

**BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING)**  
**FOURTH YEAR**  
**SECOND SEMESTER EXAM 2024**  
**SUB: 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**Answer *any three* questions from this part.

(Two marks reserved for well organized answers)

1.	a) Explain why sensitivity is better maintained for a.c attraction type overcurrent relay over its d.c counterpart. What are the disadvantages of a.c and d.c attraction type overcurrent relays?	(4+4=8)
	b) Explain how the pick up current and time delay are obtained while selecting the settings of an I.D.M.T.L relay.	(8)
2.	a) Why do the plug settings for an earth fault relay vary between 10 % to around 70 %? What are the advantages of using earth fault relays over overcurrent relays for the detection of the phase-to-ground faults?	(5+3 =8)
	b) With the help of a schematic diagram discuss why a directional overcurrent relay is necessary for the protection of the ring main feeders.	(8)
3.	a) Briefly discuss Impedance Relay, Reactance Relay and Mho Relay.	(8)
	b) State the universal torque equation for distance relays. Explain 3-step 3-zone distance protection.	(3+5=8)
4.	a) With the necessary connection diagram and derivation explain how the c.t.s on the two sides of a star-delta transformer should be connected to avoid spurious tripping. Also, explain why the harmonic restraint feature is necessary for transformer differential relays.	(6+2=8)
	b) Explain and derive how the voltage and current should be fed to the distance relays to sense a three-phase fault in a transmission line.	(8)
5.	Write short notes on the following ( <b>any two</b> ) (i) Carrier acceleration scheme and Carrier inter-tripping scheme for carrier aided distance protection. (ii) Buchholz relay for transformer protection. (iii) Use of Biased Differential Relay for protection of generators. (iv) Blocking scheme in Carrier Aided Distance Protection.	(2×8=16)

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**BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING) EXAMINATION – 2024**(4<sup>th</sup> Year, 2<sup>nd</sup> Semester)**POWER SYSTEM PROTECTION & SWITCHGEAR**

Time: Three hours

Full Marks: 100

(50 marks for each part)

Use a separate Answer-Script for each part

**Part-II**Answer **ANY THREE** questions.

(Two marks reserved for well organized answers)

1. a) Show that the sequence impedances of transmission lines are uncoupled even when mutual impedance exists between phases. **8+8**  
 b) With necessary derivation, show how to connect the sequence networks to simulate L-G fault.
2. a) Discuss how thermionic and field emissions are responsible for arc formation in a circuit breaker. Also, explain why the formation of an arc is desirable in the process of circuit breaking. **8+8**  
 b) Describe how the type of fault and condition of the neutral point affect the active recovery voltage in a circuit breaker.
3. a) Briefly explain active recovery voltage and deduce its expression. What is the significance of RRRV in circuit breakers? **8+8**  
 b) In a short circuit test with earthed neutral, on a 132 kV, 3 Phase, circuit breaker, the power factor of the fault was 0.3, the recovery voltage was 0.90 of full line voltage, the breaking current was symmetrical and the restriking transient had a natural frequency of 15 kHz. Estimate the rate of rise of restriking voltage, assume the fault is grounded.
4. a) Explain resistance switching in a circuit breaker. **8+8**  
 b) With the help of the relevant diagram, explain the current chopping phenomenon in a circuit breaker.
5. a) What are the advantages and disadvantages of SF<sub>6</sub> circuit breakers? **8+8**  
 b) What are the advantages and disadvantages of oil circuit breakers?