BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING)
FOURTH YEAR SECOND SEMESTER EXAM 2023
SUB: POWER SYSTEM PROTECTION AND SWITCHGEAR

Time: Three hours   Full Marks: 100

(50 marks for each part)
Use separate answer script for each part.
PART I
Figures in the margin indicate full marks

	Group –A Answer **any three** questions from **Group-A**	
1.	Explain the main features of power system relaying. With the help of necessary diagram explain how and why a power system is divided into a number of small zones. Draw a neat schematic of the generalized block diagram of power system relays and discuss about the basic elements of protective relaying.	(3+3+4) =10
2.	Briefly explain the following terms with respect to an overcurrent relay: (a) PSM (b) TSM. Draw the phasor diagram of a directional overcurrent relay (DOCR) and clearly show the maximum torque angle in the phasor diagram. Deduce the expression of torque equation for a DOCR. Explain the advantages of directional relay.	(4+2+2+2) =10
3.	Explain 3-step 3 zone distance protection. Briefly discuss impedance relay and reactance relay.	(5+5)=10
4.	Explain the effect of power swing on the operation of distance relay. Discuss the remedial measure against it by using Offset mho relay.	10
5.	a) An IDMTL relay is carrying a fault current of 1600A. Its primary setting current is 200A. Calculate PSM. This relay is acting as a backup relay with DTM of 0.2sec where the actual time of operation if operating as primary relay is 1sec. Calculate TMS of the relay. b) Discuss the various types of actuating structures for Induction type overcurrent relays.	(4+6)=10

PSM	2	4	6	8	12	20
Time	10	5.53	3.84	3.4	2.63	2.1

	Group –B Answer **any two** questions from **Group-B**	
6.	"It is not possible to protect 100% of the armature windings of an alternator, grounded through an impedance, against an earth fault"-Explain. With the help of schematic diagrams explain how differential relay is used for stator winding interphase and ground fault protection of an alternator.	(4+6)=10
7.	Discuss about Buchholz relay for transformer protection.	10

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8.	With the help of a neat schematic diagram explain percentage biased differential relays. Also explain through fault stability limit of differential relays with respect to a simple differential scheme.	(6+4) =10
9.	Discuss how rotor overheat protection is carried out for an alternator. Also explain how bearing overheat protection is provided for an alternator.	(6+4) =10
10.	What are the attributes of an ideal carrier channel? Also explain with help of suitable diagram how the carrier signal is coupled and trapped onto the desired line section.	(6+4) =10

BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING)4TH YEAR, 2ND
SEMESTEREXAMINATION 2023
SUBJECT: - POWER SYSTEM PROTECTION & SWITCHGEAR

Time: Three hours   (50 marks for this part)   Full Marks: 100

Use a separate Answer-Script for each part
PART -II   **Marks**
Answer any Three
(Two marks reserved for well organized answers)

1.(a)   What is auto reclosing? Briefly discuss how the power flow will be affected
        if fault occurred and (i) the system do not have auto reclosing feature (ii)   (12)
        system have auto reclosing feature and fault is cleared within auto
        reclosing time (iii) fault sustain even after auto reclosing.

(b)   State the opposing forces which the circuit breakers have to overcome   (4)
        during closing operation.

2.(a)   Briefly explain the different types of operating mechanism for circuit   (10)
        breakers.

(b)   What is arc energy? Write the expressions of arc energy for different arc   (6)
        length.

3.(a)   Draw a typical sketch for trip coil current, fault current, voltage between
        fixed contact and moving contact, and travel records of a circuit breaker   (10)
        while closing. Also define making time.

(b)   Discuss about low resistance arc interruption theories.   (6)

4.(a)   Consider a system under sudden short circuit. In this regard explain, with
        relevant diagrams, the two conditions which determine the behaviour of the   (10)
        current.

(b)   What are the advantages of using SF_6 gas as an arc interrupting medium in   (6)
        circuit breakers?

5.(a)   A 3-phase fault with maximum asymmetry in one phase occurs on a 3 Ph.
        11kV, 50Hz feeder. If the rms value of symmetrical fault current is 7070 A,
        and the making capacity is 18kA, determine,
        i) the time constant of the circuit
        ii) the doubling factor   (8)
        iii) the asymmetric breaking capacity assuming that the circuit breaker
        contacts just open after 3 cycles from the initiation of fault.

(b)   Briefly explain Active recovery Voltage & deduce its expression. Explain
        the significance of RRRV in respect of quenching of arc.   (8)

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