



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

ELECTRICAL AND ELECTRONICS ENGINEERING

DEFINITIONS AND TERMINOLOGY QUESTION BANK

Course Name	:	HIGH VOLTAGE ENGINEERING
Course Code	:	AEE015
Program	:	B. Tech
Semester	:	VII
Branch	:	Electrical and Electronics Engineering
Section	:	A
Academic Year	:	2019 -2020
Course Faculty	:	Mr. G.KRANTHI KUMAR, Assistant Professor

COURSE OBJECTIVES:

The course should enable the students to:	
I	Summarize the types of insulation and breakdown process used for power system protection.
II	Design the networks for generation of high direct current voltage , high alternating current voltage and to measure the same.
III	Identify the causes for over voltages and explain the principals of insulation co-ordination in high voltage power systems.
IV	Measure the various electrical parameters of insulation used for power system equipment for their with stand.
V	Examine breakdown strength of insulation mediums for power system using type and routine test.

DEFINITIONS AND TERMINOLOGY QUESTION BANK:

S. No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
UNIT - I						
OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS						
1	Define External Faults.	The short circuit may occur in two or three phases of electrical power system. The level of fault current is always high enough	Remember	CO2	CLO2	CAEE015.2
2	Define Lighting Strokes.	Lightning stroke is the direct discharge of an electrical charge between the atmosphere and the object of earth. .	Remember	CO2	CLO2	CAEE015.2
3	Define Switching over Voltages.	Switching over voltage caused by any switching operation, faults and CB opening and closing , one line tripping of a double cut line etc.	Understand	CO2	CLO2	CAEE015.2
4	Define Temporary over	These are caused when some major load gets disconnected from the	Understand	CO2	CLO2	CAEE015.2

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	Voltages.	long line under normal or steady state condition				
5	Define Switching Surge	Switching surges are the over current/overvoltage spikes that are experienced in the highly inductive circuits at the time of sudden interruption I.e. switching period.	Remember	CO1	CLO1	CAEE015.1
6	Describe Lightning Arrestor.	A lightning arrester is a device used on electrical power systems and telecommunications systems to protect the insulation and conductors of the system from the damaging effects of lightning.	Understand	CO3	CLO3	CAEE015.3
7	Describe Main Features of Lighting Arrestor.	Air terminal, Conductors, Ground termination Surge protection	Remember	CO3	CLO3	CAEE015.3
8	Define Ferranti Effect.	The Ferranti effect is an increase in voltage occurring at the receiving end of a long transmission line, above the voltage at the sending end.	Remember	CO1	CLO1	CAEE015.1
9	Define Earth Fault Factor.	An earth fault factor is defined as the ratio of the higher of the two sound phase voltages to the line-to-neutral voltage at the same point in the system with the fault removed	Remember	CO1	CLO1	CAEE015.1
10	Define Corona.	The phenomenon of ionization of surrounding air around the conductor due to which luminous glow with hissing noise is rise is known as the corona effect.	Remember	CO2	CLO2	CAEE015.2
11	Define Air Density Factor.	The corona loss is inversely proportional to air density factor, i.e., corona loss, increases with the decrease in density of air.	Remember	CO1	CLO1	CAEE015.1
12	Define Travelling Wave.	Travelling wave is a temporary wave that creates a disturbance and moves along the transmission line at a constant speed.	Remember	CO1	CLO1	CAEE015.1
13	Describe the Over voltage Protection	Overvoltage protection is the process of securing an electrical system from the possible damages that may be caused by overvoltage through the use of devices like arcing horns attached to transmission lines and Zener diodes for electronic circuits.	Understand	CO1	CLO1	CAEE015.1
14	Describe the Characteristics of over voltage protection.	Be fast enough to respond to transient events that can damage the power supply and downstream components	Understand	CO2	CLO2	CAEE015.2
15	Describe the lightning over voltages.	Only a part of the total charge-several hundred coulombs-is released to earth by lightning; the rest is consumed in internal cloud discharges.	Understand	CO2	CLO2	CAEE015.2

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UNIT - II DIELECTRIC BREAKDOWN						
1	Define Dielectric Breakdown.	Dielectric breakdown is when current flows through an electrical insulator when the voltage applied across it exceeds the breakdown voltage	Remember	CO4	CLO4	CAEE015.4
2	Define Thermal break down	It occurs due to heat dissipation in the sample due to current flowing through defective parts of the sample which in turn further increase the ionic defect concentration leading to subsequent increase in the conductivity and then failure.	Understand	CO4	CLO4	CAEE015.4
3	Define Electro Chemical Breakdown.	This occurs due to transport of conducting material due to the presence of local electrochemical current paths or defect into the interior of the dielectric leading to overall increase in the sample conductivity and then failure.	Understand	CO5	CLO5	CAEE015.5
4	Describe Electromechanical Breakdown.	When solid dielectrics are subjected to high electric fields, failure occurs due to electrostatic compressive forces which can exceed the mechanical compressive strength.	Understand	CO5	CLO5	CAEE015.5
5	Define Intrinsic Break Down.	When voltages are applied only for short durations of the order of 8 to 10s the dielectric strength of a solid dielectric increases very rapidly to an upper limit called the intrinsic electric strength.	Remember	CO6	CLO6	CAEE015.6
6	Describe the phenomenon occur in gaseous Dielectric.	When the applied voltage is low, small currents flow between the electrodes and the insulation retains its electrical properties.	Understand	CO4	CLO4	CAEE015.4
7	Define spark breakdown.	The break down in a gas, called spark breakdown is the transition of a non-sustaining discharge into self sustaining discharge.	Remember	CO4	CLO4	CAEE015.4
8	Define electronegative gases.	Electronegative gases are the gases that have affinity towards electrons. When electron comes into contact with these gas molecules, the gas molecule attracts the electrons and becomes negative ion	Understand	CO4	CLO4	CAEE015.4
9	Describe pure liquids dielectrics	Pure liquids are those which are chemically pure and do not contain any other impurity even in traces of 1 in 10 ⁹ , and are structurally simple	Remember	CO5	CLO5	CAEE015.5
10	Define breakdown voltage	The maximum voltage that can be applied on the insulation at the moment of breakdown is called as breakdown voltage	Remember	CO4	CLO4	CAEE015.4

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11	Define Townsend's first ionization coefficient.	Townsend's Primary ionization coefficient α is defined as the average number of ionizing collision made by the free electron per centimeter travel in the direction of applied electric field.	Remember	CO5	CLO5	CAEE015.5
12	Define Townsend's second ionization coefficient.	The Townsend's secondary ionization coefficients defined as the net number of secondary electrons produced per incident positive ion, photon, excited particle or metastable particle.	Remember	CO5	CLO5	CAEE015.5
13	Define time lag.	The time difference between the application of a voltage sufficient to cause breakdown and the occurrence of breakdown itself is called the time lag.	Remember	CO6	CLO6	CAEE015.6
14	Define vacuum discharge	Electrons get multiplied due to the various ionization processes and an electron avalanche is formed. In high vacuum, even if the electrodes are separated by a few centimeters, an electron crosses the gap without encountering any collisions.	Understand	CO6	CLO6	CAEE015.6
15	Describe composite Dielectric.	Composite dielectrics are the different insulating materials in parallel or in series with each other, such as air or SF6 gas in parallel with solid insulation	Understand	CO5	CLO5	CAEE015.5
UNIT – III						
GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS						
1	Define Tesla coil.	Tesla coil is the commonly used high frequency resonant transformer, which is a doubly tuned resonant circuit.	Remember	CO7	CLO7	CAEE015.7
2	Describe Voltage Multiplier Circuit.	Multiplier circuit is a circuit to generate very high d.c voltages from single supply transformers by extending the simple voltage doubler circuits	Understand	CO7	CLO7	CAEE015.7
3	Describe the wave front and wave tail times controlled in impulse generator circuits	For a given impulse generator, the generator capacitance C1 and load capacitance C2 will be fixed depending on the design of the generator and the test object. Hence, the desired wave shape is obtained by controlling R1 and R2.	Understand	CO7	CLO7	CAEE015.7
4	Define Peak Value.	The maximum positive deviation of the output with respect to its desired value is known as peak value.	Remember	CO9	CLO9	CAEE015.9
5	Define Voltage dividers	Voltage dividers of either damped capacitor or resistor type and an oscilloscope with recording arrangement are provided for measurement of the voltages across the test object.	Remember	CO8	CLO8	CAEE015.8

S. No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
6	Define transient voltage.	It is an oscillatory wave or a damped oscillatory wave of frequency ranging for few Hundred hertz to few kilohertz.	Remember	CO11	CLO11	CAEE015.11
7	Describe blocked mode cyclo converters	It is defined as the total time of the wave during which the current is at least 10% of its peak value.	Remember	CO9	CLO9	CAEE015.9
8	Define cascaded transformer.	Input of the first transformer unit is supplied from a motor generator or from a voltage regulator. The primary winding is supplied from a source.	Understand	CO8	CLO8	CAEE015.8
9	Define the front time of impulse wave	It is the time required for the response to raise from 10 to 90% or 0 to 100% of the final value at the very first instance.	Remember	CO9	CLO9	CAEE015.9
10	Define tail times of impulse wave.	Fall time is the time to reach 50% peak value of 50 μ s. Fall time for standard impulse wave of 1.	Remember	CO9	CLO9	CAEE015.9
11	Describe voltage doubler Circuit.	Both full wave and half wave rectifier circuits produce a d.c. voltage less than the a.c. maximum voltage. When higher d.c. voltages are needed, a voltage doubler or cascaded rectifier doubler circuits are used.	Understand	CO7	CLO7	CAEE015.7
12	Describe voltage Multiplier Circuit.	Cascaded voltage multiplier circuits for higher voltages are cumbersome and require too many supply and isolating transformers. It is possible to generate very high d.c. voltages from single supply transformers by extending the simple voltage doubler circuits.	Understand	CO7	CLO7	CAEE015.7
13	Describe the Expulsion gap.	Expulsion gap is a device which consists of a spark gap together with an arc quenching device which extinguishes the current arc when the gaps break over due to over voltages.	Understand	CO14	CLO14	CAEE015.14
14	Describe Impulse withstand voltage test.	This test is done by applying the standard impulse voltage of specified value under dry conditions with both positive and negative polarities of the wave.	Understand	CO13	CLO13	CAEE015.13
15	Define Impulse testing of transformers.	The purpose of the impulse tests is to determine the ability of the insulation of the transformers to withstand the transient voltages due to lightning, etc.	Remember	CO13	CLO13	CAEE015.13
UNIT – IV						
MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS						
1	Define capacitance voltage Dividers.	Capacitance voltage dividers are ideal for the measurement of fast rising voltages and pulses	Remember	CO8	CLO8	CAEE015.8
2	Describe Field Controlled Voltage	The electrostatic or capacitive field distribution of a shield or guard ring placed over a resistive	Understand	CO8	CLO8	CAEE015.8

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	Dividers.	divider to enforce a uniform field in the neighborhood and along the divider may be adopted for high voltage measurements				
3	Describe Hall Effect for DC measurements	If an electric current flow through metal plate located in a magnetic field perpendicular to it, Lorentz forces will deflect the electrons in the metal structure in a direction normal to the direction normal to the direction of both the current and the magnetic field.	Understand	CO8	CLO8	CAEE015.8
4	Define Current Transformers.	Measurement of high frequency currents such as fault currents in power systems, switching current transients and impulse currents during impulse testing of transformers can be measured using current transformers with an air core or a ferrite core.	Understand	CO15	CLO15	CAEE015.15
5	Define Rogowski Coils.	If a coil is placed surrounding a current carrying conductor, the voltage signal induced in the coil is $v_i(t) = M \frac{dI(t)}{dt}$ where M is the mutual inductance between the conductor and the coil, and I(t) is the current flowing in the conductor.	Understand	CO15	CLO15	CAEE015.15
6	Define Pure Capacitance Dividers.	A pure capacitance divider for high voltage measurements and its electrical equivalent network without stray elements	Remember	CO8	CLO8	CAEE015.8
7	Define potential Dividers.	Potential or voltage dividers for high-voltage impulse measurements ,high frequency ac measurements or for fast rising transient voltage frequency ac measurements, or for fast rising transient voltage measurements are usually either resistive or capacitive or mixed element type.	Remember	CO8	CLO8	CAEE015.8
8	Define Spark Gaps.	A uniform field spark gap will always have a spark over voltage with in a known to lerance under constant atmospheric conditions. Hence a spark gap can be used for measurement of the peak value of the voltage	Remember	CO8	CLO8	CAEE015.8
9	Describe High Voltage Measurement.	High voltages can be measured in a variety of ways. Direct measurement of high voltages is possible up to about 200 kV, and several forms of voltmeters have been devised which can be connected directly across the test circuit.	Understand	CO8	CLO8	CAEE015.8

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10	Describe Electrostatic Voltmeters.	One of the direct methods of measuring high voltages is by means of electro-static voltmeters. For voltages above 10 kV, generally the attracted disc type of electrostatic voltmeter is used.	Understand	CO16	CLO16	CAEE015.16
11	Describe Resistive potential divider method.	In this method, a high resistance potential divider is connected across the high-voltage winding, and a definite fraction of the total voltage is measured by means of a low voltage voltmeter.	Understand	CO16	CLO16	CAEE015.16
12	Describe Series resistance method of measurement.	In the series resistance method a high series resistance (specially designed to withstand high voltage) and resistance of 20k/v.	Understand	CO16	CLO16	CAEE015.16
13	Describe hall voltage and hall coefficient.	If electric current flows through a metal plate located in a magnetic field perpendicular to it, Lorenz forces will deflect the electrons in the metal structure in a direction normal to the direction of both the current and the magnetic field.	Understand	CO17	CLO17	CAEE015.17
14	Define CVT.	CVT meant for capacitive voltage transformer. It is used for measurement, relaying applications and sometimes for carrier communications.	Remember	CO17	CLO17	CAEE015.17
15	Describe the porosity test on insulators.	The insulator is broken and immersed in a 0.5 % alcohol solution under a pressure of 13800 kN/sq.m for 24 hours. The broken insulator is taken out and further broken.	Understand	CO13	CLO13	CAEE015.13
UNIT – V						
HIGH VOLTAGE TESTING AND INSULATION COORDINATION						
1	Define surge diverter.	It is a non-linear resistor in series with a spark gap kept at line terminals in the substations	Remember	CO15	CLO15	CAEE015.15
2	Define creeping distance.	It is the shortest distance on the contour of the external surface of the insulator unit.	Remember	CO14	CLO14	CAEE015.14
3	Define withstand voltage.	The voltage which has to be applied to a test object under specified conditions in a withstand test is called the withstand voltage	Remember	CO13	CLO13	CAEE015.13
4	Describe an isolator.	It is a disconnect or a mechanical switching device, which provides in the open position an isolating distance in accordance with special requirements	Understand	CO15	CLO15	CAEE015.15
5	Define partial discharge.	An electrical discharge that only partially bridges the dielectric between the conductors.	Remember	CO10	CLO10	CAEE015.10
6	Define a circuit breaker.	It is a switch, which automatically interrupts the circuit when a critical current	Remember	CO14	CLO14	CAEE015.14

S. No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
		overvoltage rating is exceeded.				
7	Define 50% flashover.	It is the voltage, which has the 50 % flashover when applied to test object.	Remember	CO15	CLO15	CAEE015.15
8	Define 100 % flash over.	The voltage that causes a flashover at each of its application under specified conditions when applied to test objects as specified.	Remember	CO15	CLO15	CAEE015.15
9	Disruptive discharge voltage.	This is defined as the voltage which produces the loss of dielectric strength of insulation. It is that voltage at which the electrical stress in the insulation causes a failure, which includes the collapse of voltage and passage of current.	Understand	CO15	CLO15	CAEE015.15
10	Define safety margin as applied to insulation coordination.	The Safety margin is defined by selecting the risk of failure, the statistical safety factor and by firing the withstand level of any equipment or apparatus corresponding to 90% or 95% of the withstand voltage.	Remember	CO11	CLO11	CAEE015.11
11	Define BIL.	It is defined as the minimum insulation impulse withstands voltage of any power equipment or apparatus.	Remember	CO17	CLO17	CAEE015.17
12	Describe the type and routine test.	The type test is conducted on the sample to test the quality of the material with which the component is made. Routine test is conducted on the equipment or component periodically to check the deterioration in the quality during operation.	Understand	CO13	CLO13	CAEE015.13
13	Describe the significance of power factor test.	High voltage Schering bridge is used to perform dielectric power factor test on the cable sample. The power factor is measured for different values of voltages eg 0.5,1,1.5,2 times of rated operating voltages	Understand	CO13	CLO13	CAEE015.13
14	Describe impulse withstand voltage test.	This test is done by applying standard impulse voltage of specified value under dry conditions with both positive and negative polarities of the wave. If five consecutive waves do not cause a flashover or puncture, the insulator is deemed to have passed the test..	Understand	CO13	CLO13	CAEE015.13
15	Define lightning impulse voltage.	The system disturbances occur due to natural lightning can be represented by three different basic wave shapes. If a lightning impulse voltage travels some distance along the transmission line before it reaches to a insulator its wave	Understand	CO9	CLO19	CAEE015.19

S. No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
		shaped approaches to full wave, and this wave is referred as 1.2/50 wave.				

Signature of the Faculty

Signature of HOD