

MIZORAM PUBLIC SERVICE COMMISSION

TECHNICAL COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO JUNIOR GRADE OF MIZORAM ENGINEERING SERVICE UNDER POWER & ELECTRICITY DEPARTMENT, NOVEMBER, 2015

ELECTRICAL ENGINEERING PAPER - I

Time Allowed : 3 hours

Full Marks : 200

Attempt all questions.

Part A - Objective Type Questions (100 Marks)

All questions carry equal marks of 2 each.

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

1. The property of a material which opposes the production of magnetic flux in it is known as
 - (a) mmf
 - (b) reluctance
 - (c) permeance
 - (d) permittivity
2. An air gap is usually inserted in magnetic circuits to
 - (a) increase the flux
 - (b) prevent saturation
 - (c) increase the mmf
 - (d) none of these
3. With the increase in temperature, the insulating property of insulator
 - (a) weakens
 - (b) gains
 - (c) remains same
 - (d) none of these
4. The conductivity of a metal is determined by
 - (a) the number of valence electrons per atom
 - (b) the electron concentration and the mobility of the free electrons
 - (c) both (a) and (b)
 - (d) none of these
5. Hall's effect is used to measure
 - (a) electric field intensity
 - (b) magnetic field intensity
 - (c) carrier concentration
 - (d) none of these
6. Which of the following exhibits hysteresis?
 - (a) Ferromagnetic materials only
 - (b) Ferroelectric materials only
 - (c) Ferrielectric materials only
 - (d) Both ferromagnetic and ferroelectric materials
7. The materials in which valence electrons are bounded very tightly to their parent atoms are called
 - (a) ferrites
 - (b) super conductors
 - (c) insulators
 - (d) none of these

8. Power factor of a resonant circuit is
- (a) 1
 - (b) 0
 - (c) infinite
 - (d) depends on the values of the circuit parameters
9. The current in an RLC series circuit at resonance is
- (a) maximum
 - (b) minimum
 - (c) infinity
 - (d) zero
10. Frequency can be measured by using
- (a) Maxwell's bridge
 - (b) Schering bridge
 - (c) Heaviside Campbell bridge
 - (d) Wien's bridge
11. Line insulators are made of
- (a) porcelain
 - (b) mica
 - (c) marble
 - (d) pvc
12. Pure metals generally have
- (a) high conductivity and low temperature coefficient
 - (b) high conductivity and high temperature coefficient
 - (c) low conductivity and zero temperature coefficient
 - (d) low conductivity and high temperature coefficient
13. Thevenin's theorem cannot be applied to networks that contain elements which are
- (a) non-linear
 - (b) linear
 - (c) active
 - (d) passive
14. A circuit component that opposes the change in circuit voltage is
- (a) resistance
 - (b) capacitance
 - (c) inductance
 - (d) all of these
15. While measuring power of a 3-phase load by two-wattmeter method, the readings of the two wattmeters are equal and opposite when
- (a) power factor is unity
 - (b) load is balanced
 - (c) phase angle is between 30° and 60°
 - (d) the load is purely inductive
16. What causes electromagnetic wave polarisation?
- (a) Transverse nature of electromagnetic wave
 - (b) Longitudinal nature of electromagnetic wave
 - (c) Refraction
 - (d) Reflection
17. An electromagnetic field is radiated from
- (a) A stationary point charge
 - (b) A capacitor with dc voltage
 - (c) A conductor carrying a dc current
 - (d) An oscillating dipole
18. Forbidden band is largest in
- (a) insulator
 - (b) semiconductor
 - (c) conductor
 - (d) metal alloy

19. Which of the following is the poorest electrical conductor?
(a) steel (b) carbon
(c) copper (d) aluminium
20. Which of the following is correct? As frequency increases, the surface resistance of a metal
(a) Decreases (b) Increases
(c) Remains unchanged (d) Varies in an unpredictable manner
21. Superconducting metal in superconducting state has relative permeability of
(a) More than one (b) One
(c) Zero (d) Negative
22. When the temperature of a magnetic material is raised above the Curie point, it becomes
(a) Diamagnetic (b) Paramagnetic
(c) Ferromagnetic (d) Ferrimagnetic
23. Which of the following materials can be used for permanent magnets?
(a) Alnico (b) Barium ferrite
(c) Carbon steel (d) Iron – cobalt alloy
24. Two incandescent light bulbs of 40 W and 60 W rating are connected in series across the mains. Then
(a) The bulbs together consume 100 W. (b) The bulbs together consume 50 W.
(c) The 60 W bulb glows brighter. (d) The 40 W bulb glows brighter.
25. A 3-phase 3-wire supply feeds a star connected load consisting of 3 equal resistors. If one of the resistors is to be removed, then what is the reduction in power as compared to the original power?
(a) 25% of the original power (b) 33.3% of the original power
(c) 50% of the original power (d) 66.66% of the original power
26. The difference between the indicated value and the true value of a quantity is
(a) gross error (b) absolute error
(c) dynamic error (d) relative error
27. The errors introduced by an instrument fall in which category?
(a) Systematic errors (b) Random errors
(c) Gross errors (d) Environmental errors
28. If R , L and C are parameters of a resistor, what is the condition for the resistor to be non-inductive?
(a) $L = CR$ (b) $L = CR^2$
(c) $C = LR^2$ (d) $C = R/L$
29. A moving coil galvanometer is made into a dc ammeter by connecting
(a) a low resistance across the meter (b) a high resistance in series with meter
(c) a pure inductance across the meter (d) a capacitor in series with the meter
30. Which one of the following bridges is used for measurement of dielectric loss and power factor of a capacitor?
(a) Maxwell's bridge (b) Anderson bridge
(c) De Sauty's bridge (d) Schering bridge
31. Which of the following is the most sensitive device?
(a) Thermocouple (b) RTD
(c) Thermistor (d) Pyrometer

32. Which of the following are data representation elements in a generalised measurement system?
(a) Analog indicator (b) Amplifier
(c) A/D converter (d) Digital display
33. A digital voltmeter measures
(a) Peak value (b) Peak to peak value
(c) Rms value (d) Average value
34. Unit of electric intensity is
(a) joules/coulomb (b) newton/coulomb
(c) volt/meter (d) both (b) and (c)
35. A material that does not allow current under normal conditions is a(n)
(a) insulator (b) conductor
(c) semiconductor (d) valence
36. When ferromagnetic substance is magnetised, there are small change in dimensions. The phenomenon is called
(a) hysteresis (b) magnetostiction
(c) diamagnetism (d) dipolar relaxation
37. ALNICO is an alloy of?
(a) iron, aluminum (b) aluminum, nickel
(c) iron, cobalt, nickel (d) aluminum, nickel, iron and cobalt
38. Fermi level in a p type semiconductor lies close to which one of the following?
(a) The top of the valence band (b) The bottom of the valence band
(c) The top of the conduction band (d) The bottom of the conduction band
39. Four amperes of current are measured through a $24\ \Omega$ resistor connected across a voltage source. How much voltage does the source produce?
(a) 960 V (b) 9.6 V
(c) 96 V (d) 8 V
40. R.M.S. value & mean value both are the same in case of
(a) Square wave (b) Triangular wave
(c) Sine wave (d) Rectangular wave
41. Which of the following instruments is commonly used to measure primary current of a transformer connected to mains?
(a) Electrostatic meter (b) Current transformer
(c) Moving coil type meter (d) Moving iron meter
42. Kelvin double bridge is chosen to measure low resistance because
(a) it has high sensitivity
(b) thermoelectric emf's can be taken
(c) resistance variation due to temperature can be accounted for
(d) resistance variation due of contacts and leads can be eliminated
43. Data acquisition systems are usually of
(a) analog type (b) digital type
(c) integrating type (d) hybrid type

44. Schering bridge can be used to measure which one of the following?
(a) Q of a coil (b) Inductance and its Q-value
(c) Very small resistance (d) Capacitance and its power factor
45. The precision of a ramp type digital voltmeter depends on
(a) frequency of the generator and slope of the ramp
(b) frequency of the generator
(c) slope of the ramp
(d) switching time of the gate
46. How can the power supplied to a high frequency heating system be measured?
(a) By dynamometer wattmeter (b) By induction wattmeter
(c) By thermocouple type wattmeter (d) By moving iron ammeter and voltmeter
47. Dissipation factor, $\tan \delta$, of a capacitor is measured by which bridge?
(a) Anderson bridge (b) Hay bridge
(c) Schering bridge (d) Wien bridge
48. Which of the following is a frequency sensitive bridge?
(a) De-sauty bridge (b) Schering bridge
(c) Wien's bridge (d) Maxwell's bridge
49. If the bandwidth of an oscilloscope is given as direct current to 10 MHz, what is the fastest rise time a sine wave can have to be produced accurately by the oscilloscope?
(a) 35 ns (b) 10 ns
(c) 3.5 ns (d) 0.035 ns
50. Which of the following defects is responsible for creeping in an induction type energy meter?
(a) Imperfect lag compensation (b) Over friction compensation
(c) Imperfect overload compensation (d) Misalignment of brake magnet

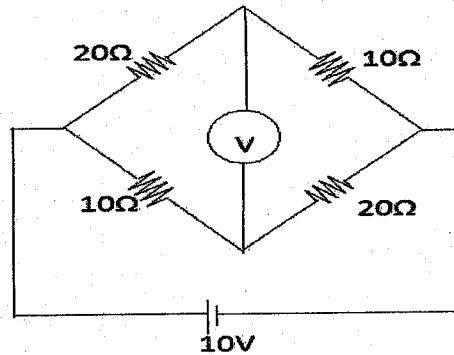
Part B - Short Answer Questions (100 Marks)

All questions carry equal marks of 5 each.

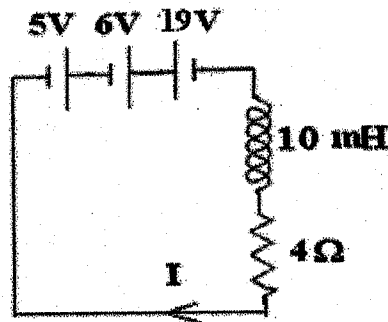
This Part should be answered only on the Answer Booklet provided.

1. State and prove Ampere's circuital law.
2. What is meant by superconductivity? How is it affected by the application of a magnetic field?
3. What are ferromagnetic and ferrimagnetic materials? State the properties of each.
4. A 3-phase 3-wire supply feeds a load consisting of three equal resistors connected in star. If one of the resistors is open circuited, find the percentage reduction in load.
5. What are the various sources of error in moving iron instruments? Explain.
6. A single-phase energy meter has a meter constant of 1200 rev/Kwh. When a load of 200 watts is connected, the disc rotates at 4.2 RPM, if the load is on for 10 hours, how many units are recorded as error? Also find the percentage error.
7. Explain how a thermo-couple is used for temperature measurement.

8. State and explain the boundary conditions for electrical fields at an interface between two dielectrics.
9. With the help of band theory distinguish conductor, semi-conductor and insulator.
10. Explain what Hall Effect is. Give some of its practical applications.
11. What do you understand by balanced and unbalanced three phase circuits? Explain.
12. What is superposition theorem? How is it applied in circuits for analysis?
13. What is the importance of damping system in indicating instruments?
14. Distinguish between active and passive transducer.
15. Determine the reading of voltmeter V in the bridge circuit shown in the following figure, assume the impedance of the voltmeter is high.



16. Three batteries are connected in series to a resistance and inductor as shown in the following figure. Determine the steady state current in the circuit.



17. Derive condition for maximum power transfer in an AC circuit.
18. Define and explain Ampere's circuital law.
19. What do you understand by Hall Effect and provide name of a few devices where this effect is used.
20. Use mesh analysis to determine the total current drawn from the source and also the current through the 15Ω resistor in the following circuit.

