disruptive discharge voltage (ii) Creepage distance (iii) Impulse voltage (iv) 100% flash over voltage.	Understand	CO5	AEE015.12
3	Explain the method of impulse testing of high voltage transformers.	Understand	CO5	AEE015.12
4	Describe the importance of insulation co-ordination in power system.	Understand	CO5	AEE015.14
5	What is the difference between type and routine test?	Understand	CO5	AEE015.13
6	What is the procedure adopted for locating the failure in high voltage transformer.	Understand	CO5	AEE015.13
7	List out various tests to be carried out insulator and give brief account of each test.	Understand	CO5	AEE015.13
8	Explain the impulse testing procedure for insulator.	Understand	CO5	AEE015.14
9	How are the protective devices chosen for the optimal insulation level in a power system?	Understand	CO5	AEE015.15
10	What is the importance of power frequency tests carried out in a power transformer?	Understand	CO5	AEE015.13

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