

- ii. Compare and analyze the working of impedance and MHO relays based on its operating characteristics. 7 2 2 1

(OR)

- b.i. The current rating of an overcurrent relay is 5 A. The relay has a plug setting of 150% and time multiplier setting (TMS) of 0.4. The CT ratio is 400/5. Determine the operating time of the relay for a fault current of 6000 A. at TMS =1, the operating time at various PSM are given in the table below. 4 2 2 2

| PSM | 2 | 4 | 5 | 8 | 10 | 20 |
|---------------------------|----|---|---|---|-----|-----|
| Operating time in seconds | 10 | 5 | 4 | 3 | 2.8 | 2.4 |

- ii. Describe the working of induction type directional overcurrent relay, with the necessary diagram. 6 1 2 1
28. a. List out the various faults that might occur on an alternator and explain the methods generally adopted for its protection. 10 2 3 1

(OR)

- b. Which relay is designed based on "Hydrogen gas release/actuation"? Explain with neat diagram the working of the gas activated relay and mention its advantages and disadvantages. 10 2 3 1
29. a. Elaborate the realization of a directional overcurrent relay using microprocessor based numerical relay with relevant flowchart and block diagram. 10 2 4 1

(OR)

- b.i. Discuss the steps to be followed for the design of ANN for their application to power system protection. 7 2 4,6 5
- ii. Mention the advantages of FPGA based relays over conventional relays. 3 1 4 1
30. a. Differentiate bulk oil circuit breaker from low oil circuit breaker. Also discuss the constructional details and operation of a typical low oil circuit breaker. 10 2 5 1

(OR)

- b. Describe the construction and operating principle of the circuit breaker which is most suitable for extra high voltage applications. Also discuss its merits and demerits. 10 2 5,6 1

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Reg. No.

B.Tech. DEGREE EXAMINATION, MAY 2022

Sixth Semester

18EEEC305T – POWER SYSTEM PROTECTION

(For the candidates admitted from the academic year 2018-2019 to 2019-2020)

Note:

- (i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.
- (ii) **Part - B** should be answered in answer booklet.

Time: 2½ Hours

Max. Marks: 75

PART – A (25 × 1 = 25 Marks)

Answer **ALL** Questions

- | | | | | |
|---|---|---|-----|---|
| 1. The ability of the relay to operate with low value of actuating quantity is called _____ | 1 | 1 | 1 | 1 |
| (A) Selectivity | | | | |
| (B) Sensitivity | | | | |
| (C) Reliability | | | | |
| (D) Simplicity | | | | |
| 2. The percentage of failure rate for relays in power system protection scheme is | 1 | 1 | 1,6 | 1 |
| (A) 14 | | | | |
| (B) 12 | | | | |
| (C) 44 | | | | |
| (D) 8 | | | | |
| 3. Carrier current protection scheme is used for the protection of _____ lines. | 1 | 1 | 1,6 | 1 |
| (A) 132 kV and above | | | | |
| (B) 33 kV and above | | | | |
| (C) 66 kV and above | | | | |
| (D) 11 kV and above | | | | |
| 4. The ratio error (or) current error in CT's largely depends on the value of | 1 | 1 | 1 | 1 |
| (A) Magnetizing component of exciting current | | | | |
| (B) Winding losses in primary winding | | | | |
| (C) Winding losses in secondary winding | | | | |
| (D) Iron-loss component of exciting current | | | | |
| 5. The driving torque in the shaded pole structure relay is proportional to the | 1 | 1 | 1 | 1 |
| (A) Square of the current in the relay coil | | | | |
| (B) Square of the voltage across the relay coil | | | | |
| (C) Primary current in C.T | | | | |
| (D) Primary voltage of C.T | | | | |
| 6. The distance relay is said to be inherently directional if its characteristics on R-X diagram. | 1 | 1 | 2 | 1 |
| (A) Is a straight line offset from the origin | | | | |
| (B) Is a circle that pass through the origin | | | | |
| (C) Is a circle that encloses the origin | | | | |
| (D) Is a straight line parallel to R-axis | | | | |
| 7. For parallel feeders fed from one end, the relays required are | 1 | 1 | 2 | 1 |
| (A) Non-directional relays at the source and directional relays at the load end | | | | |
| (B) Non-directional relays at both ends | | | | |
| (C) Directional relays at source end and non-directional relays at load end | | | | |
| (D) Directional relays at both ends | | | | |

8. According to the British standard, the time-current characteristics of extreme inverse overcurrent relay is given by
 (A) $t = \frac{13.5}{I-1}$ (B) $t = \frac{80}{I^2-1}$
 (C) $t = \frac{0.14}{I^{0.02}-1}$ (D) $t = \frac{80}{I-1}$
9. The overcurrent relay having current setting of 125% is connected to a supply circuit through a current transformer of 400/5. The rated secondary current of CT is 5 A. What should be the pickup current value?
 (A) 6.25 A (B) 500 A
 (C) 5 A (D) 400 A
10. The line trap in carrier current protection is tuned for carrier frequency provides
 (A) Low impedance to both carrier and power frequency (B) High impedance to both carrier and power frequency
 (C) High impedance to carrier frequency but low impedance to power frequency (D) Low impedance to carrier frequency but high impedance to power frequency
11. In bus bar protection, what is the method of providing an earthed metal barrier surrounding the bus throughout its length called?
 (A) Fault bus protection (B) Earth fault protection
 (C) Distance protection (D) Differential protection
12. Merz price current scheme protection is employed for
 (A) Transformer (B) Bus bar
 (C) Transmission line (D) Transformer and alternator
13. To prevent maloperation of differentially connected relay while energizing a transformer, the relay restraining coil is biased with
 (A) Second harmonic current (B) Third harmonic current
 (C) Fifth harmonic current (D) Seventh harmonic current
14. To protect the power transformer with Y-Y neural ground against fault, which type of connection do the current transformers have?
 (A) Y-Y Connection (B) Δ -Y Connection
 (C) Y- Δ Connection (D) Δ - Δ Connection
15. Which one of the following device protects the power station and substation equipments only from direct lightning strokes?
 (A) Lightning arrester (B) Earthing screen
 (C) Surge absorber (D) Overhead ground wires
16. _____ is the process of converting a continuous range of values into a finite range of discrete values.
 (A) Quantizing (B) Encoding
 (C) Sampling (D) Holding
17. Numerical distance protection is widely used protection scheme for
 (A) Transformer protection (B) Generator protection
 (C) Transmission line protection (D) Bus bar protection

18. The phenomenon of appearance of a high frequency signal as a lower frequency signal that distorts the desired signal is called _____.
 (A) Signal conditioning (B) Sampling
 (C) Analog interfacing (D) Aliasing
19. In a microprocessor based numerical reactance relay, the microcomputer reads the output of the zero crossing detector to examine whether
 (A) The voltage has crossed the zero point (B) The current has crossed the zero point
 (C) The power has crossed the zero point (D) The impedance has crossed the zero point
20. The sampling theorem states that in order to preserve the information contained in a signal of frequency (ω_{signal}), it must be sampled at a frequency of
 (A) $\omega_{\text{sampling, min}} \geq 2\omega_{\text{signal}}$ (B) $\omega_{\text{sampling, min}} \leq 2\omega_{\text{signal}}$
 (C) $\omega_{\text{sampling, min}} = 2\omega_{\text{signal}}$ (D) $\omega_{\text{sampling, min}} < 2\omega_{\text{signal}}$
21. For a round wire, the approximate relationship between fusing current I and diameter d of the wire is
 (A) $I = kd^{1/2}$ (B) $I = kd^{3/2}$
 (C) $I = kd^2$ (D) $I = kd^{2/3}$
22. The R.M.S value of the first loop of the fault current obtained if the fuse is replaced by an ordinary conductor of negligible resistance is known as
 (A) Cut off current (B) Prospective current
 (C) Fusing current (D) Breaking current
23. The phenomenon of current interruption before the natural current zero is called _____.
 (A) RRRV (B) Current chopping
 (C) Capacitive current breaking (D) Resistance switching
24. The resistance of an electric arc can be increased by
 (A) Increasing the concentration of ionized particles (B) Reducing the arc length
 (C) Splitting the arc (D) Increasing the arc cross section
25. In a vacuum circuit breaker, the vacuum is of the order of
 (A) 10^{-7} to 10^{-5} torr (B) 10^{-2} to 10^{-5} torr
 (C) 10^{-6} to 10^{-9} torr (D) 10^{-7} to 10^{-9} torr

PART – B (5 × 10 = 50 Marks)

Answer ALL Questions

- | | Marks | BL | CO | PO |
|--|-------|----|----|----|
| 26. a.i. Discuss the fundamental requirements of protective relaying. | 5 | 1 | 1 | 1 |
| ii. Classify and brief the various protective relays based on technology, speed of operation and its functions. | 5 | 1 | 1 | 1 |
| (OR) | | | | |
| b. With neat sketch, explain the construction and working of any two types of electromagnetic attraction type relay. | 10 | 1 | 1 | 1 |
| 27. a.i. State the principle and operation of distance relay. | 3 | 1 | 2 | 1 |