

MIZORAM PUBLIC SERVICE COMMISSION
TECHNICAL COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO
JUNIOR GRADE OF MIZORAM ENGINEERING SERVICE
UNDER PUBLIC HEALTH ENGINEERING DEPARTMENT, 2014

ELECTRICAL ENGINEERING
PAPER - I

Time Allowed : 3 hours

Full Marks : 200

Attempt all questions.

Part A - Objective Type Questions (100 Marks)

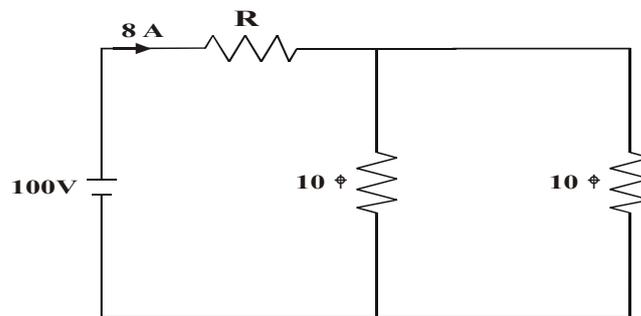
All questions carry equal marks of 2 each.

1. The charge on an isolated conductor resides
 - (a) At the conductor surface
 - (b) Inside the conductor
 - (c) Partly at the surface and partly inside the conductor
 - (d) None of these
2. Dielectric strength of a material depends on
 - (a) Temperature
 - (b) Thickness
 - (b) Moisture content
 - (d) All of these
3. Electromagnetic waves may be diffracted
 - (a) By reflection from the ground
 - (b) When encountered with a spherical wave front
 - (c) Around the edge of a sharp obstacle
 - (d) While passing through a large slot
4. Forbidden band is largest in
 - (a) conductor
 - (b) semiconductor
 - (c) insulator
 - (d) reactor
5. Superconductivity in a material occurs at
 - (a) very high temperature
 - (b) near absolute zero
 - (c) very low temperature
 - (d) none of these
6. All magnetic materials lose their magnetic properties when
 - (a) cooled to low temperature
 - (b) heated to high temperature
 - (c) kept in an aluminum box
 - (d) kept in vacuum
7. Hall's effect is used to measure
 - (a) electric field intensity
 - (b) magnetic field intensity
 - (c) carrier concentration
 - (d) none of these

8. An insulating material starts conducting when the
 - (a) temperature is raised to a very high level
 - (b) voltage applied exceeds the breakdown voltage
 - (c) either (a) or (b)
 - (d) none of these
9. The insulating materials meant for most of electronic equipment should possess high
 - (a) dielectric strength
 - (b) mechanical strength
 - (c) thermal stability
 - (d) all of these
10. Kirchhoff's laws are applicable to
 - (a) D.C. only
 - (b) A.C. only
 - (c) both A.C. and D.C.
 - (d) none of these
11. The parallel circuit resonance magnifies
 - (a) Current
 - (b) Voltage
 - (c) Both current and voltage
 - (d) Power
12. A 3-phase, star-connected symmetrical load consumes P watts of power from a balanced supply. If the same load is connected in delta to the same supply, the power consumption will be
 - (a) P watts
 - (b) $\sqrt{3}$ P watts
 - (c) 3 P watts
 - (d) P/3 watts
13. A sinusoidal current has an rms value of 14 mA. The peak-to-peak value is
 - (a) 45.12 mA
 - (b) 16 mA
 - (c) 39.6 mA
 - (d) 22.6 mA
14. A milliammeter can be used as a voltmeter by connecting
 - (a) a low resistance in parallel with the instrument
 - (b) a high resistance in parallel with the instrument
 - (c) a low resistance in series with the instrument
 - (d) a high resistance in series with the instrument
15. Megger is an instrument used to measure
 - (a) very low resistance
 - (b) insulation resistance
 - (c) Q-factor of a coil
 - (d) inductance of a coil
16. The damping force acts on the moving system of an indicating instrument only when it is
 - (a) moving
 - (b) stationary
 - (c) near its full deflection
 - (d) just starting to move
17. A single-phase energy meter is operating on 230 V, 50 Hz, supply with a load of 20 A for two hours at unity power factor. The meter makes 1380 revolutions in that period. The meter constant is
 - (a) 695 rev/KWh
 - (b) 150 rev/ kWh
 - (c) 0.15 rev/KWh
 - (d) 1/150 rev/ kWh
18. Which of the following bridges is used to measure frequency?
 - (a) Anderson bridge
 - (b) Wein bridge
 - (c) De Sauty's bridge
 - (d) none of these

19. Capacitive transducers can be used for measurement of liquid level. The principle of operation used in this case is
- (a) change of capacitance with change of distance between plates
 - (b) change of area plates
 - (c) change of dielectric strength
 - (d) none of these
20. What is the value of total electric flux coming out of a closed surface?
- (a) Zero
 - (b) Equal to volume charge density
 - (c) Equal to the total charge enclosed by the surface
 - (d) Equal to the surface charge density.
21. Two coupled coils with $L_1 = L_2 = 0.6$ H have a coupling coefficient of $K = 0.8$. The turn ratio $\frac{N_1}{N_2}$ is
- (a) 4
 - (b) 2
 - (c) 1
 - (d) Data insufficient
22. What causes electromagnetic wave polarization?
- (a) Transverse nature of electromagnetic wave
 - (b) Longitudinal nature of electromagnetic wave
 - (c) Refraction
 - (d) Reflection
23. 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
24. Width of energy bands depends on which of the following?
- (a) Temperature
 - (b) Pressure
 - (c) Relative freedom of electrons in the crystal
 - (d) Mass of atom in the material
25. For which one of the following materials is the Hall coefficient zero?
- (a) Metal
 - (b) Insulator
 - (c) Intrinsic semiconductor
 - (d) Alloy
26. Principle of Hall Effect is used in the construction of which one of the following?
- (a) Ammeter
 - (b) Voltmeter
 - (c) Galvanometer
 - (d) Gauss meter
27. As frequency increases, the surface resistance of a metal
- (a) Decreases
 - (b) Increases
 - (c) Remains unchanged
 - (d) Varies in an unpredictable manner
28. With increase in temperature, magnetic susceptibility of a ferromagnetic material will
- (a) Increase
 - (b) Decrease
 - (c) Increase initially and then decrease
 - (d) Remain constant
29. When the temperature of a magnetic material is raised above the Curie point, it becomes
- (a) Diamagnetic
 - (b) Paramagnetic
 - (c) Ferromagnetic
 - (d) Ferrimagnetic

30. Which one of the following materials can be used for permanent magnets?
(a) Alnico (b) Barium ferrite
(c) Carbon steel (d) Iron – cobalt alloy
31. The hysteresis loop for the material of the core of a transformer should be
(a) Short and narrow (b) Tall and narrow
(c) Short and wide (d) Tall and wide
32. Four resistances $80\ \Omega$, $50\ \Omega$, $25\ \Omega$ and R are connected in parallel. Current through $25\ \Omega$ resistance is 4 A. Total current of the supply is 10 A. The value of R will be
(a) $66.66\ \Omega$ (b) $40.25\ \Omega$
(c) $36.36\ \Omega$ (d) $76.56\ \Omega$
33. In the figure given below the value of R is



- (a) $2.5\ \Omega$ (b) $5.0\ \Omega$
(c) $7.5\ \Omega$ (d) $10.0\ \Omega$
34. 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
35. A series RLC circuit will have unity power factor if operated at a frequency of
(a) $\frac{1}{LC}$ (b) $1/\omega\sqrt{LC}$
(c) $\frac{1}{\omega^2 LC}$ (d) $1/2\pi\sqrt{LC}$
36. 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
37. The errors introduced by an instrument fall in which category?
(a) Systematic errors (b) Random errors
(c) Gross Errors (d) Environmental errors
38. 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

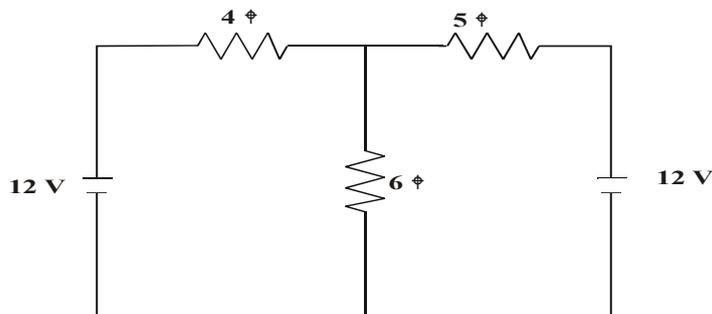
39. Which one of the following is the most sensitive device?
(a) Thermocouple (b) RTD
(c) Thermistor (d) Pyrometer
40. Series connection of current sources is not allowed because it violates
(a) Principle of energy conservation (b) Ohm's law
(c) KCL (d) KVL
41. If R , X_L and X_C be the resistance, inductive reactance and capacitive reactance of a series resonant circuit then current is
(a) Minimum and in phase with voltage given by $I=V/R$
(b) Maximum and in phase with voltage given by $I=V/R$
(c) Minimum and lagging in phase with voltage given by $I=V/X_L$
(d) Maximum and leading in phase with voltage given by $I=V/X_C$
42. In a star connected balanced 3 phase system the phase difference between the line and phase voltage is
(a) 90° (b) 30°
(c) 60° (d) 120°
43. The Q factor of an RLC circuit is defined as the ratio of
(a) Upper half power frequency to the bandwidth
(b) Lower half power frequency to the bandwidth
(c) Resonant frequency to the bandwidth
(d) Bandwidth to the resonant frequency
44. Semiconductors are sensitive to
(a) Heat (b) Magnetic field
(c) Light energy (d) All of these
45. Which one of the following is an active transducer?
(a) Strain gauge (b) Selsyn
(c) Photovoltaic cell (d) Photo emissive cell
46. Ampere's Circuital Law is analogous to _____ Law in electrostatics.
(a) Lenz's (b) Gauss's
(c) Biot-Savart's (d) Faraday's
47. Two light bulbs P and Q are identical in all respects, except that P's filament is thicker than Q's. If the same potential difference is applied to each, then
(a) P will burn brighter because it has the greater resistance
(b) Q will burn brighter because it has the greater resistance
(c) P will burn brighter because it has the lower resistance
(d) Q will burn brighter because it has the lower resistance
48. The adjustment of position of shading bands, in an energy meter is done to provide
(a) friction compensation (b) creep compensation
(c) braking torque (d) none of these
49. For measurement of mutual inductance we can use
(a) Anderson bridge (b) Maxwell's bridge
(c) Heaviside bridge (d) Any of these

50. The gravity controlled instrument has crowded scale because current is proportional to
- (a) balancing weight
 - (b) deflection angle
 - (c) sine of deflection angle
 - (d) None of these

Part B - Short Answer Questions (100 Marks)

All questions carry equal marks of 5 each.

51. Discuss the classification of magnetic materials.
52. A coil having a resistance of 5 ohms and inductance of 0.1 H is connected in series with a condenser of capacitance 50 μ F. A constant alternating voltage of 200 volts is applied to the circuit. Find the voltage across the coil at resonance.
53. What are p-type and n-type semiconductors? Explain with the help of energy diagrams.
54. Use Thevenin's theorem to find the current through the 6 Ω resistor in the circuit shown below:



55. A coil of resistance 30 Ω and inductance 0.6 H is switched on to a 240 V supply. Calculate (i) the rate of change of current at the time of closing the switch when $t=0$, and (ii) at time 0.04 sec. Also find the steady state current.
56. Explain the various ways of producing damping torque produced in indicating instruments.
57. What is meant by superconductivity? How is it affected by the application of a magnetic field?
58. What are the various sources of error in moving iron instruments? Explain.
59. What are the advantages of (i) a 3-phase delta-connected system and (ii) a 3-phase star-connected system?
60. Write down the Maxwell's equations for magnetostatic field and explain its physical interpretation.
61. Explain what Hall Effect is. Give some of its practical applications.
62. Can you measure exactly the e.m.f. of a cell with a volt meter? Explain.
63. What is the importance of controlling torque in indicating instruments?
64. Why is an electrostatic instrument not used as an ammeter?
65. Explain how magnetic materials are classified on the basis of magnetic dipoles.
66. Define electric field intensity. Three identical point charges of 10 nC each are located at the vertices of an equilateral triangle of side 10 cm. Calculate the electric field intensity at the centre of the triangle.
67. State and prove maximum power transfer theorem.

68. Explain the physical meaning of resonance in an electrical circuit. Explain the terms bandwidth and Q factor of a series circuit.
69. Describe two wattmeter method for measuring power in a three phase circuit.
70. Define the terms: Precision, accuracy, resolution.
