

**B.E. Electrical Engineering Fourth Year First Semester Supplementary
Exam 2024**

Power System Protection and Switchgear

Time: Three Hours

Full Marks: 100

(50 marks for each part)

Use a separate Answer-Script for each Part

PART-I.

Two marks are reserved for neat and well organised answer

Group A

Answer *any one* question.

1. a) Explain what you understand by unsymmetrical faults in a power system network. State the assumptions considered for the analysis of faults in power systems. 8
b) Derive the necessary equation to determine the fault current for a single line to ground fault with diagram showing the interconnection of sequence networks. 8
2. a) Show that the sequence impedances of transmission lines are uncoupled even when mutual impedances exist between the phases. 8
b) An alternator rated 15MVA, 13.2kV has a solidly grounded neutral. The positive, negative and zero sequence reactances are 40%, 30% and 5% respectively. Determine the value of the reactance in ohms to be connected in the neutral circuit so that fault current for single line to ground fault does not exceed rated line current. Also determine the value of the resistance in ohms to be connected in the neutral circuit to serve the same purpose. 8

Group B

Answer *any two* questions.

3. a) Explain the function of magnetic blow out coil in air break circuit breaker. 4
b) Explain with suitable diagram axial blast and cross blast oil circuit breaker. 6
c) Mention the main features of SF₆ as an arc quenching medium. 6

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4. a) Explain why current interruption is easier in ac circuit breaker than in dc circuit breaker. 3+5
Discuss how the arc formation in vacuum circuit breaker is different from other circuit breakers.
- b) Describe how the type of fault and condition of neutral point affect the active recovery voltage in a circuit breaker. 8
5. Write short note on: 4x4
- a) Auto-Reclosing in circuit breaker b) Minimum oil circuit breaker c) Double break oil circuit breaker d) Current chopping in circuit breaker.

	<p align="center">Ref. No.: Ex/EE/PC/B/T/411/2024(S) B. E. Electrical Engg. 4th Year, 1st Semester Examination 2024 POWER SYSTEM PROTECTION AND SWITCHGEAR Time: Three hours Full Marks: 100 (50 marks for each part) Use separate answer script for each part. PART II Figures in the margin indicate full marks</p>	
	<p align="center">Group –A Answer any three question from group-A</p>	10×3= 30
1.	Discuss the operating principle of biased differential relay. Draw its characteristics curve. Explain why the bias setting of such differential relay is high for transformer protection but low for generator protection.	(6+4)=10
2.	Derive the torque equation for the directional unit of a relay and explain how the directional feature is implemented within it. Draw the 90-degree connection of a power relay and explain it.	10
3.	Write the universal relay torque equation and explain it. Derive the torque equation of the reactance relay from the universal relay torque equation with proper justification. Explain the advantages and disadvantages of reactance relays in distance protection. What do you understand by the term 'reach of a relay'?	10
4.	Explain 3-step 3-zone distance protection. Draw and explain the trip control circuit for a 3-zone distance protection where zone -1 and zone-2 relays are reactance relays and the third zone relay is a mho relay.	10
5.	Briefly explain why the protection system is divided into various zones. Explain Remote backup and local backup schemes. Discuss about basic elements of protective relaying.	10
	<p align="center">Group –B Answer any two questions from Group-B</p>	
6.	With the necessary trip circuit explain the Blocking scheme in Carrier-Aided Distance Protection.	10
7.	What qualities are ideal for a carrier channel? Additionally, describe how the carrier signal is linked and trapped onto the chosen line section using an appropriate diagram.	(6+4)=10
8.	Explain why overheating takes place in a synchronous generator rotor. Also, explain how the synchronous generator rotor is protected against overheating.	(6+4)=10
9.	Explain restricted earth fault protection for the protection of transformers with the aid of a suitable diagram.	(10)