

MIZORAM PUBLIC SERVICE COMMISSION
DEPARTMENTAL EXAMINATION FOR JUNIOR GRADE OF M.E.S. (AE/SDO)
UNDER POWER & ELECTRICITY DEPARTMENT, GOVERNMENT OF MIZORAM.
(DECEMBER-2025)

ENGINEERING PAPER – II

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

Time Allowed : 3 hours

FM : 100 PM : 40

SECTION - A (50-MARKS)

*This Section should be answered only on the **OMR Response Sheet** provided.
All questions carry equal marks of 1 each. Attempt all questions.*

1. If a conductor has a resistance of 15Ω and a current of 3A is flowing through it, what is the potential difference across it?
(a) 5V (b) 45V
(c) 0.2V (d) 18V
2. What happens to the resistance of a metallic conductor if its length is doubled while keeping the cross-sectional area constant?
(a) It remains the same. (b) It doubles.
(c) It is halved. (d) It quadruples.
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. In a series connection of resistors, what happens to the current across each resistor?
(a) Increases (b) Decreases
(c) Remains the same (d) Initially increases and then decreases
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. In Fig.B (a), the resistance of $R_{31} = 1\Omega$, $R_{12} = 1\Omega$ and $R_{23} = 2\Omega$. What will be the resistance of R_3 of Fig.B (b)?

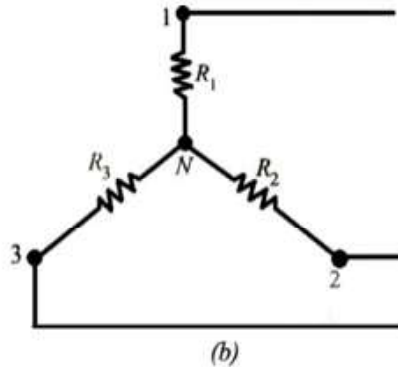
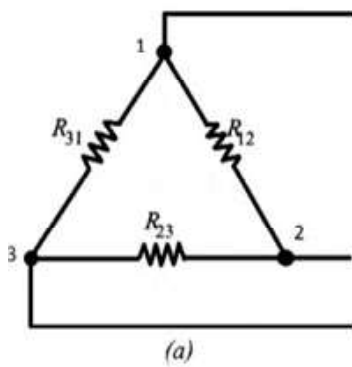


FIG. B

- (a) 0.25Ω (b) 0.5Ω
(c) 0.75Ω (d) 1Ω
7. The algebraic sum of voltages (potential differences) around any closed path in a network is equal to:
- (a) Infinity (b) 1
(c) 0 (d) Negative polarity
8. What is the SI unit of electric power?
- (a) Joule (b) Watt
(c) Volt (d) Ampere
9. Which physical quantity is measured in kilowatt-hours (kWh)?
- (a) Current (b) Voltage
(c) Energy (d) Power
10. What is the formula for electric power (P) in a circuit, given current (I) and voltage (V)?
- (a) $P = V/I$ (b) $P = I/V$
(c) $P = V \times I$ (d) $P = V/R$
11. A motor provides 3 horsepower (hp) of power. What is this power in watts (W)?
- (a) 746 W (b) 1492 W
(c) 2238 W (d) 3000 W
12. The unit of capacitance is:
- (a) Farad (b) Farad/m
(c) Farad/m² (d) Farad/m³
13. When capacitors are connected in parallel, the total capacitance is:
- (a) Less than the smallest individual capacitance
(b) The reciprocal of the sum of the individual capacitances
(c) The sum of the individual capacitances
(d) The product of the individual capacitances
14. What is the primary function of an inductor in an AC circuit?
- (a) To store energy in a magnetic field
(b) To oppose a change in circuit current
(c) Both (a) and (b)
(d) To convert electrical energy to mechanical energy

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. 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)
17. The relationship between frequency (f) and time period (T) of an AC waveform is:
- (a) $T = f$
 - (b) $T = 1/f$
 - (c) $T = 2\pi f$
 - (d) $f = T/2$
18. The maximum value of an alternating voltage or current in a cycle is known as its
- (a) RMS value
 - (b) Peak-to-peak value
 - (c) Amplitude
 - (d) Average value
19. Which power is the actual power that performs useful work in a circuit?
- (a) Reactive Power
 - (b) Active Power
 - (c) Apparent Power
 - (d) Absolute Power
20. In a power triangle, what is the relationship between active power (P), reactive power (Q), and apparent power (S)?
- (a) $P + Q = S$
 - (b) $P^2 + Q^2 = S^2$
 - (c) $P = Q + S$
 - (d) $S^2 + Q^2 = P$
21. In a balanced delta-connected system, the line voltage (V_L) is
- (a) $V_L = 0.707 \times V_{ph}$
 - (b) $V_L = 1.732 \times V_{ph}$
 - (c) $V_L = 1.414 \times V_{ph}$
 - (d) $V_L = V_{ph}$
22. Alternators and AC generators work on the principle of:
- (a) Fleming's left-hand rule
 - (b) Lenz's Law
 - (c) Faraday's law of electromagnetic induction
 - (d) Ohm's Law
23. Which of the following is a method to reduce skin effect losses in a transmission line?
- (a) Using solid conductors
 - (b) Increasing the frequency
 - (c) Using stranded conductors
 - (d) Increasing conductor resistance
24. A freewheeling diode in a phase-controlled rectifier is used to:
- (a) Improve the power factor
 - (b) Provide a path for inductive load current
 - (c) Reduce the reverse breakdown voltage requirement
 - (d) Increase the output voltage
25. Which of the following power semiconductor devices has the highest switching speed?
- (a) BJT
 - (b) IGBT
 - (c) Power MOSFET
 - (d) SCR

26. What is the primary purpose of laminating a transformer core?
- (a) To increase flux density
 - (b) To reduce eddy current losses.
 - (c) To improve insulation
 - (d) To increase mechanical strength
27. Which component absorbs moisture from the air during a transformer's "breathing"?
- (a) Conservator
 - (b) Radiator
 - (c) Breather (Silica Gel)
 - (d) Buchholz Relay
28. When is the efficiency of a transformer maximum?
- (a) At no load
 - (b) When copper loss equals iron loss
 - (c) At half load
 - (d) When voltage is maximum
29. Why are off-load tap changers operated only when the transformer is de-energized?
- (a) To prevent sparking
 - (b) To avoid damaging the mechanism
 - (c) To ensure safety and proper contact engagement
 - (d) They don't require power
30. Where should lightning arresters be installed for optimal transformer protection?
- (a) Inside the transformer tank
 - (b) At the termination point of overhead lines leading to the transformer
 - (c) On the ground below the transformer
 - (d) Only on the low-voltage side
31. What is the benefit of proper grounding for lightning protection?
- (a) It attracts more lightning strikes.
 - (b) It stores the lightning energy.
 - (c) It provides a low-resistance path for surge current to dissipate into the earth safely.
 - (d) It creates a magnetic field to deflect strikes
32. What is the primary protection for Power transformers against internal faults?
- (a) Fuse Protection
 - (b) Overcurrent Relay
 - (c) Differential Protection (Main) & Gas (Buchholz) Protection
 - (d) Thermal Relay
33. Which relay protects the transformer from external short circuits and overloads?
- (a) Differential Relay
 - (b) Buchholz Relay
 - (c) Overcurrent Relay
 - (d) Thermal Relay
34. Restricted Earth Fault (REF) protection covers faults in:
- (a) The entire winding
 - (b) Part of the winding between neutral and tapping point
 - (c) Only the HV side
 - (d) Only the LV side
35. What is magnetizing inrush current?
- (a) Current during heavy load
 - (b) Current during fault
 - (c) A transient rush of current (6 to 8 times rated current) when first energized
 - (d) Current during unloading

36. How does earthing contribute to system stability?

- (a) By introducing resistance in the neutral
- (b) By providing a stable reference point (zero potential) for the system
- (c) By increasing system impedance
- (d) By creating an isolated neutral

37. In case of an insulation failure, earthing provides:

- (a) A high-resistance path
- (b) The easiest path for short-circuit current to flow to the ground
- (c) A path to the live wire
- (d) An open circuit

38. What is the primary purpose of the Insulation Resistance (Megger) test of a Transformer?

- (a) To measure copper losses
- (b) To check winding insulation health
- (c) To determine core losses
- (d) To verify turns ratio

39. What is the primary instrument used specifically for measuring earth resistance?

- (a) Ammeter
- (b) Voltmeter
- (c) Earth Tester (or Ground Resistance Tester)
- (d) Frequency Meter

40. The primary consideration for a transmission substation site is:

- (a) Proximity to residential areas
- (b) High population density
- (c) Proximity to load centers & transmission line corridors
- (d) Close to airports

41. A major constraint for substation location is proximity to:

- (a) River crossings
- (b) Industrial zones
- (c) Airports & defense establishments
- (d) Agricultural lands

42. What is a common maintenance task for Power Transformers in outdoor substations?

- (a) Changing the tank paint every year.
- (b) Checking oil level, colour, and moisture content, plus oil testing.
- (c) Removing all bushings for cleaning.
- (d) Reducing the load to below 50%.

43. What is the main goal of preventive maintenance in an outdoor substation?

- (a) To fix faults immediately after they occur.
- (b) To identify and rectify potential issues *before* they cause failure, ensuring reliability.
- (c) To repaint everything every few years.
- (d) To replace all equipment every decade

44. What is the primary purpose of switchgear in an electrical power system?
- (a) To generate electricity
 - (b) To step up or step down voltage levels
 - (c) To protect, control, and isolate electrical equipment
 - (d) To measure power consumption
45. The function of a protective relay is to:
- (a) Detect the fault and initiate the operation of the circuit breaker
 - (b) Absorb the fault current
 - (c) Step down the voltage for metering
 - (d) Provide an alarm only during a fault
46. An instantaneous over-current relay operates:
- (a) With a time delay that is inversely proportional to the current
 - (b) Immediately when the current exceeds a predetermined value
 - (c) After a fixed, definite time delay
 - (d) Only for earth faults
47. Which protection scheme is generally recommended for Power transformers with a rating above 5MVA?
- (a) Over-current protection
 - (b) Differential protection
 - (c) Restricted Earth Fault protection
 - (d) Buchholz relay
48. The common type of storage battery generally used in electric power stations is the:
- (a) Nickel-cadmium battery
 - (b) Zinc-carbon battery
 - (c) Lead-acid battery
 - (d) Lithium-ion battery
49. Which of the following activities is typically part of routine (preventive/scheduled) maintenance of HT/LT ABC lines?
- (a) Replacement of worn-out parts
 - (b) Troubleshooting during a breakdown
 - (c) Regular inspection for physical damage, wear or sagging of the cable
 - (d) Re-varnishing of the cable
50. If a section of LT ABC is experiencing frequent faults due to illegal tapping (hooking), which inherent feature of ABC helps mitigate this issue?
- (a) The use of a messenger wire
 - (b) The insulated nature of all conductors
 - (c) Its high mechanical strength
 - (d) Its ability to be run concurrently with communication lines

SECTION- B (25-MARKS)

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

Marks for each question is indicated against it.

Attempt all questions.

1. At a junction (node) in an electrical circuit, if a current of 5 A is flowing into the junction and currents of 2 A and 1.5 A are flowing out, what is the magnitude and direction (in or out) of the fourth current (I) at that junction? (5)
2. Define self-inductance and what is its SI unit? Define mutual inductance and its SI unit? (5)
3. What is Reactive Power (Q)? What is Apparent Power (S)? (5)
4. What is the general formula that relates frequency (f), number of poles (P), and rotor speed (N)? An alternator is required to generate power at 60 Hz. If it has 6 poles, at what speed must the rotor rotate? (5)
5. What is the Ferranti effect? What is the main cause of the Ferranti effect? In which type of transmission lines is this effect most prominent? (5)

SECTION - C (25-MARKS)

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

Marks for each question is indicated against it.

Attempt all questions.

6. Why are transformer ratings given in kVA, not kW? (2)
7. What is the primary purpose of earthing in a transformer system? What happens if a transformer system is not properly earthed (an isolated neutral system)? (4)
8. Mention desirable earth resistance values for Power Transformers/Sub-Stations and Distribution Transformers/ Structures. (3)
9. How do you measure the insulation resistance (IR) and Polarization Index (PI) of a transformer? (3)
10. Mention the main applications of Current Transformers (CT). Why must the secondary winding of a CT never be open-circuited while the primary is energized? (4)
11. If external Current transformer ratio (CTR) or Connected CT ratio is 200/5, external Potential transformer ratio (PTR) or Connected PT ratio is 11000/110 Volts, Energy Meter CT Ratio is 100/5 and Energy Meter PT Ratio is 11000/110 Volts, What is Multiplying Factor of that Energy Meter? (2)
12. What are the primary advantages of using Aerial Bunched Cable (ABC) over bare overhead lines? What common faults occur in ABC systems and how are they detected? (5)
13. What are the common problems associated with EHV/HV transmission lines that require maintenance? (2)