INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

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ELECTRICAL AND ELECTRONICS ENGINEERING

DEFINITIONS AND TERMINOLOGY QUESTION BANK

Course Name	**:**	**POWER SYSTEM PROTECTION**
Course Code	**:**	**AEE014**
Program	**:**	**B.Tech**
Semester	**:**	**VII**
Branch	**:**	**Electrical and Electronics Engineering**
Section	**:**	**A**
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Course Faculty	**:**	**Mr. P Shivakumar, Assistant Professor, EEE**

OBJECTIVES:

I	Understand types of various circuit breakers.
II	Classify relays into various types such as of electromagnetic, static and numerical relays.
III	Evaluate the performance of protection schemes of generator and transformer.
IV	Analyze the performance of feeder and bus-bar protection.
V	Discuss the protection schemes against over voltages.

DEFINITIONS AND TERMINOLOGY QUESTION BANK:

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
UNIT – I CIRCUIT BREAKERS						
1	Define relay	An electrical coil switch that uses a small current to control a much larger current	Remember	CO1	CLO1	AEE014.01
2	Define Protective relay	A relay device designed to trip a circuit breaker when a fault is detected	Remember	CO1	CLO1	AEE014.02
3	Define circuit breaker	A circuit breaker is an automatically-operated electrical switch designed to protect an electrical circuit from damage caused by overload of electricity or short circuit. A circuit breakers function is to detect a fault condition and, by interrupting continuity, to immediately discontinue electrical flow.	Understand	CO1	CLO1	AEE014.03
4	What are the functions of a circuit breaker?	The function of a circuit breaker is to make and break an electric circuit under normal and abnormal conditions.	Remember	CO1	CLO1	AEE014.03

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
5	What do you mean by the term "Switchgear?	A switchgear is a general term used for an electrical apparatus intended for switching and interrupting the current in the power system under normal and abnormal operating conditions covering the combination of switching devices and a wide range of associated auxiliaries e.g. controlling, measuring, protecting, regulating equipments along with their associated of switching devices and a wide range of associated auxiliaries e.g. controlling, measuring, protecting, regulating equipments along with their associated interconnection, accessories, enclosures and supporting structures. It comprises the following elements viz, switches, fuses, circuit breakers, busbar connection, relays, control panel, metering panel, current transformers, potential transformers etc.	Understand	CO1	CLO1	AEE014.04
6	What do you mean by the term "Opening time"	It is the time interval from the energisation of the trip coil to the instant of contact separation.	Understand	CO1	CLO1	AEE014.03
7	What do you mean by the term Arcing time	It is the time interval from the separation of contact to the extinction of the arc.	Understand	CO1	CLO2	AEE014.06
8	What do you mean by the term	Cannot be used for ac measurements some errors are caused by temperature variations.	Understand	CO1	CLO2	AEE014.04
9	What do you mean by the term Make time	It is the time interval from the energisation of the solenoid to the instant of making contact for current establishment during closing of circuit breaker.	Understand	CO1	CLO4	AEE014.03
10	What do you mean by the term Total break time	It is the sum of the opening time interval and the arcing time interval.	Remember	CO1	CLO1	AEE014.02
11	Why are circuit breakers designed to have a short time rating ?	In the power system sometimes a very temporary nature of fault persists for a short period of 2 or 3 seconds and after which the fault is automatically cleared. To maintain continuity of supply the breaker should not trip in such condition. Therefore, breaker should be able to carry high current safely for some for some specified period during running i.e. the circuit breakers should have a short time rating.	Understand	CO1	CLO5	AEE014.01
12	What is the meaning of rupturing capacity of a circuit breaker?	Rupturing capacity of a circuit breaker means the maximum power a circuit breaker can interrupt under a fault. It is usually expressed in Mega volt Ampere (MVA) and it is then the product of the rated breaking current in kilo amperes and rated voltage expressed in kilo volts.	Remember	CO1	CLO4	AEE014.04
13	What do you mean by the term "Making	The 'Making Current' of a circuit breaker is the total maximum current peak which occurs during the first cycle immediately	Remember	CO1	CLO6	AEE014.06

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
	Current"	after the circuit is closed on a short circuit.				
14	What do you mean by the term "Breaking Current"	The 'Breaking Current' of a circuit breaker is the total maximum current peak that can be safely broken by the circuit breaker at the time of separation of the contacts at its rated voltage.	Understand	CO1	CLO5	AEE014.05
15	What do you understand by the term "Short Circuit MVA"?	Short Circuit MVA" is the rupturing capacity or breaking capacity of a circuit breaker in case of a three phase symmetrical fault which determines the size of the circuit breaker.	Understand	CO1	CLO4	AEE014.04
16	What do you understand by the term "Short Circuit Capacity"?	The breaking capacity of a circuit breaker is specified either in terms of symmetrical breaking current/MVA or asymmetrical breaking current/MVA.	Remember	CO1	CLO1	AEE014.01
17	What do you mean by the 'recovery voltage' of a circuit breaker?	The recovery voltage is defined to be the r.m.s. the value of the line voltage of service frequency that reappears across the poles of the circuit breaker short after arc extinction in all the poles and after damping of the transient phenomena.	Remember	CO1	CLO3	AEE014.03
18	What do you mean by the term 'restriking voltage' of a circuit breaker?	The restriking voltage or the transient recovery voltage is the voltage between the contacts of a pole of the circuit breaker after the extinction of the arcs while the transient state persists.	Understand	CO1	CLO2	AEE014.02
19	On what factors does the rate of rising of restriking voltage depend?	The rate of rising of restriking voltage depends upon the inductance and capacitance of the system.	Remember	CO1	CLO1	AEE014.01
20	Is an a.c. circuit breaker suitable for d.c. supply line?	Generally a.c. the circuit breaker is not suitable for d.c. supply line because of a.c. circuit breaker quenches arc easily at current zero of an alternating wave which is not possible in d.c. due to nonexistence of current zero.	Remember	CO1	CLO1	AEE014.01
21	What is an arc?	Arc is a phenomenon occurring when the two contacts of a circuit breaker separate under heavy load or fault or short circuit condition	Remember	CO1	CLO6	AEE014.06
22	What is meant by recovery voltage?	The power frequency rms voltage appearing across the breaker contacts after the arc is extinguished and transient oscillations die out is called recovery voltage.	Remember	CO1	CLO5	AEE014.05
23	What do you mean by current chopping?	When interrupting low inductive currents such as magnetizing currents of the transformer, shunt reactor, the rapid deionization of the contact space and blast effect may cause the current to be interrupted before the natural current zero. This phenomenon of interruption of the current before its natural zero is called	Understand	CO1	CLO6	AEE014.06

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
		current chopping.				
UNIT-II ELECTROMAGNETIC, STATIC AND NUMERICAL RELAYS						
1	What are the different relays that employed for protection of apparatus and transmission lines?	The relays that are usually employed for protection of transmission lines include Over current relay Directional relay Distance relay Under Voltage relay Under-frequency relay Thermal relay Differential relay Phase sequence relays pilot relays	Understand	CO2	CLO7	AEE014.07
2	How the electrical power system protection is divided?	The overall system protection is divided into Generator protection Transformer protection Busbar protection Transmission line protection and Feeder protection	Understand	CO2	CLO7	AEE014.07
3	How relays are connected in the power system?	The relays are connected to the power system through the current transformer (CT) or potential transformer (PT).	Understand	CO2	CLO7	AEE014.07
4	What is meant by "relay Settings"?	Relay settings means actual value of the energizing or characteristic quantity at which the relay is designed to operate under given conditions.	Understand	CO2	CLO7	AEE014.07
5	Where Is Directional Relay Used?	Directional relay are used when graded time overload protection is applied to ring mains and interconnected networks.	Understand	CO2	CLO8	AEE014.08
6	For what type of fault does buchholz relay is employed?	Buchholz relay provides protection only against transformer internal fault.	Understand	CO2	CLO7	AEE014.07
7	Where does negative phase sequence relay is employed?	Negative sequence relay is employed for the protection of generators and motors against unbalanced loading that may arise due to phase to phase faults	Understand	CO2	CLO8	AEE014.08
8	What Is The Operation Principle Of Differential Relay?	differential relay operates when the phasor difference of two or more similar electrical quantities exceeds a pre-determined amount.	Understand	CO2	CLO7	AEE014.07
9	Where Impedance relay is employed?	The Impedance relay is suitable for the phase faults relaying for the lines of moderate lengths	Remember	CO2	CLO8	AEE014.08
10	Where Reactance relay is employed?	Reactance type relays are employed for the ground faults	Remember	CO2	CLO7	AEE014.07
11	Where Mho relays are employed?	Mho type of relays are best suited for the long transmission lines and particularly where synchronizing power surge may occur	Remember	CO2	CLO7	AEE014.07
12	What is Reach?	Distance relay operates whenever the impedance seen (V/I) seen by the relay is less than the specified set value. This impedance or corresponding distance is known as reach of the relay. Reach is the	Understand	CO2	CLO8	AEE014.08

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
		limiting distance covered by the relay for protection of line. Faults beyond the distance (reach of the relay) relay will not operate and should be covered by the other relay.nanocrystalline, amorphous.				
13	What are the fundamental elements of relay?	*Sensing element:* It is the measuring element measures the actuating quantity. Actuating quantity is change in current in case of over current relay *Comparing element:* It compares the actuating quantity with the relay pre-setting of the relay *Control element:* On pick up of the relay control element carryout the final switching operations such as closing the circuit to operate the circuit breaker	Remember	CO2	CLO7	AEE014.07
14	What Action carried out by the relay and circuit breaker during fault condition?	After the relay sensing the fault condition, relay operates and close the trip coils. The effect of this will be circuit breaker operate to open the contacts.	Remember	CO2	CLO8	AEE014.08
15	What is fault clearance time?	When the fault occurs relay operates and close the trip coils and circuit breaker operates and open the contacts subsequently and fault is cleared. Therefore fault clearance time is the sum of relay operating time and circuit breaker operating time and clearing the fault	Understand	CO2	CLO7	AEE014.07
16	What are the good features of protective relaying?	Some of the good features for protective relaying are: Reliability, Selectivity, Sensitivity, Simplicity, Speed and economy	Understand	CO2	CLO8	AEE014.08
17	List Some of the causes for relay failures?	Primary reason for relay failure to operate during faults is wrong settings, bad contacts and open circuit in the relay coil.	Understand	CO2	CLO8	AEE014.08
18	What is numerical relay.	Numerical relay is a relay which is operated on the bases of numbers. that numbers are coded in the program for the relay operation. hence it is operated depending on the time delay i.e number of cycles per second	Understand	CO2	CLO7	AEE014.07
19	What is IDMT relay.	In IDMT relays the time of operation is inversely proportional to the fault current level and the actual characteristics is a function of both time and current setting	Remember	CO2	CLO7	AEE014.07
20	What is static relay.	It is a relay in which measurement or comparison of electrical quantities is made in a static network which is designed to give an output signal when a threshold condition is passed which operates a tripping device.	Remember	CO2	CLO8	AEE014.08
21	What is pick up value.	It is the minimum current in the relay coil at which the relay starts to operate.	Remember	CO2	CLO7	AEE014.07
UNIT-III SUBSTATIONS AND PROTECTION OF FEEDER / BUS BAR						
1	What is electrical substation.	The electrical substation is the part of a power system in which the voltage is transformed from high to low or low to high for transmission, distribution, transformation and switching.	Understand	CO3	CLO9	AEE014.09
2	What is the	The Substation receives power from the	Understand	CO3	CLO9	AEE014.09

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
	function of a substation.	generating station by a signal or more feeders at a high voltage, transforms the same to different distribution voltages and sends the power to different consumers through distribution network.				
3	What is called indoor substation.	The Substation, of which the equipments are installed indoor for voltages upto 11kV because of economic consideration, is called as indoor Substation. In case of contaminated atmospheric condition these substations can be erected for voltages upto 66kV.	Remember	CO3	CLO9	AEE014.09
4	What is called outdoor substation.	The Substation for voltage 33kV and above, where the equipments are installed outdoor because for such voltages, the clearance between conductors and the space required for various equipments becomes so great that it is not economical to install indoor, is called outdoor substation.	Understand	CO3	CLO10	AEE014.10
5	What is called outdoor substation.	The Substation for voltage 33kV and above, where the equipments are installed outdoor because for such voltages, the clearance between conductors and the space required for various equipments becomes so great that it is not economical to install indoor, is called outdoor substation.	Understand	CO3	CLO10	AEE014.10
6	What is pole mounted substation.	Pole mounted substation is the outdoor type cheapest form of substation for voltages not exceeding 33kV in which the equipments are installed overhead on H-pole or 4-pole structure and electric power is almost distributed in localities through such substation.	Remember	CO3	CLO11	AEE014.11
7	What is called underground substation.	In thickly populated areas where the available space for substation equipment and building is limited and cost of land is high, the substation equipment are placed under ground and then it is said to be underground substation which requires more careful consideration than other types of substation.	Remember	CO3	CLO11	AEE014.011
8	What is a transformer substation.	A substation, in which the voltage is either stepped up or stepped down by means of a transformer, is called a transformer substation.	Understand	CO3	CLO9	AEE014.09
9	What is a switching substation.	A substation, in which simple switching operation of power lines is performed without the voltage level, is called as switching substation.	Remember	CO3	CLO10	AEE014.10
10	What is the necessity of busbars ?.	Busbars are necessary for acting as common point when a number of generators or feeders operating at same voltage are to be connected together.	Understand	CO3	CLO11	AEE014.11
11	What are the advantages of sectionalisation arrangement of busbars .	The advantages are as follows :- a) Each section of the busbar can be withdrawn from the circuit for maintenance work other remaining active. b) By introducing current limiting reactor in between sections the fault MVA can be	Understand	CO3	CLO9	AEE014.09

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
		reduced. and dc circuits				
12	Define feeder .	Feeders are the power lines through which electricity is transmitted in power systems	Understand	CO3	CLO10	AEE014.10
13	What are classifications of distribution feeders.	• Radial • Parallel feeders • Ring main • interconnected systems	Understand	CO3	CLO10	AEE014.10
14	Why busbar protection is needed.	Fault level at busbar is high The stability of the system is affected by the faults in the bus zone. A fault in the bus bar causes interruption of supply to a large portion of the system network.	Remember	CO3	CLO11	AEE014.11
15	What are the merits of carrier current protection.	Fast operation, auto re-closing possible, easy discrimination of simultaneous fault.	Remember	CO3	CLO11	AEE014.11
UNIT-IV GENERATOR AND TRANSFORMER PROTECTION						
1	Why Over Current Protection Is Not Necessary For Modern Generators.	Over Current protection is not considered necessary for modern alternators because these are capable of withstanding a complete short circuit at their terminals for sufficient time without much over heating and damage.	Remember	CO4	CLO12	AEE014.12
2	Which Type Of Relays Are Used For The Merz-price Protection System For Alternator.	Merz-Price protection is differential protection provided for the alternator. The relays used in the Merz-Price protection system of alternator are instantaneous electro-magnetic type protection.	Remember	CO4	CLO13	AEE014.13
3	List the lightening protection schemes	Direct lightening stroke Indirect lightening stroke	Understand	CO4	CLO13	AEE014.13
4	What do you mean by 'Burden' of a P.T. or C.T. ?	The maximum load in volt amperes (VA) which may be applied across the secondary terminals of P.T. or C.T. is known as 'burden' of a P.T. or C.T. It depends upon the number of instruments or relays connected and their individual ratings.	Understand	CO4	CLO14	AEE014.14
5	What will be the effect of open circuiting the secondary of a C.T. ?	If the secondary of a C.T. is open circuited the whole current in the primary becomes magnetizing current & a dangerously high voltage will appear across the secondary which may cause insulation breakdown, damage to the magnetic property of its iron core, overheating and also death to life. For these reasons open circuiting of a C.T. should never be permitted.	Understand	CO4	CLO12	AEE014.12
6	What are the limitations of Buchholz relay?	Only fault below the oil level are detected. Mercury switch setting should be very accurate, otherwise even for vibration, there can be a false operation. The relay is of slow operating type, which is unsatisfactory.	Remember	CO4	CLO12	AEE014.12
7	What are the	Ratio error	Understand	CO4	CLO13	AEE014.13

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
	errors in CT?	(a) Percentage ratio error = [(Nominal ratio – Actual ratio)/Actual ratio] x 100 The value of transformation ratio is not equal to the turns ratio. (b) Phase angle error: Phase angle =180/π[(ImCos δ-I1Sin δ)/nIs]				
8	What are the main types of stator winding faults?	Fault between phase and ground; fault between phases and inter-turn fault involving turns of the same phase winding.	Remember	CO4	CLO13	AEE014.13
9	When will a transformer have regulation closer to zero?	Since voltage regulation of a transformer in the leading loading condition is not additive in nature, at particular power factor in leading we can get zero voltage regulation. While, in lagging condition we'll get ultimately non-zero VR	Understand	CO4	CLO14	AEE014.14
10	What are reasons for oil degradation	1.degragation 2.oxidation 3.contamination	Understand	CO4	CLO14	AEE014.14
11	What is over fluxing protection in transformer?	f the turns ratio of the transformer is more than 1:1, there will be higher core loss and the capability of the transformer to withstand this is limited to a few minutes only. This phenomenon is called over fluxing	Understand	CO4	CLO13	AEE014.13
12	How Many Types Of Colling System InTransformers?	ONAF (oil natural,air forced). OFAF (oil forced,air forced). ODWF (oil direct,water forced). OFAN (oil forced,air forced) Natural cooling	Remember	CO4	CLO13	AEE014.13
13	Why Syn. Generators Are Used For The Production Of Electricity?	Synchronous machines have capability to work on different power factor(or say different imaginary pow varying the field emf. Hence syn. generators are used for the production of electricity.	Understand	CO4	CLO14	AEE014.14
14	What Is The Difference Between Synchronous Generator & Asynchronous Generator?	in simple, synchronous generator supply's both active and reactive power but asynchronous generator(induction generator) supply's only active power and observe reactive power for magnetizing.This type of generators are used in windmills.	Understand	CO4	CLO12	AEE014.12
15	What Is Boucholz Relay And The Significance Of It In To The Transformer?	Boucholz relay is a device which is used for the protection of transformer from its internal faults, it is a gas based relay. whenever any internal fault occurs in a transformer, the boucholz relay at once gives a horn for some time, if the transformer is isolated from the circuit then it stop its sound itself other wise it trips the circuit by its own tripping mechanism.	Understand	CO4	CLO13	AEE014.13
UNIT-V PROTECTION AGAINST OVER VOLTAGES						
1	What is lightening arrester?	Lightning arrester is a protective device which conduct high voltages surges on the power system to the ground.	Understand	CO5	CLO14	AEE014.15
2	What is bill or	Bill or basic impulse level is the maximum	Understand	CO5	CLO14	AEE014.15

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
	basic impulse level?	voltage level withstands by an equipment during or before lightning .Bill is used for testing the lightning arrester .All equipment should be bill rated.				
3	What is the difference between lightening arrester and surge arrester?	Lightning arrester are installed outside and connected to the earth. Surge arrestor are installed inside the panel and comprising of resistor to nullify the effect of surge.	Remember	CO5	CLO14	AEE014.15
4	What Is Cause of Lightning:	There are various theories regarding the formation of lightning. I am not going into detail however there are two types of charges creates lightning such as: Due to negatively charged cloud: 90% lighting strike is due to negatively charged cloud.	Remember	CO5	CLO15	AEE014.15
5	What are the Causes of Over voltage in Power System	1. Over voltage due to external causes 2. Over voltage due to internal causes	Remember	CO5	CLO14	AEE014.15
6	What are the effects of over voltages on power systems	Overvoltage Protection Voltage Surge Switching Impulse or Switching Surge	Remember	CO5	CLO14	AEE014.15
7	What are the Methods of Protection Against Lightning	Earthing screen. Overhead earth wire. Lighning arrester or surge dividers.	Remember	CO5	CLO14	AEE014.15
8	What is insulation coordination	When any over voltage appears in the electrical power system, then there may be a chance of failure of its insulation system. Probability of failure of insulation, is high at the weakest insulation point nearest to the source of over voltage. In power system and transmission networks, insulation is provided to the all equipment and components.	Remember	CO5	CLO14	AEE014.15
9	What is voltage surge.	The over voltage stresses applied upon the power system, are generally transient in nature. Transient voltage or voltage surge is defined as sudden sizing of voltage to a high peak in very short duration	Understand	CO5	CLO15	AEE014.15
10	What is switching impulse or switching surge.	When a no load transmission line is suddenly switched on, the voltage on the line becomes twice of normal system voltage. This voltage is transient in nature.	Remember	CO5	CLO15	AEE014.15
11	List the types of lightening arrester	Horn GapArresters Multi-GapArresters Valve-Type Arrester. Pellet-Type Arresters	Remember	CO5	CLO14	AEE014.15
12	What is the difference between the lightning arrester and surge absorber?	Lightning arrester limits the duration and amplitude of the follow current while a surge absorber reduces the steepness of the wave front for a particular surge	Understand	CO5	CLO15	AEE014.15

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
13	What is the difference between neutral and ground ?	A neutral is an reference point with in an electrical distribution system. Neutral is used to connect the equipment enclosure to an earth .Care must be taken the voltage should not be higher with respect to the ground. A ground represent an electric path ,normally designed to carry the fault current when fault occurs .	Understand	CO5	CLO15	AEE014.15
14	Why Use The Vcb At High Transmission System ? Why Can't Use Acb?	Actually the thing is vacuum has high arc quecheing property compare to air because in VCB ,the die electric strengths equal to 8 times of air . That is y always vaccum used as in HT breaker and air used as in LT .	Understand	CO5	CLO15	AEE014.15
15	What is poly switch	A resettable fuse is a passive electronic component used for protecting electronic circuits from over-current mistakes. This device is also called as a poly switch or multi fuse or poly fuse	Remember	CO5	CLO15	AEE014.15

Signature of the Faculty **HOD, EEE**