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

Department of Electrical and Electronics Engineering

TUTORIAL QUESTION BANK

Course Name	:	HIGH VOLTAGE ENGINEERING
Course Code	:	51067
Class	:	B. Tech IV Year I Semester
Branch	:	Electrical and Electronics Engineering
Year	:	2018 – 2019
Course Coordinator	:	Mr. T Anil Kumar, Assistant Professor, EEE
Course Instructors	:	Mr. T. Anil Kumar, Assistant Professor, EEE

S.NO	QUESTION	BLOOM'S TAXANOMY	COURSE LEARNING OUTCOME
	UNIT - I		
	Introduction to High Voltage Engineering		
	Part – A (Short Answer Questions)		
1	Write the expression for electric field intensity.	Understand	01
2	Give the importance of di-electric strength.	Understand	02
3	Give any two parameters on which breakdown voltage of insulation depends.	Understand	02
4	Explain the process of ionization by collision in gas insulation.	Understand	02
5	Give the units of breakdown voltage.	Remember	02
6	Give two importance of liquid insulations.	Remember	02
7	Write poisson's euqtion.	Remember	01
8	Name the two methods to determine potential distribution	Remember	01
9	Define field enhancement factor.	Remember	01
10	Give the names of numerical methods for electric field Computation	Remember	03
11	State the causes which leads to surge voltages .	Understand	01
12	Explain super node.	Understand	01
13	Write application of insulation materials in transformer	Understand	02
14	List application of insulation materials in circuit breaker	Understand	02
15	Write application of insulation materials in bushings.	Understand	02
16	Write application of insulation materials in cables.	Understand	02
17	Write application of insulation materials in power capacitor.	Understand	02
18	Write application of insulation materials in rotating machines.	Understand	02
19	Temperature classification is not done for liquids and gases .Justify the statement.	Understand	02
20	Discuss the different dielectric materials according to their physical nature.	Understand	02
	Part – B (Long Answer Questions)		
1	Give the necessity of electric field stress control.	Understand	01
2	List the insulation materials used in high voltage transformer.	Understand	02
3	Explain about electric field stress.	Understand	01
4	Explain the distribution and control of surge voltages in high voltage equipment.	Understand	01
5	Name the insulation materials used in high voltage circuit breaker.	Understand	02

6	Explain the method of charge simulation in determining electric field stress.	Understand	03
7	classify the insulation materials used in high voltage rotating machines.	Understand	02
8	Explain the finite element analysis and step by step procedure.	Understand	03
9	Explain how boundary element method is different from charge simulation method.	Understand	03
10	Discuss the insulation materials used in high voltage cables .	Understand	02
11	Explain the effect of transient and surge voltages in power equipment.	Understand	01
12	Categorize the insulation materials used in high voltage power capacitor .	Understand	02
13	Explain the finite element method used to estimate electric field stress on power system equipment insulation.	Understand	03
14	Distinguish the insulation materials used in high voltage power transformer .	Understand	02
UNIT – II			
Break Down In Dielectric Materials			
Part – A (Short Answer Questions)			
1	Define treeing .	Understand	06
2	Explain tracking.	Understand	06
3	State paschen's law.	Understand	04
4	Give the statement of townsend 's criteria.	Remember	04
5	Explain primary ionization process.	Understand	04
6	Explain secondary ionization process.	Understand	04
7	Define mean free path.	Remember	04
8	Discuss the effect of photo ions on breakdown of insulation medium.	Understand	04
9	Write the expression for breakdown in gas insulation medium from townsend's criteria.	Understand	04
10	Differentiate between formative and statistical time.	Remember	04
11	Draw the pd curve from paschen's law.	Remember	04
12	Give the classification of liquid di-electrics.	Remember	05
13	State the characteristics of liquid insulations.	Remember	05
14	Draw the purification cycle of commercial liquid.	Understand	05
15	The force experienced by solid particles in liquid according to suspended particle theory is ----------.	Remember	05
16	Give the properties of composite di-electric.	Remember	06
17	Give the examples of solid dielectric.	Remember	06
18	Discuss partial discharge phenomenon in solid insulation medium.	Understand	06
19	Explain how the temperature affects the breakdown strength of solid dielectrics.	Understand	06
20	Define wave front time and wave tail time.	Remember	04
Part – B (Long Answer Questions)			
1	Explain the difference between photo ionization and photo electric emission.	Understand	04
2	Explain pure and commercial liquids.	Understand	05
3	Define townsend's primary and secondary ionization co-efficients and also explain breakdown criteria.	Understand	04
4	Explain the two conditions for collision of atom and electron for ionization process.	Understand	04
5	Discuss the breakdown phenomenon occurs in composite di-electrics.	Understand	06
6	Explain thermal breakdown in solid insulation.	Understand	06
7	State paschen's law and explain clearly.	Understand	04
8	Derive the townsend's current growth equation.	Understand	04
9	Explain the breakdown of solid electrics due to treeing and tracking.	Understand	06
10	Write short notes on various theories of breakdown in liquids dielectric mediums.	Understand	05
11	Differentiate between short term breakdown and from long term breakdown in composite di-electric.	Understand	06
12	Explain the streamer theory of gas insulation.	Understand	06
13	Explain the partial discharge phenomenon in solid insulations.	Understand	06

14	Explain different ionization process leading to breakdown in gas.	Understand	04

UNIT-III
Generation & Measurement of High Voltages & Currents
Part – A (Short Answer Questions)

1	Write different forms of high voltage generation.	Remember	07
2	Draw half wave rectifier circuit for high DC voltage generation.	Remember	07
3	Draw full wave rectifier circuit for high DC voltage generation.	Remember	07
4	Draw voltage doubler circuit for high DC voltage generation.	Remember	07
5	Draw COCKROFT WALTON circuit used to generate high DC voltage.	Remember	07
6	Write the expression of output from COCKROFT WALTON circuit.	Remember	07
7	Write the expression for optimum number of stages for minimum voltage drop in COCKROFT WALTON circuit.	Remember	07
8	Draw the cascade transformer for the generation of high AC voltage.	Remember	07
9	Draw the resonant transformer for the generation of high AC voltage.	Remember	07
10	Draw the multi stage impulse generator for the generation of high Impluse voltage.	Remember	07
11	Define peak to peak ripple for the high DC voltage generation.	Remember	07
12	In COCKROFT WALTON circuit Vmax = 125V, operating frequency = 150Hz, C = 0.05μF and load current is 5mA, determine optimum number of stages.	Understand	07
13	In COCKROFT WALTON circuit Vmax = 125V, operating frequency = 150Hz, C = 0.05μF and load current is 5mA, calculate output voltage at optimum number of stages.	Understand	07
14	In COCKROFT WALTON circuit Vmax = 125V, operating frequency = 150Hz, C = 0.05μF and load current is 5mA, measure voltage regulation.	Understand	07
15	Discuss the functions of trigatron gap.	Understand	07
15	Name any two methods for measurement of high DC and AC voltages.	Remember	08
16	State Hall effect.	Remember	08
17	Discuss the importance of magnetic links.	Understand	08

Part – B (Long Answer Questions)

1	Draw and explain tesla coil for the generation high AC voltage..	Understand	07
2	Explain different methods to produce switching voltages for testing at laboratories.	Understand	07
3	Explain full wave and half wave rectifier circuits to generate high DC voltage.	Understand	07
4	Explain voltage doubler circuits to generate high DC voltage.	Understand	07
5	Draw and explain the principle of Vandegraff generator used for the generation of high DC voltage.	Understand	07
6	Draw and explain COCKROFT WALTON circuit for the generation of high DC voltage.	Understand	07
7	Draw and explain cascade transformer to generate high AC voltage.	Understand	07
8	Draw and explain multi stage impulse generator for the generation of high Impluse voltage..	Understand	07
9	Analyze various impulse generator circuit and explain effect of circuit inductance and small resistance on them.	Understand	07
10	Discuss the principle of operation of electro-static generator.	Understand	07
11	Write short notes on any two methods for measurement of high DC voltages.	Understand	08
12	Discuss the principle of generating voltmeter helps in measuring high voltages.	Understand	08
13	Explain any two methods for measurement of high AC voltages.	Understand	08
14	Show how the capacitive voltage transformer helps in measuring the high AC voltage .	Understand	08
15	Draw and explain operation of the peak reading AC voltmeters for measuring AC voltage.	Understand	08
16	State Hall effect and principle of operation of Hall generator.	Understand	08

Part - C (Analytical Questions)

1	A COCKROFT WALTON circuit with 8 stages with all equal capacitance of 0.05 µF. 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	07
2	An impulse generator has 8 stages with each condenser rated for 0.16 µF and 125KV. The load capacitor available is 1000PF. Find the series resistance and the damping resistance needed to produce 1.2/50µs impulse wave. measure the maximum output voltage of the generator, if the charging voltage in 12KV.		Understand	07
3	A 12 stages impulse generator has 0.12 µF 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	07
4	Calculate the peak current and wave shape of the output current of the generator having the total capacitance of 53 µF. the charging voltage is 200KV, circuit inductance 1.47mH and the dynamic resistance of the objects is 0.05 ohms.		Understand	07

UNIT-IV				
Over Voltages and Insulation Co-Ordination				
Part – A (Short Answer Questions)				
1	Write two sentences about lighting and switching over voltages.		Understand	10
2	Writing characteristics of switching surges.		Understand	10
3	State Ferranti effect.		Remember	10
4	How over voltages can be controlled due to switching.		Understand	10
5	Name parameters which states lighting strokes.		Remember	10
6	State principles for design of insulation for EHV and UHV systems.		Remember	11
7	Name protective devices used against lighting strokes.		Remember	11
8	Classify the transmission lines.		Remember	11
9	State the causes of over voltages.		Understand	10
10	Name the temporary over voltages.		Understand	11
11	Explain lighting phenomenon.		Remember	10
12	List the different methods as protection against lighting.		Remember	10
13	Compare switching and lighting surges.		Understand	10
14	Mention different kinds of over voltages.		Remember	10

Part – B (Long Answer Questions)				
1	Explain the mechanism by which lighting strokes develop and induce over voltages on over head power lines.		Understand	10
2	Discuss the different aspects of insulation design and insulation co-ordination adopted for EHV systems.		Understand	11
3	Give the mathematical models for lighting discharges and explain them.		Understand	10
4	List out the abnormal switching over voltages and why do these occur? And the methods to control above in power systems.		Understand	10
5	Write short notes on volt-time curves. Explain their significance in power systems studies.		Understand	10
6	Discuss the importance of switching over voltages in EHV power systems and How is protection against over voltages achieved.		Understand	11

UNIT-V				
Testing Of Materials and Electrical Apparatus				
Part - A (Short Answer Questions)				
1	Explain the methods of type and routine test.		Remember	13
2	The resistance of insulation using loss of charge method ------------.		Remember	12
3	Draw schering bridge for measurement of high charging currents.		Remember	12
4	Compare earthing and shielding.		Understand	12
5	Name the detectors used in di-electric strength measurements.		Remember	12
6	Write the expression for energy associated in single discharge.		Remember	13
7	Discuss partial discharge phenomenon on solid insulation.		Remember	13
8	Define discharge magnitude and discharge energy.		Remember	13
9	Define sensitivity and resolution.		Remember	12

10	Define discharge disruptive voltage.	Remember	13
11	Give the importance of withstand voltage..	Remember	13
12	Define 50% and 100% flash over voltage.	Remember	13
13	Define creepage distance.	Remember	13
14	List out the reference atmospheric conditions for insulation installation.	Remember	13
15	Distinguish between power frequency and impulse tests.	Remember	13
Part - B (Long Answer Questions)		
1	Explain the insulation testing methods on bushings.	Understand	14
2	Write short notes on various tests can be conducted on insulation to test their dielectric strength.	Understand	13
3	Explain the insulation testing methods on power cables to check their withstand capability .	Understand	15
4	Estimate the partial discharge in power apparatus and discuss the calibration of PD detectors.	Understand	12
5	Explain the insulation testing methods on surge arrester to estimate their breakdown voltage..	Understand	15
6	Write short notes on radio interference measurements.	Understand	15
7	Discuss the insulation testing methods on isolators and circuit breakers to predict their dielectric strength.	Understand	14
8	Define the terminologies used in testing of insulation associated with power equipment.	Remember	13
9	Define the important partial discharge quantities which occur in the solid insulation medium.	Remember	13
10	Explain the insulation testing methods on transformer to understand its withstand capability.	Analyze	15
11	Draw a neat diagram of high voltage schering bridge and describe various feature of the bridge. Explain how this can be used to measure the dielectric constant of a dielectric material.	Understand	12
12	Explain about the measurement of dielectric constant and loss factor of insulating materials.	Understand	12
13	Write short notes on loss of charge method for measurement of insulation resistance.	Understand	12
14	Define all the terminology used in partial discharge phenomenon which occurs in solid dielectric medium..	Remember	12
15	Explain various methods to determine the volume resistivity of s solid dielectric material.	Understand	12
Part - C (Analytical Questions)		
1	A schering bridge was used to measure the capacitance and loss angle of a HV bushing . At balance the observation were: The value of standard condenser = 100PF, R3 = 3180 ohms, C3 = 0.00125µF and R4 = 636 ohms. Calculate the values of capacitance and loss factor of the bushing.	Understand	12
2	The lossless standard capacitor used in the high voltage schering bridge has a value 100PF. In a certain measurement , the other arms of the bridge at balance are i) a resistance of 641 ohms and ii) a capacitance of 0.052 µF in parallel with a resistance of 2500 ohms. Determine capacitance and loss tangent of the specimen at 50Hz.	Understand	12
3	The capacitance and dissipation factor of a Bakelite sample were determined by using circular electrodes and found to be 150 PF and 0.00015 respectively by schering bridge measurements. For the same electrode system the air capacitance was found to be 31PF. Find the complex permittivity of the sample.	Understand	12

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