

MIZORAM PUBLIC SERVICE COMMISSION

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

ENGINEERING PAPER – II

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

Time Allowed : 3 hours

FM : 100 PM : 40

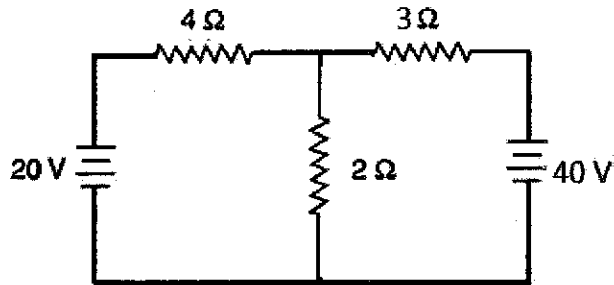
PART - A (50-MARKS)

*This Section should be answered only on the **OMR Response Sheet** provided.*

All questions carry equal marks of 2 each.

1. For the same resistance per unit length, cross-sectional area of aluminium conductor has to be _____ times that of copper conductor.
 - (a) 1.5
 - (b) 1.6
 - (c) 1.8
 - (d) 2.0
2. Which of the following statement is not among the law of resistance?
 - (a) resistance varies directly as the length of conductor
 - (b) resistance varies inversely as the cross sectional area of the conductor
 - (c) resistance depends on the temperature of the conductor
 - (d) resistance depends on the type of current flowing in the conductor
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 two resistors are connected in *series*-
 - (a) they both must have the same resistance value.
 - (b) the voltage across each must be the same.
 - (c) they must have same resistivity
 - (d) there is only one path for current through both resistors

5. To solve the circuit below by Kirchhoff's law how many equation is required?



- (a) one equation
(b) two equations
(c) three equations
(d) four equations

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

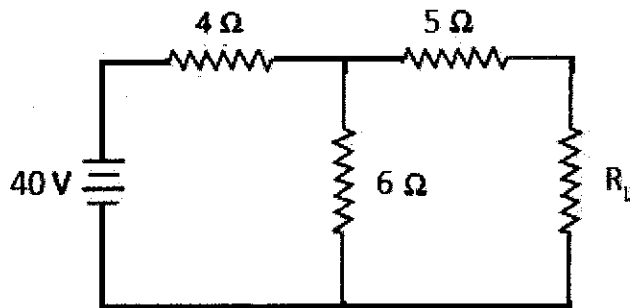


FIG. A

- (a) 15Ω
(b) 3.5Ω
(c) 6.4Ω
(d) 7.4Ω

7. In Fig. B (a), the resistance of $R_{31} = 2\Omega$, $R_{12} = 4\Omega$ and $R_{23} = 6\Omega$. What will be the resistance of R_3 in Fig. B(b)?

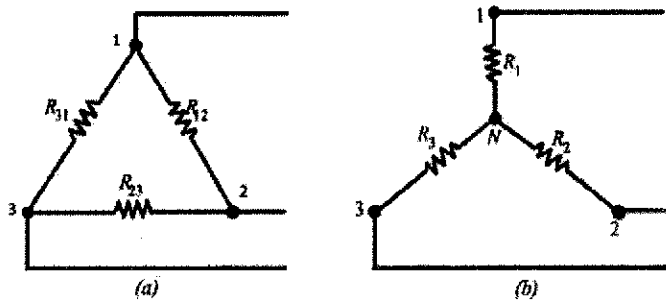


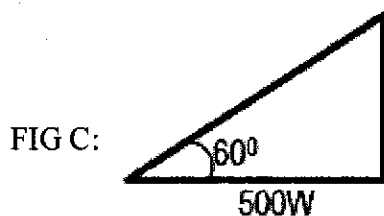
FIG. B

- (a) 0.33Ω
(b) 0.66Ω
(c) 0.77Ω
(d) 0.99Ω

8. A kilowatt hour is the unit of-

- (a) energy
(b) power
(c) electric charge
(d) electric current

9. A generator produces 100kW of power at a potential difference of 10kV. The power is transmitted through cables of total resistance 5Ω . What is the power loss in cables?
- (a) 1000 W (b) 500 W
(c) 250 W (d) 50 W
10. The value of capacitive reactance increases as the-
- (a) value of capacitance increases (b) frequency decreases
(c) voltage increases (d) current increases
11. The capacitance of a capacitor is _____ relative permittivity.
- (a) directly proportional to (b) inversely proportional to
(c) independent of (d) directly proportional to square of
12. Two capacitors of capacitances C_1 and C_2 are connected in parallel. A charge Q given to them is shared. The ratio of charges Q_1/Q_2 is-
- (a) C_2 / C_1 (b) C_1 / C_2
(c) $C_1 C_2 / 1$ (d) $1 / C_1 C_2$
13. Which of the following circuit element stores energy in the electromagnetic field?
- (a) resistance (b) variable resistor
(c) condenser (d) inductance
14. The time period of a direct current is-
- (a) infinite (b) zero
(c) finite (d) random
15. If $e_1 = A \sin \omega t$ and $e_2 = B \sin (\omega t - \Phi)$, then-
- (a) e_1 lags e_2 by Φ (b) e_2 lags e_1 by Φ
(c) e_2 is in phase with e_1 (d) e_1 is in phase with e_2
16. Domestic appliances in household internal wiring are connected in parallel across a.c mains because-
- (a) it is a simple arrangement
(b) operation of each appliance becomes independent of the other
(c) appliances have same current ratings
(d) this arrangement occupies less space
17. In the power triangle shown in FIG C, 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 over delta connected 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. The magnitude of e.m.f generated by an alternator depends on-
- (a) number of poles
 - (b) rotor speed
 - (c) flux per pole
 - (d) all of the above
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) increasing conductor spacing
23. Total minimum number of discs in a string of 120kN porcelain insulators for 132kV AC overhead transmission line is-
- (a) 3
 - (b) 6
 - (c) 8
 - (d) 10
24. A full-wave rectifier is _____ as effective as a half-wave rectifier.
- (a) twice
 - (b) thrice
 - (c) two and half times
 - (d) four times
25. In a Thyristor the magnitude of anode current will-
- (a) increase if gate current is increased
 - (b) not change with variation of gate current
 - (c) decrease if gate current is decreased
 - (d) increase if gate current is decreased

PART - B (50-MARKS)

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

Marks for each question is indicated against it.

Attempt all questions.

26. 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. Considering HV side only, what are the condition required for the transformer core to be magnetically balance? From the measured voltages are the required conditioned fulfilled? (5)

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	424	469	190	79	90	37	
YB	155	420	259	29	79	49	
BR	168	356	423	32	68	79	

27. Insulation resistance of 10MVA, 33/11kV transformer is measured between HV and LV side and the result obtained is shown below: (5)
1. $0.57 \text{ G}'\Omega$ after 10 minutes
 2. $0.41 \text{ G}'\Omega$ after 1 minutes
 3. $0.32 \text{ G}'\Omega$ after 30 seconds

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

28. Draw schematic diagram of Wenner Array 4-point method for Earth Resistance measurement. What is the formula for calculating earth resistivity, ρ . What is the prescribed uniform distance between each probe compared to the depth of probe under ground? (5)
29. What are the criteria for selection site for Power Sub-Station? (5)
30. FIG. E shows a 100-50/1-1 Current Transformer (CT) circuit drawing where P1 & P2 denotes the primary winding terminals and S1, S2 & S3 denotes the secondary winding terminals. If the CT ratio is to be set at 100/1 ratio, which secondary terminals must be connected? For 33kV CT, what is the accuracy class acceptable for metering core? (5)

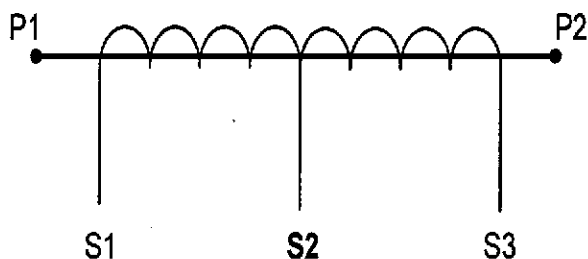
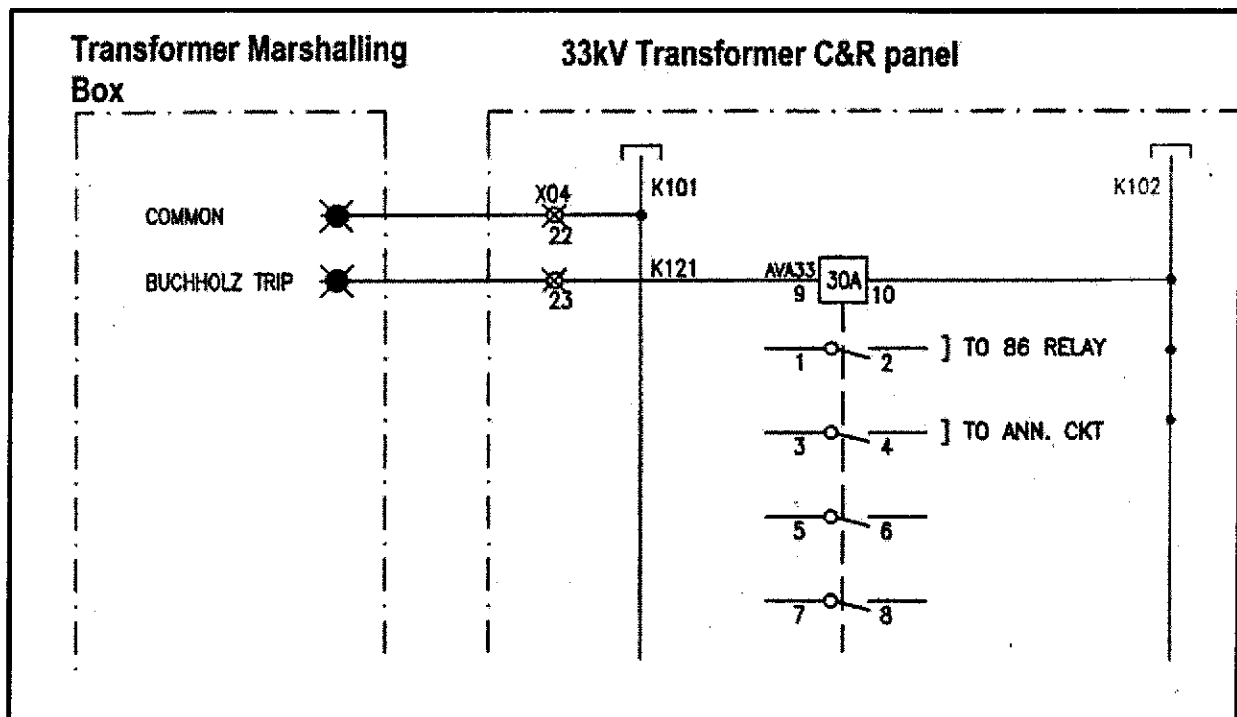


FIG. E

31. Figure below shows the nameplate of 100kVA, 11/0.415kV Distribution transformer. What is the normal tap position? What is the full form of ONAN? From the vector group how is the primary and secondary winding connected and what is the phase shift between the two? (5)

Rated power 100 kV·A		No. of phases 3	
TRANSFORMER to specification EN (IEC) 60076-1			
Rated voltage [V]		Current [A]	Insulation level
HV	11000 ± 2x2.5%	5.25	LI75 AC28
LV	415	139.10	AC3
Tap no.	HV voltage [V]	Connection symbol	Dyn11
1	11550	Cooling	ONAN
2	11275	Rated frequency	50 Hz
3	11000	Short-circuit imp.	3.88 %
4	10725	Load losses	1750 W
5	10450	No-load losses	145 W

32. Figure shows interconnection between Power Transformer Marshalling Box and 33kV Transformer Control & Relay for Buchholz protection. What is 86 relay stands for and what is its function? In the figure shown, what can cause 86 relay to operate? (5)



33. The external PT ratio is 33000/110V and external CT ratio is 400/1A. If the energy meter is calibrated for PT ratio 33000/110V, CT ratio -/1A then what will be the multiplying factor for the meter? (5)
34. Draw single line diagram 33kV Incoming line connecting 33kV Bus at Substation showing the following elements: (10)
- (a) Surge Arrestor
 - (b) Isolator with Earth Switch
 - (c) Current Transformer
 - (d) Circuit Breaker
