MIZORAM PUBLIC SERVICE COMMISSION

DEPARTMENTAL EXAMINATIONS FOR JUNIOR GRADE OF M.E.S. (AE/SDO) UNDER POWER & ELECTRICITY DEPARTMENT, GOVERNMENT OF MIZORAM, JUNE-2024.

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 <u>Separate Answer Sheet</u> provided.
All questions carry equal marks of 2 each.

1. An essential condition for Ohm's law to be applicable to a circuit is that
   (a) resistance must be at room temperature
   (b) voltage should be only DC
   (c) the current should flow in forward direction only
   (d) the resistance must be uniform

2. The specific resistance of a wire depends upon?
   (a) its length
   (b) its cross-sectional area
   (c) its dimension
   (d) its material

3. Kirchhoff's law is applicable to
   (a) AC circuits only
   (b) DC circuits only
   (c) Both AC as well as DC circuits
   (d) Passive networks only

4. When two resistances are connected in parallel
   (a) the current through each must be the same
   (b) the voltage across each must be the same.
   (c) their combined resistance value equals the sum of the individual values.
   (d) each must have the same resistance value

5. When converting a star resistive network to an equivalent delta network, if all the three resistors are equal in value, then the value of the resultant resistors in the equivalent delta network will be
   (a) same as that of star resistors
   (b) 2 times the value of the star resistors
   (c) 3 times the value of the star resistors
   (d) 4 times the value of the star resistors

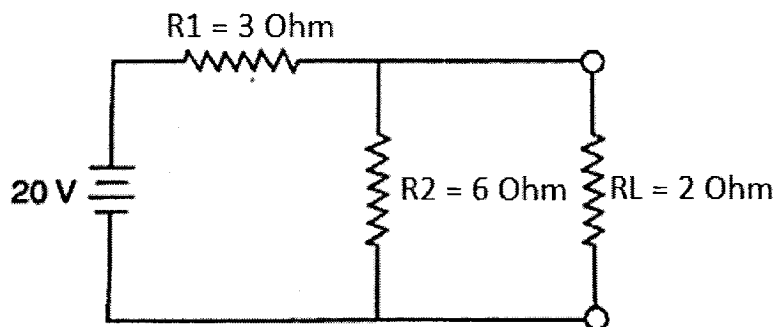6. If RL of Fig. A is the load resistance, then Thevenin's equivalent resistance R_{TH} of the circuit will be

R1 = 3 Ohm

20 V

R2 = 6 Ohm   RL = 2 Ohm

FIG. A

(a) 2 Ohm   (b) 5 Ohm
(c) 7 Ohm   (d) 9 Ohm

7. Capacitance increases with
    (a) increase in plate area and the distance between the plates
    (b) reduction in plate area and the distance between the plates
    (c) increase in plate area and decrease in the distance between the plates
    (d) decrease in the plate area and the value of the applied voltage

8. How much energy is consumed when ten 100W bulb is operated for 10 hours per day for 30 days?
    (a) 15kWh   (b) 20kWh
    (c) 25kWh   (d) 30kWh

9. A motor draws 17A from a 230V AC source. If the motor is 95% efficient, the horsepower rating of the motor is
    (a) 3.5 h.p   (b) 4.9 h.p
    (c) 5.5 h.p   (d) 6.5 h.p

10. The unit of capacitance is
    (a) Farad   (b) Farad/m
    (c) Farad/m^2 (d) Farad/m^3

11. 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

12. How much energy is consumed when ten 100W bulb is operated for 10 hours per day for 30 days?
    (a) 15kWh   (b) 10kWh
    (c) 20kWh   (d) 30kWh

13. Inductive reactance is measured in ohms because it
    (a) reduces the amplitude of alternating current
    (b) increases the amplitude of alternating current
    (c) reduces the amplitude of direct current
    (d) has a back emf opposing a steady direct current

14. From the fig showing sinusoidal waves of induced e.m.f. A and B, we may say that
    (a) A & B are in phase with each other
    (b) A is leading B by ϖt
    (c) A is leading B by ϕ
    (d) B is leading A by ϕ

$e_A = e_m \sin \omega t$

$e_B = e_m \sin (\omega t + \phi)$
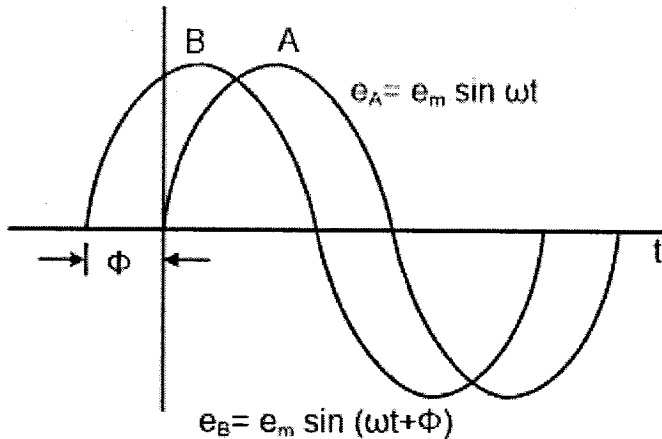
15. According to Faraday's Laws of Electromagnetic Induction, an e.m.f. is induced in a conductor whenever it
    (a) lies in a magnetic field
    (b) cuts magnetic field
    (c) moves parallel to the direction of the magnetic field
    (d) lies perpendicular to the magnetic flux

16. What is the unit of self-induction (L)?
    (a) mho   (b) weber
    (c) henry   (d) weber-turn

17. Lenz's law is related to
    (a) the direction of magnetic field   (b) the direction of motion of conductor
    (c) the direction of the induced current   (d) both (a) and (b)

18. 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

19. 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

20. What do you mean by phase sequence RYB?
    (a) It denotes phase R, Y and B
    (b) It is the standard manufacturer's nomenclature
    (c) It is the sequence in which the voltage across R, Y and B attain their maximum values
    (d) It denotes the colour of the wire

21. If V_{PH}, I_{PH} are the phase voltage and current and V_L, I_L are the line voltages in a star connected system, then
   (a) $V_L = \sqrt{3}\, V_{PH}$ and $I_L = I_{PH}$
   (b) $V_L = \sqrt{3}\, V_{PH}$ and $I_L = \sqrt{3}\, I_{PH}$
   (c) $V_L = 1/\sqrt{3}\, V_{PH}$ and $I_L = I_{PH}$
   (d) $V_L = 1/\sqrt{3}\, V_{PH}$ and $I_L = \sqrt{3}\, I_{PH}$

22. In an alternator, if the frequency is f, the rotational speed is N and the number of poles is P then
   (a) P = 120N/f
   (b) P = 120f/N
   (c) P = N/120f
   (d) P = f/120N

23. Cylindrical type rotors are used in
   (a) high speed alternators
   (b) medium speed alternators
   (c) low speed alternators
   (d) very low speed alternators

24. The rectifier which requires minimum amount of filtering is
   (a) Half wave rectifier
   (b) Full wave rectifier
   (c) Voltage double circuit
   (d) SCR half wave rectifier

25. The circuit shown is
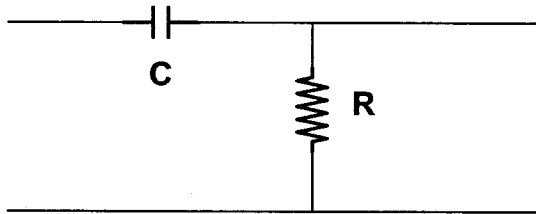
   (a) integrator
   (b) low pass filter
   (c) high pass filter
   (d) band pass filter

## PART - B (50-MARKS)

This Section should be answered only on the <u>Separate Answer Sheet</u> provided.
*All questions carry equal marks of 5 each.*

1. What is the short-circuit current on the LV side of 132/33kV 12.5MVA Power Transformer whose % impedance is 9.6%?

2. Insulation resistance of 1.6MVA, 33/11kV transformer is measured between HV and LV side and the result obtained is shown below:

   1. 0.48 GΩ after 10 minutes

   2. 0.23 GΩ after 1 minutes

   3. 0.15 GΩ after 30 seconds

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

3. In a 3-point method of Earth Resistance measurement, what is the minimum distance between earth electrode and potential electrode and what will be the corresponding distance between the potential and current electrodes. If the voltage between Earth and Potential electrode is V volts and the current across Earth and Current electrode is I amps, what will be the earth resistance?

4. Mention three differences between CT and PT? Why is CVT used in long transmission lines instead of PT?

5. FIG shows a 33kV Current Transformer (CT) circuit diagram. What does P1, P2 & S1,S3 nad S3 denotes? Is it a single core CT or three core CT? How many CT core do we usually used for 33kV line protection?
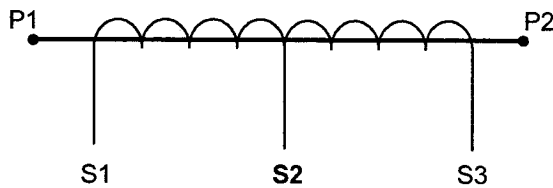
6. Briefly describe the function of trip supervision relay in 33kV Control and Relay panel? How can we know whether 33kV Circuit Breaker will be able to trip at the time of fault? What is the most common element that makes the trip circuit faulty?

7. The total unit of 11kV panel energy meter for one month is 340kWh from the normal meter reading. The external PT ratio is 11000/110V and CT ratio is 50/5A. If the energy meter is calibrated for PT ratio 11000/110V, CT ratio 25/5A what will be the actual energy in kWh?

8. Figure below shows the schematic diagram of Distribution Transformer Earthing. Describe the connections to the three electrodes X, Y, Z .
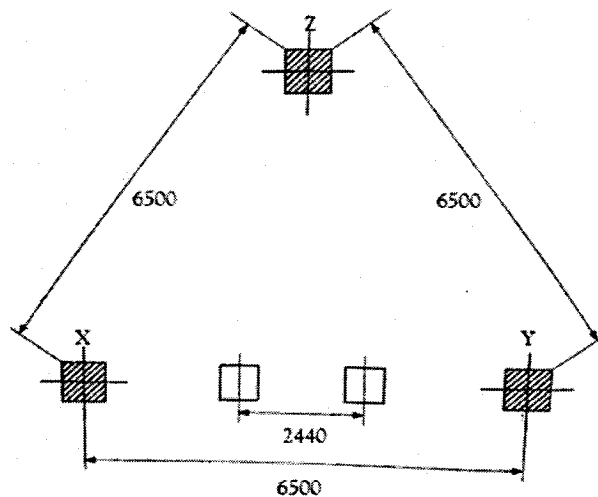
9. (a) How many poles will be required in 1 km of LT ABC line if standard spacing between each pole is maintained as per SOR 2023 ?

   (b) In 33kV and 11kV line construction, when shall double pole structure must be used?

   (c) How many hours new transmission line shall be charged for observation?

10. 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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