



END SEMESTER EXAMINATION QUESTION BANK
Regulation : 2022

Branch : B.E. Electrical and Electronics Engineering	Year/Semester: VII/ 07
Course Code : EE606105	Course Name : HIGH VOLTAGE ENGINEERING

Course Outcomes (COs): At the end of the course, the student will be able to	
CO1	Ability to understand Generation and measurement of high voltage.
CO2	Ability to understand High voltage testing.
CO3	Ability to understand various types of over voltages in power system.
CO4	Ability to measure over voltages.
CO5	Ability to test power apparatus and insulation coordination

BL – Bloom’s Level (1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 –Evaluating, 6 - Creating);

UNIT - 1

No .	PART-A (2 Marks)	Marks	CO	BL
1.	Write some applications of high voltage?	2	CO1	1
2.	What are the causes of over voltages in a power system?	2	CO1	2
3.	What are the theories associated with the formation of charges in clouds?	2	CO1	1
4.	What are the types of lightning strokes	2	CO1	1
5.	What are the sources of switching surges?	2	CO1	1
6.	What are the factors to be considered for switching over voltages in EHV and UHV system?	2	CO1	2
7.	What are the methods to control overvoltage due to switching and power frequency?	2	CO1	1
8.	Write the causes of power frequency over voltages.	2	CO1	2
9.	What are the various methods of protecting the power system from lightning?	2	CO1	3
10.	What are the uses of ground wires?	2	CO1	1
11.	What are the requirements of the lightning arrestor?	2	CO1	1
12.	What are the methods to vary the tower footing resistance?	2	CO1	1

13.	What are the advantages of rod gaps?	2	CO1	1
14.	What are the disadvantages of rod gaps?	2	CO1	1
15.	What are the disadvantages of expulsion type lightning arrestor?	2	CO1	1

No .	PART-B (13 Marks)	Marks	CO	BL
1.	Explain the causes of over voltages in power systems.	13	CO1	4
2.	Describe the formation of switching surges and compare them with lightning over voltages in terms of origin, duration, and impact.	13	CO1	3
3.	With the help of a neat diagram, explain the Bewley Lattice Diagram and how it is used to determine voltage waves on transmission lines.	13	CO1	1
4.	Explain corona and its effect on power system	13	CO1	3
5.	What are the different methods employed for lightning protection of overhead lines	13	CO1	1
6.	Explain the control methods of over voltages due to switching.	13	CO1	3
7.	Explain the sources and characteristics of switching surges(13	CO1	3
8.	Explain the mathematical model for lightning	13	CO1	2

No .	PART-C (15 Marks)	Marks	CO	BL
1.	A 220 kV substation recently experienced a transformer failure immediately after an unloaded transmission line was energized during a scheduled switching operation. The post-fault analysis suggested that the transformer bushing failed due to a high switching surge. The system lacked surge arresters at the line entrance, and the transformer insulation level was just marginally above the system operating voltage.	15	CO1	5
2.	A 132 kV system feeding an industrial zone experienced a sudden load rejection due to a fault at the industrial plant. This caused temporary over voltages that led to tripping of circuit breakers and damage to capacitor banks connected at the substation.	15	CO1	4

UNIT - 2

No .	PART-A (2 Marks)	Marks	CO	BL
1.	Define breakdown voltage.	2	CO2	1
2.	What are the electrical discharges in gases	2	CO2	2
3.	What are the theories associated with the breakdown in gases	2	CO2	1

4.	Define Ionization	2	CO2	2
5.	Define electron attachment process	2	CO2	2
6.	Define Townsend's ionization co-efficient	2	CO2	1
7.	What are the various types of breakdown	2	CO2	1
8.	What is called a composite dielectric	2	CO2	2
9.	Write the several theories proposed to explain the breakdown in liquids	2	CO2	2
10.	What are the uses of vacuum insulator	2	CO2	1
11.	What are the mechanisms in vacuum breakdown	2	CO2	1
12.	Define mean free path	2	CO2	1
13.	Name the various mechanisms in composite dielectric	2	CO2	1
14.	What is tracking	2	CO2	1
15.	State Paschen's law	2	CO2	1

No .	PART-B (13 Marks)	Marks	CO	BL
1.	Deduce an expression for townsend's criteria for breakdown of gaseous medium.	13	CO2	1
2.	State and explain paschen's law	13	CO2	2
3.	Explain the phenomenon of corona discharges and breakdown mechanism in non uniform field.	13	CO2	2
4.	Explain clearly various process which explain electric breakdown in vacuum	13	CO2	1
5.	Explain the various theory involved in commercial liquid dielectric.	13	CO2	3
6.	Explain the various characteristic in pure liquid dielectric	13	CO2	2
7.	Explain the various breakdown mechanism in composite dielectric	13	CO2	2
8.	Explain the maintenance of oil quality with neat diagram	13	CO2	2

No .	PART-C (15 Marks)	Marks	CO	BL
1.	A Gas Insulated Substation (GIS) rated for 400 kV experienced a flashover incident near a busbar junction. Post-incident analysis showed intense corona discharge activity in that region. The equipment had minor surface imperfections. Discuss the	15	CO2	5

	impact of electrode surface roughness and field non-uniformity on gaseous breakdown.			
2.	A 33 kV vacuum circuit breaker (VCB) experienced a flashover while interrupting inductive load current. Post-event analysis pointed toward field emission-induced breakdown in vacuum and poor contact surface conditions. Evaluate the advantages and limitations of vacuum as an insulating medium compared to SF ₆ or oil.	15	CO2	5

UNIT - 3

No .	PART-A (2 Marks)	Marks	CO	BL
1.	Give some uses of HVDC.	2	CO3	1
2.	What are the applications of impulse current wave forms of high magnitude	2	CO3	3
3.	Draw a circuit diagram of simple voltage doublers	2	CO3	1
4.	Write the expressions to find the optimum number of stages and % ripple in a voltage multiplier circuits	2	CO3	1
5.	Draw a simple Tesla Coil equivalent circuit for generation of high frequency A.C high voltage	2	CO3	2
6.	An impulse generator has 10 stages with capacitors rated 0.15 μ F and 150 kV per stage. The load capacitor is 1000 pf. Find the front and tail resistance to produce an impulse of 1.2 / 50 μ s	2	CO3	1
7.	What is the need for generating impulse currents	2	CO3	1
8.	What are the factors influencing the measurements using sphere gap	2	CO3	2
9.	What is the necessity for generating high voltages	2	CO3	3
10.	What is the principle of Marx circuit	2	CO3	1
11.	Define the front and tail times of an impulse wave	2	CO3	2
12.	Explain the superiority of cascaded transformer over two winding transformer	2	CO3	1
13.	Write an expression to find the % ripple and % voltage regulation in a multi stage voltage multiplier circuit.	2	CO3	2
14.	What type of wave form will be available in impulse current generator output	2	CO3	2
15.	Define the specification of impulse voltage as per Indian standard	2	CO3	2

No .	PART-B (13 Marks)	Marks	CO	BL
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1.	Explain various types of high DC voltage generation with neat diagrams	13	CO3	2
2.	Explain the working of voltage doubler circuit with diagrams.	13	CO3	1
3.	With a neat circuit explain the working principle of a Cockcroft Walton voltage multiplier circuit	13	CO3	3
4.	Discuss with diagram the operation of Van de Graaff Generators	13	CO3	2
5.	Explain the working of Electrostatic Generators	13	CO3	1
6.	With a neat circuit explain the working generation of High AC.voltages, impulse voltages	13	CO3	2
7.	With neat diagram explain the working of Marx circuit Multistage Impulse Generators	13	CO3	2
8.	With neat diagram explain the working of generation of Impulse Currents	13	CO3	2

No .	PART-C (15 Marks)	Marks	CO	BL
1.	An HVDC transmission cable is being tested for insulation integrity using a high-voltage DC supply generated through a voltage multiplier circuit. The testing team observed fluctuations in output voltage and slow charging times. Compare the Van de Graaff generator and voltage multipliers for HVDC generation in terms of efficiency and maintenance.	15	CO3	5
2.	A Gas Insulated Switchgear (GIS) rated for 800 kV is to be tested for switching surge withstand voltage. A controlled switching surge is required, and a resonant transformer setup is used. However, the surge generated did not reach the expected waveform characteristics and voltage level. Describe the role of resonant transformers and Tesla coils in generating high AC voltages	15	CO3	5

UNIT - 4

No .	PART-A (2 Marks)	Marks	CO	BL
1.	What are the general methods used for measurement of high frequency and impulse currents	2	CO4	1
2.	What is the high voltage d.c measurement techniques used?	2	CO4	1
3.	For what measurement are Hall generators normally used?	2	CO4	1
4.	What type of measuring devices are preferred for measurement of Impulse currents of short duration	2	CO4	1
5.	Draw the simple circuit of peak reading voltmeter and its equivalent	2	CO4	1
6.	List the factors that are influencing the peak voltage measurement using sphere gap	2	CO4	2
7.	What are the advantages of CVT measurement in HVAC	2	CO4	1

8.	Why do we resort to statistical approach during breakdown due to impulse voltage	2	CO4	2
9.	What are high current shunts mention their design criterion	2	CO4	2
10.	Why are capacitive voltage dividers preferred for AC high voltage measurements	2	CO4	1
11.	Calculate the correction factors for atmospheric conditions, if the laboratory temperatures is 37°C, the atmospheric pressure is 750 mm Hg and the wet bulb temperature is 27°C.	2	CO4	2
12.	Explain the merits and demerits of analog and digital techniques used for high voltage measurements.	2	CO4	1
13.	What are the general methods used for measurement high frequency and impulse currents	2	CO4	2
14.	State the demerits of CVT measurement for HVAC measurements	2	CO4	2
15.	Define Generating voltmeter	2	CO4	2

No .	PART-B (13 Marks)	Marks	CO	BL
1.	Explain the various methods involved in DC measurement with neat diagrams	13	CO4	2
2.	Explain with neat diagram Generating voltmeter	13	CO4	1
3.	Explain the working of CVT with diagrams	13	CO4	2
4.	Explain the working of Electrostatic Voltmeters with diagrams	13	CO4	5
5.	Explain the working of Spark Gaps for Measurement of High D.C., A.C. and Impulse Voltages	13	CO4	3
6.	Explain the various methods involved in High AC measurement with neat diagrams	13	CO4	5
7.	Explain the working of measurement of high d.c., a.c. and impulse currents	13	CO4	5
8.	Explain the Cathode Ray Oscillographs For Impulse Voltage and Current Measurements	13	CO4	2

No .	PART-C (15 Marks)	Marks	CO	BL
1.	During an impulse voltage test on a 220 kV transformer, a resistive voltage divider was used to measure the applied impulse waveform. The recorded peak value showed a 15% deviation from the expected value. The test lab suspects improper grounding and stray capacitance effects. Briefly explain how digital signal processing techniques can be integrated to enhance impulse waveform analysis.	15	CO4	4
2.	During the type testing of a lightning arrester, the impulse current was measured using a high current shunt. However, waveform oscillations and thermal drift in the shunt introduced significant measurement	15	CO4	5

	errors in current magnitude. Identify the causes of waveform distortion and thermal drift during high current measurement.			
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UNIT - 5

No .	PART-A (2 Marks)	Marks	CO	BL
1.	What are tests conducted on insulators	2	CO5	1
2.	What are test conducted on Bushings	2	CO5	4
3.	Define withstand voltage	2	CO5	1
4.	Define impulse voltage	2	CO5	1
5.	Differentiate type test and routine test.	2	CO5	1
6.	Define Disruptive discharge voltage	2	CO5	3
7.	What are the atmosphere correction factor and mention their influence in high voltage testing.	2	CO5	1
8.	Explain the role of Bureau of Indian standards in high voltage testing.	2	CO5	2
9.	Define insulation co- ordination	2	CO5	3
10.	What is the significance of impulse tests?	2	CO5	1
11.	Name the different types of tests conducted on high voltage apparatus	2	CO5	2
12.	Explain the reasons for conducting wet tests on high voltage apparatus and give the specifications of the water used for wet tests.	2	CO5	1
13.	Define creepage distance	2	CO5	2
14.	Give the Indian standard reference atmospheric conditions for high voltage testing.	2	CO5	2
15.	Define safety margin as applied to be insulation co-ordination	2	CO5	3

No .	PART-B (13 Marks)	Marks	CO	BL
1.	Mention the different Electrical test on Over Head insulators	13	CO5	2
2.	What are the different test conducted on cables ?explain any one of them	13	CO5	2
3.	What are the different test conducted on Bushings ?explain in detail	13	CO5	5
4.	What are the different test conducted on Power capacitors ?explain in detail	13	CO5	5
5.	Discuss the method of impulse testing of high voltage transformer (or) power Transformer.	13	CO5	2
6.	Discuss the various tests carried out in a circuit breaker at HV lab?	13	CO5	2
7.	Write short notes on the following	13	CO5	5

	a) Significance of withstand and flashover voltage b) Difference between type and routine tests c) Voltage test on GIS equipment d) Role of standard waveforms in HV testing			
8.	Compare and contrast high voltage testing procedures for AC and DC insulators	13	CO5	5

No .	PART-C (15 Marks)	Marks	CO	BL
1.	After installation of a 400 kV SF ₆ circuit breaker, high voltage testing was conducted to validate dielectric strength. The breaker passed the power frequency test but failed the switching impulse test, indicating insulation degradation in one pole. Explain how insulation coordination helps avoid such post-installation failures.	15	CO5	1
2.	During type testing of a 245 kV porcelain bushing, the equipment failed under wet power frequency withstand test. The bushing had passed dry tests earlier, and visual inspection showed surface discharges and contamination. Analyze how contamination and surface leakage can affect test outcomes.	15	CO5	3

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