MIZORAM PUBLIC SERVICE COMMISSION

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

ENGINEERING PAPER – II

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

Time Allowed : 3 hours   FM : 100   PM : 40

*Marks for each question is indicated against it.*
Attempt all questions.

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. For all practical purpose, the resistivity of aluminium conductor per sq.mm per meter length is?
    (a) 0.012 ohms   (b) 0.018 ohms
    (c) 0.028 ohms   (d) 0.022 ohms

2. A 1500 watt immersion rod takes 10 minutes to heat a bucket of water. Which of the following modification will help in heating the bucket of water less than 10 minutes?
    (a) reducing the supply voltage   (b) increasing the length of heating element
    (c) reducing the length of heating element (d) using heating element of larger diameter

3. In Ohm's law if the resistance or impedance is uniform then
    (a) voltage is equal to current
    (b) voltage is directly proportional to current
    (c) voltage is inversely proportional to current
    (d) voltage is directly proportional to square of current

4. When resistances are connected in series
    (a) the current through each resistors are same.
    (b) the resistances are additive.
    (c) the voltage drops across each resistors are additive.
    (d) all of the above

5. Kirchhoff's current law is applicable to only
    (a) closed loops in a network   (b) electronic circuits
    (c) junctions in a network   (d) electric circuits

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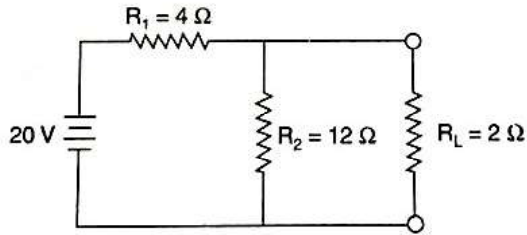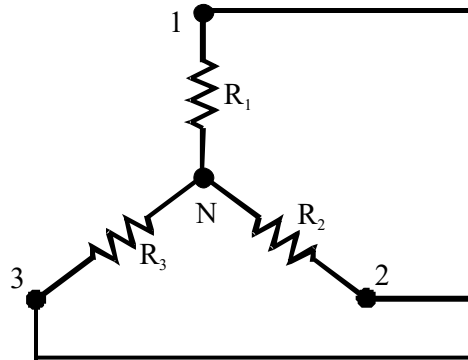

(a) 3 W

(b) 5 W

(c) 7 W

(d) 10 W

7. In Figure (a), the resistance of $R_{31} = 1W$, $R_{12} = 1W$ and $R_{23} = 2W$. What will be the resistance of R_3?
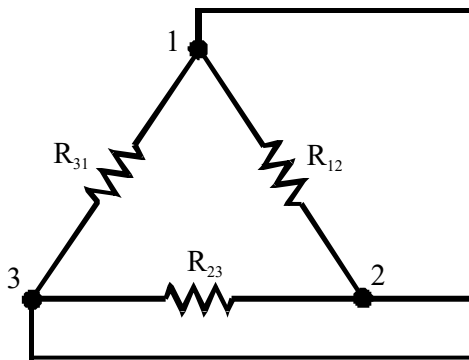
(a)   (b)

(a) 0.25W

(b) 0.5W

(c) 0.75W

(d) 1 W

8. A certain motor draws 17A from a 240V source. If the motor is 91.5% efficient, the horsepower rating of the motor is

(a) 3 h.p

(b) 6 h.p

(c) 5 h.p

(d) 10 h.p

9. The unit of capacitance is

(a) Farad

(b) Farad/m

(c) Farad/m^2

(d) Farad/m^3

10. The value of capacitive reactance increases as the

(a) value of capacitance increases

(b) frequency decreases

(c) voltage increases

(d) current increases

11. Inductive reactance is measured in ohms because it

(a) reduces the amplitude of alternating current

(b) increases the amplitude of alternating current

(c) increases the amplitude of direct current

(d) has a back e.m.f. opposing a steady direct current

12. 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

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

14. The time period of a direct current is
    (a) infinite
    (b) zero
    (c) finite
    (d) random

15. If $e_1 = A \sin wt$ and $e_2 = B \sin (wt - f)$, then
    (a) e_1 lags e_2 by f
    (b) e_2 lags e_1 by f
    (c) e_2 is in phase with e_1
    (d) e_1 is in phase with e_2

16. In an R-L series circuit, line current
    (a) leads the applied voltage
    (b) lags behind the applied voltage
    (c) is in phase with the applied voltage
    (d) none of the above

17. In the power triangle shown in figure, the reactive power is
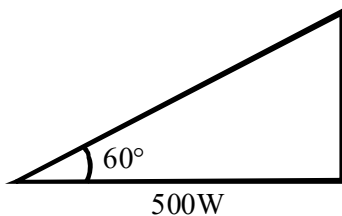
    (a) 1000 VAR leading
    (b) 1000 VAR lagging
    (c) 866 VAR lagging
    (d) 866 VAR leading

18. The advantage of star-connected supply system is that
    (a) line current is equal to phase current
    (b) two voltages can be used
    (c) phase sequence can easily be changed
    (d) it is a simple arrangement

19. When 3-phase system is balanced, the neutral wire carries
    (a) no current
    (b) one-third of current for each phase
    (c) half of current for each phase
    (d) one-fourth of current for each phase

20. 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

21. The speed at which a 6-pole alternator should be driven to generate 50 cycles per second is
    (a) 1500 r.p.m
    (b) 1000 r.p.m
    (c) 800 r.p.m
    (d) 500 r.p.m

22. Corona effect can be reduced by
    (a) increasing conductor size
    (b) decreasing conductor size
    (c) decreasing conductor spacing
    (d) none of the above

23. Total minimum number of discs in a string of porcelain insulators for 132kV AC overhead transmission line is
    (a) 5
    (b) 6
    (c) 7
    (d) 8

24. A thyristor can be brought to forward conducting state with gate-circuit open when the applied voltage exceeds

(a) the forward break-over voltage

(b) reverse breakdown voltage

(c) 1.5V

(d) 2.0 V

25. In a transistor with normal bias

(a) the emitter junction has a low resistance

(b) the emitter junction is reversed biased

(c) the emitter junction offers high resistance

(d) none of the above

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. Table 1 shows the measured voltage for magnetic core balance test where LT 440V AC is injected in across HT terminals RY, YB and BR as shown. What is the condition required for the transformer core to be magnetically balance? From the measured voltages are the required conditioned fulfilled?

Apply Single phase voltage 440V Across	Measured Voltage						Condition required
	HV Volts (Ph-Ph)			LV Volts (Ph-n)			
	RY	YB	BR	rn	yn	bn	
RY	418	294	124	80	58	22	
YB	201	412	202	38	79	40	
BR	128	281	409	13	67	81	

2. Insulation resistance of 10MVA, 33/11kV transformer is measured between HV and LV side and the result obtained is shown below:

   1. 0.57 GᴡV after 10 minutes
   2. 0.41 GᴡV after 1 minutes
   3. 0.32 GᴡV 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 of *S1* i.e the distance between earth electrode and potential electrode and what will be the corresponding distance of *S2* shown in figure. 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?
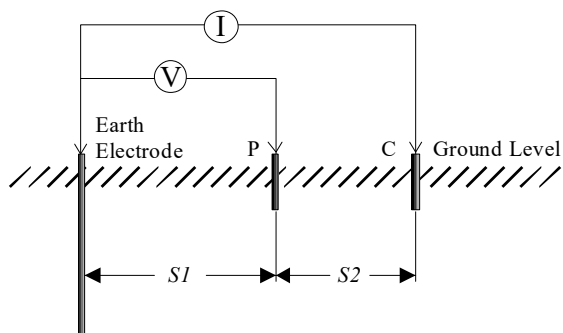

Figure : 3-Point method of Earth Resistance Measurement

4. What are the criteria for selection site for Power Sub-Station?

5. Figure shows a 100-50/1-1 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?
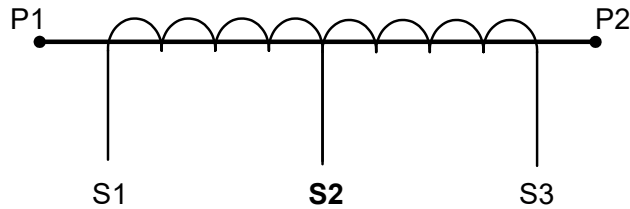
6. (a) Name three types of arc quenching medium normally used in 33kV Outdoor Type Circuit Breaker (CB)?

(b) What is the controlling voltage for 33kV Outdoor type Circuit Breaker closing and tripping circuit?

7. Figure shows the circuit diagram of 33kV outdoor type Circuit Breaker.
(a) What does 52T1 and 52T2 denotes and what are its function when it is energized?
(b) When 43L/R switch is kept at R position what does it mean and which switch does it by-pass?
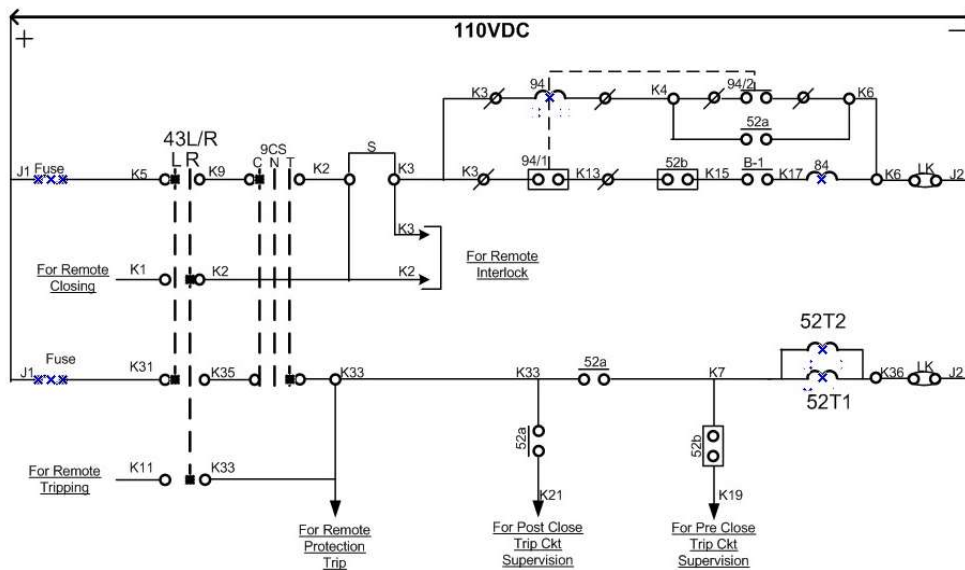
8. The external PT ratio is 33000/110V and external CT ratio is 200/1A. If the energy meter is calibrated for PT ratio 33000/110V, CT ratio -/1A then what will be the multiplying factor for the meter?

9. What are the models of numerical relays used for
(a) Overcurrent/Earth fault protection relay
(b) Transformer protection relay
(c) Distance protection relay

10. (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 2020?

(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?

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