



QUESTION BANK

Year / Semester: III B. Tech. VI Semester
Subject and Code: Switch Gear and Protection (23EEE364D)

Regulation: R23

SYLLABUS

UNIT-1: CIRCUIT BREAKERS:

Circuit Breakers: Elementary principles of arc interruption, Recovery, Restriking Voltage and Recovery voltages – Restriking Phenomenon, Average, Max. RRRV, Current Chopping and Resistance Switching – CB ratings and Specifications, Selection of CB; Types and Numerical Problems – Auto reclosures, Description and Operation of Minimum Oil Circuit Breakers, Air Blast Circuit Breakers, Vacuum and SF₆ circuit breakers.

UNIT -2: ELECTRO MAGNETIC, STATIC AND NUMERICAL RELAYS:

Basic requirements of Relays – Primary and Backup protection – Construction details of – Attracted armature, balance beam, inductor type and differential relays – Universal Torque equation – Characteristics of Over current, Direction and distance relays, Static relays – Advantages and Disadvantages – Definite time, Inverse and IDMT static relays – Comparators – Amplitude and Phase comparators, Microprocessor based relays – Advantages and Disadvantages – Block diagram for over current (Definite, Inverse and IDMT), Distance Relays, Impedance Relays and Reactance Relays with their Flow charts.

UNIT-3: PROTECTION OF GENERATORS AND TRANSFORMERS :

Protection of generators: Protection of generators against Stator faults, Rotor faults and Abnormal conditions, Restricted Earth fault and Inter-turn fault protection, Numerical Problems on Percentage winding unprotected, Protection of transformers: Percentage differential protection, Numerical problems on Design of CTs Ratio, Buchholtz relay protection.

UNIT-4: PROTECTION OF FEEDERS, TRANSMISSION LINES AND BUSBARS:

Protection of Feeders (Radial & Ring main) using over current Relays, Protection of Transmission lines – 3 Zone Protection using Distance relays, Carrier Current Protection, Protection of Bus bars – Differential protection, Differential Pilot wire protection.

UNIT-5: PROTECTION AGAINST OVER VOLTAGES:

Generation of Over Voltages in Power Systems, Protection against Lightning Over voltages – Valve type and Zinc-oxide Lightning Arresters – Insulation Coordination – BIL. Neutral Grounding, Grounded and Ungrounded Neutral Systems – Effects of Ungrounded Neutral on system performance. Methods of Neutral Grounding: Solid, Resistance, Reactance – Arcing Grounds and Grounding Practices.



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Max Marks: 10

S. No.	CO	Questions	BT
Unit I: CIRCUIT BREAKERS			
1	1	Explain the following: i). High resistance interruption ii). Current zero interruption	L4
2	1	Explain the concept of restriking phenomenon and thereby derive the equation of maximum RRRV	L3
3	1	Write short notes on the following: i). Resistance switching ii). Current chopping	L4
4	1	In a 220kV system, the reactance and capacitance upto the location of circuit breaker is 8Ω and $0.025\mu\text{F}$ respectively. A resistance of 600 ohms is connected across the contacts of the circuit breaker. Determine the following: (a). Natural frequency of oscillation, (b). Damped frequency of oscillation, (c). Critical value of resistance which will give no transient oscillation, (d). The value of resistance which will give damped frequency of oscillation, one-fourth of the natural frequency of oscillation.	L3
5	1	Discuss the following: i). Breaking capacity ii). Making capacity and iii). Short-time capacity	L5
6	1	Classify the circuit breakers used in power systems and explain any one of them of your choice	L4
7	1	Explain the construction and working of minimum oil circuit breaker with a neat sketch. Mention its advantages and disadvantages	L4
8	1	Elaborately explain the following with neat diagram: i). Axial-blast type ABCB ii). Cross-blast type ABCB	L4
9	1	Mention the advantages and disadvantages of SF6 circuit breaker and explain its construction and operation with a neat sketch.	L4
10	1	Demonstrate the construction and working of Vacuum circuit breaker with a necessary figure.	L4
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Unit II: ELECTRO MAGNETIC, STATIC AND NUMERICAL RELAYS			
1	2	What are the basic requirements of a relay? Explain in detail.	L4



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2	2	Explain with the necessary diagrams the constructional details of attracted armature and balanced beam relays.	L3
3	2	Elaborately explain the concept of inductor type relay and derive a universal torque equation	L4
4	2	Draw and explain the characteristics of over current relays.	L3
5	2	Explain the concept of Impedance relays and reactance relays with their flow charts	L5
6	2	What are static relays? Mention its advantages and disadvantages over other types of relays	L4
S. No.	CO	Questions	BT
Unit III: PROTECTION OF GENERATORS AND TRANSFORMERS			
1	3	Denote a few important faults that may occur on a generator and explain the concept of differential protection used for protection of generators against stator faults.	L4
2	3	Elaborately explain the protective scheme available for the protection of generators against stator inter-turn faults.	L3
3	3	Discuss the issue of restricted earth fault on a generator and suggest a suitable method to protect a generator against such a fault.	L4
4	3	a). A star connected 3-phase, 10MVA, 6.6kV alternator is protected by Merz-price circulating current principle which is set to operate for fault current not less than 175A. Calculate the value of earthing resistance to be provided in order to ensure that only 10% of the alternator winding remains unprotected. b). A 3-phase, 20MVA, 11kV, star-connected generator is protected by the current balancing system of protection. If the ratio of CTs is 1200/5, the minimum operating current of the relay is 0.75A and the neutral point earthing resistance is 6Ω, calculate the percentage of each phase of stator winding which is unprotected against earth faults when the machine is operating at normal voltage.	L3
5	3	Explain the construction and working of Buchholz relay which is used for the protection of transformer against all kinds of faults.	L4
6	3	How a percentage differential protection is used for protection of three phase star/delta transformer? Explain with neat sketch.	L3
7	3	A 3-phase, 66/11kV star-delta connected transformer is protected by Merz-price system. The CTs on LT side have a ratio of 420/5A. Find the ratio of the CTs on HT side.	L4

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Unit IV: PROTECTION OF FEEDERS, TRANSMISSION LINES AND BUSBARS			
1	4	Explain the concept of protection of radial and ring main feeders by the use of overcurrent relays.	L4
2	4	What is 3-zone protection? Explain in detail	L3
3	4	Discuss the carrier current protection scheme used for the protection of transmission lines.	L4
4	4	Write brief notes on the following related to protection of bus bars. i). Differential protection ii). Fault bus protection	L3

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Unit V: PROTECTION AGAINST OVER VOLTAGES			
1	5	Discuss the various causes of overvoltages in a power system	L4
2	5	Explain the concept of lightning phenomenon that can cause an external over voltage in a power system equipment.	L3
3	5	How can you protect the substation apparatus from a severe direct lightning stroke? Explain the various methods.	L4
4	5	With neat diagram explain the operation of valve type and zinc-oxide type lightning arresters used in power system.	L3
5	5	Write short notes on the following: i). Insulation coordination ii). BIL	L3
6	5	Elaborately explain the concept of neutral grounding and the effects of ungrounded neutral on the system performance	L3