

MIZORAM PUBLIC SERVICE COMMISSION

DEPARTMENTAL EXAMINATIONS FOR JUNIOR GRADE OF M.E.S. (AE/SDO)
UNDER POWER & ELECTRICITY DEPARTMENT,
GOVERNMENT OF MIZORAM, DECEMBER, 2023.

ENGINEERING PAPER – II

(Electricals/Electronics/Electrical & Electronics/Electronics & Communication/ Electronics & Telecommunication Engineers under Electrical Wing)

Time Allowed : 3 hours

FM : 100 PM : 40

PART - A (50-MARKS)

This Section should be answered only on the Separate Answer Sheet provided.

All questions carry equal marks of 2 each.

- The specific resistance of a wire depends upon?
 - its length
 - its cross-sectional area
 - its dimension
 - its material
- The value of α (temperature co-efficient of resistance) depends upon?
 - length of the material
 - cross-sectional area of the material
 - volume of the material
 - nature of the material and temperature
- In Ohm's law if the resistance or impedance is uniform then
 - voltage is equal to current
 - voltage is directly proportional to current
 - voltage is inversely proportional to current
 - voltage is directly proportional to square of current
- When a number of resistances are connected in parallel, the total resistance is
 - greater than the smallest resistance
 - between the smallest and the greatest resistance.
 - less than the smallest resistance
 - none of the above
- Kirchhoff's voltage law deals with
 - conservation of energy
 - conservation of charge
 - conservation of momentum
 - conservation of angular momentum
- If R_L of Fig. A is the load resistance, then Thevenin's equivalent resistance R_{TH} of the circuit will be

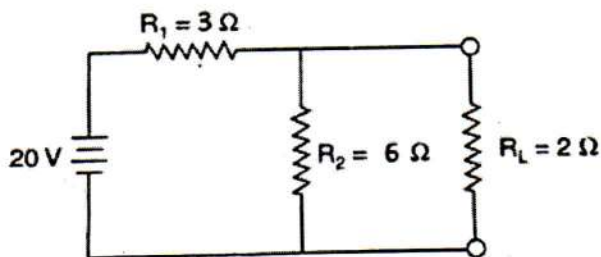


Fig. A

- $2\ \Omega$
- $5\ \Omega$
- $7\ \Omega$
- $9\ \Omega$

7. In Fig.B (a), the resistance of $R_{31} = 2\Omega$, $R_{12} = 4\Omega$ and $R_{23} = 2\Omega$. What will be the resistance of R_1 ?

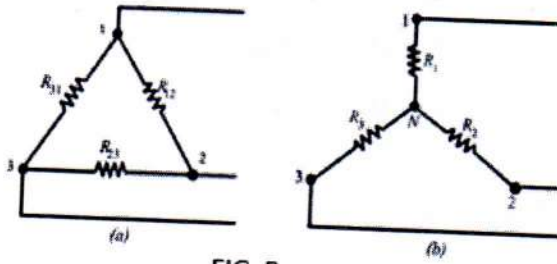


FIG. B

- (a) 4Ω (b) 3Ω
 (c) 2Ω (d) 1Ω
8. How much energy is consumed when ten 60W bulb is operated for 10 hours per day for 30 days?
 (a) 160kWh (b) 148kWh
 (c) 180kWh (d) 120kWh
9. A motor draws 12A from a 230V AC source. If the motor is 95% efficient, the horsepower rating of the motor is
 (a) 3.5 h.p (b) 4.0 h.p
 (c) 5.5 h.p (d) 6.5 h.p
10. A 132kV overhead line using Panther conductor has a resistance of $0.1363\Omega/\text{km}$. If the power drawn by the line is 30MW, what will be the transmission loss per km?
 (a) 6.5kW (b) 7.0kW
 (c) 7.5kW (d) 8.0kW
11. The capacitance of a capacitor is _____ relative permittivity.
 (a) directly proportional to (b) inversely proportional to
 (c) independent of (d) directly proportional to the square of
12. The inductance L of a coil will decrease
 (a) when the number of turns N increases
 (b) when more area A for each turn is provided
 (c) when permeability of the core increases
 (d) when more length for the same number of turns is provided
13. According to Faraday's Laws of Electromagnetic Induction, an e.m.f. is induced in a conductor whenever it
 (a) lies in a magnetic field
 (b) cuts magnetic field
 (c) moves parallel to the direction of the magnetic field
 (d) lies perpendicular to the magnetic flux
14. The e.m.f induced in a coil of N turns is given by
 (a) $d\phi/dt$ (b) $N d\phi/dt$
 (c) $-N d\phi/dt$ (d) $N dt/d\phi$

15. The AC system is preferred to DC system because
- (a) AC voltages can be easily changed in magnitude
 - (b) DC motors do not have fine speed control
 - (c) high voltage AC transmission is less efficient
 - (d) DC voltages cannot be used for domestic appliances
16. The r.m.s value of an AC wave is always greater than the average value except in case of
- (a) sawtooth waves
 - (b) semicircular wave
 - (c) square and rectangular waves
 - (d) triangular wave
17. The active and apparent powers of an AC circuit are equal in magnitude when power factor is
- (a) 0.707
 - (b) 0.5
 - (c) 0.8
 - (d) 1
18. A power triangle can provide information about
- (a) power factor
 - (b) kVA
 - (c) kVAR
 - (d) all the above
19. A balanced delta connected load is converted to equivalent balanced star load. Then
- (a) Impedance $Z_{\text{star}} = 1/3 \times \text{Impedance } Z_{\text{Delta}}$
 - (b) Impedance $Z_{\text{star}} = 2/3 \times \text{Impedance } Z_{\text{Delta}}$
 - (c) Impedance $Z_{\text{star}} = 3 \times \text{Impedance } Z_{\text{Delta}}$
 - (d) Impedance $Z_{\text{star}} = 3/4 \times \text{Impedance } Z_{\text{Delta}}$
20. In a star-connected system, the relation between the line voltage V_L and phase voltage V_{PH} is
- (a) $V_L = V_{PH}$
 - (b) $V_L = V_{PH}/\sqrt{3}$
 - (c) $V_L = \sqrt{3} \times V_{PH}$
 - (d) $V_L = V_{PH}/\sqrt{2}$
21. When the speed of an alternator is reduced by half, the generator e.m.f will become
- (a) twice
 - (b) one-fourth
 - (c) half
 - (d) four times
22. The frequency of e.m.f generated per revolution in an alternator is equal to
- (a) number of poles
 - (b) twice the number of poles
 - (c) number of pair of poles
 - (d) three times the number of poles
23. Corona is affected by
- (a) condition of atmosphere
 - (b) size and spacing of conductors
 - (c) line voltages
 - (d) all of the above
24. The skin effect increases the
- (a) resistance of the line
 - (b) inductance of the line
 - (c) capacitance of the line
 - (d) all of the above
25. The number of depletion layers in a transistor is
- (a) four
 - (b) three
 - (c) one
 - (d) two

PART - B (50-MARKS)

This Section should be answered only on the Separate Answer Sheet provided.

All questions carry equal marks of 5 each.

26. What are the difference between power transformers and distribution transformers? Draw the schematic diagram of Distribution Transformer Earthing system with three earthing electrodes.
27. Insulation resistance of 10MVA, 33/11kV transformer is measured between HV and LV side and the result obtained is shown below:
- (i) 1.3 GΩ after 10 minutes
 - (ii) 0.9 GΩ after 1 minutes
 - (iii) 0.7 GΩ after 30 seconds

Calculate the Polarization Index (PI) value and the Dielectric Absorption Ratio (DAR) value?

28. What is soil resistivity? Draw a schematic diagram a four point method of Earth Resistance Measurement?
29. What are the criteria for selection site for Power Sub-Station?
30. FIG. 1 shows a 200-100/1-1 Current Transformer (CT) circuit drawing where P denotes the primary winding and S denotes the secondary winding. If the CT secondary is to be set at 100/1 ratio. in which terminals must the control cables must be connected? For 33kV CT, what is the minimum acceptable Insulation Resistance (IR) between phase to phase and phase to earth?

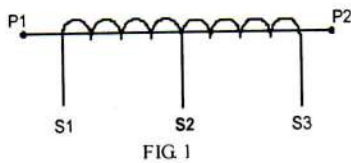


FIG. 1

31. (a) Name three types of arc quenching medium normally used in 33kV Outdoor Type Circuit Breaker (CB)?
- (b) What is the controlling voltage for 33kV Outdoor type Circuit Breaker closing and tripping circuit?
32. Figure 2 below shows transformer auxiliary protection scheme, where NO contact of Bucholz Trip at Transformer is connected to Auxilliary Relay of 33kV C&R panel having coil 30A. What will happen if NO contact of Bucholz trip closes due to fault sensed by Bucholz Relay of 10 MVA, 33/11kV Power Transformer?

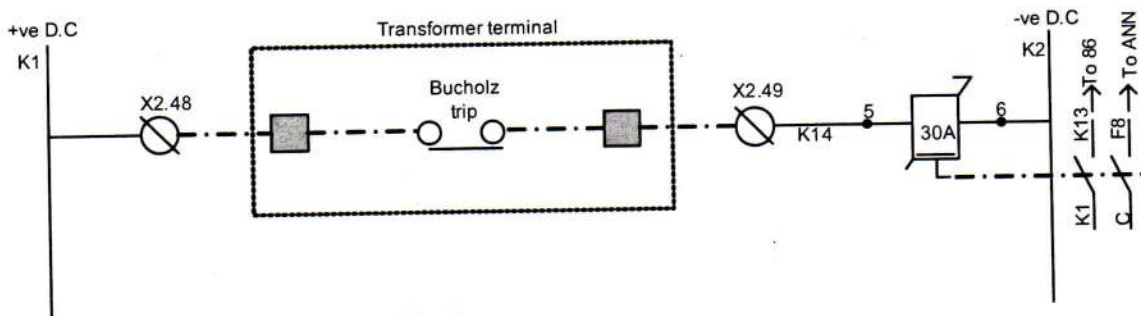


Fig. 2

33. The external PT ratio is 33000/110V and external CT ratio is 100/1A. If the energy meter is calibrated for PT ratio 33000/110V, CT ratio -/1A then what will be the multiplying factor for the meter?
34. What are the models of numerical relays commonly used in Mizoram for
- (i) Overcurrent/Earth fault protection relay
 - (ii) Transformer protection relay
 - (iii) Distance protection relay
35. What do you mean by span and sag of an overhead transmission line? What are the factors upon which the sag in an overhead line depends?

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