MIZORAM PUBLIC SERVICE COMMISSION

COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO THE POST OF INSPECTOR OF FACTORIES UNDER LABOUR, EMPLOYMENT, SKILL DEVELOPMENT & ENTREPRENEURSHIP DEPARTMENT, GOVERNMENT OF MIZORAM, 2019

ELECTRICAL ENGINEERING
PAPER - I

Time Allowed : 2 hours   Full Marks : 200

All questions carry equal marks of 2 each.
Attempt all questions.

1. Magnetic moment is the -
   (a) pole strength
   (b) vector strength
   (c) scalar strength
   (d) universal constant

2. Presence of magnetic flux in a magnetic circuit is due to -
   (a) mmf
   (b) emf
   (c) low reluctance path
   (d) none of these

3. Susceptibility is positive for -
   (a) ferromagnetic substances
   (b) paramagnetic substances
   (c) non-magnetic substances
   (d) none of these

4. Which one of the following statements is correct? The wavelength of a wave propagation in a waveguide is-
   (a) smaller than the free space wavelength
   (b) greater than the free space wavelength
   (c) directly proportional to the group velocity
   (d) inversely proportional to the phase velocity

5. 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 total charge enclosed by the surface
   (d) equal to the surface charge density

6. The force experience by a current carrying conductor lying parallel to a magnetic filed is -
   (a) BIL
   (b) BIL$sinu$
   (c) HIL
   (d) Zero

7. An electromagnetic field is said to be conservative when -
   (a) $\nabla^2 E = \mu \in (\partial^2 E / \partial t^2)$
   (b) $\nabla^2 H = \mu \in (\partial^2 H / \partial t^2)$
   (c) Curl of the field is zero
   (d) Divergence of the field is zero

8. Reciprocal of permeability is -
   (a) conductivity
   (b) reluctivity
   (c) susceptibility
   (d) permittivity

9. Where is the Laplace's equation valid?
   (a) Only in free space
   (b) Only in conductors
   (c) Only in charge free dielectric regions
   (d) Only in cavities bounded on all sides by conducting walls

10. The phase velocity of waves propagating in a hollow metal waveguide is -
    (a) greater than the velocity of light in free space (b) less than the velocity of light in free space
    (c) equal to the velocity of light in free space (d) equal to the group velocity

11. The unit of $\nabla \times H$ is -
    (a) Ampere (b) Ampere/meter
    (c) Ampere/meter^2 (d) Ampere-meter

12. The waveguide operated below cut-off frequency can be used as -
    (a) A phase shifter (b) An attenuator
    (c) An isolator (d) None of these

13. The input impedance of a short circuited quarter wave long transmission line is -
    (a) Purely reactive
    (b) Purely resistive
    (c) Dependent on the characteristics impedance of the line
    (d) None of these

14. When the phase velocity of an electromagnetic wave depends on the frequency in any medium, the phenomenon is called -
    (a) scattering (b) polarization
    (c) absorption (d) dispersion

15. A uniform plane wave has a wavelength of 2 cm in free space and 1 cm in a perfect dielectric. What is the permittivity of the dielectric?
    (a) 2.0 (b) 0.5
    (c) 4.0 (d) 0.25

16. The loss-less transmission line with characteristics impedance of 600 ohms is terminated in a purely resistive load of 900 ohms. The reflection coefficients is -
    (a) 0.2 (b) 0.5
    (c) 0.667 (d) 1.5

17. When a particular mode is excited in a wave-guide, there appears an extra electric component in the direction of propagation. The resulting mode is -
    (a) Transverse-electric (b) Transverse-magnetic
    (c) Longitudinal (d) Transverse-electromagnetic

18. Which one of the following sets of equations is independent in Maxwell's equations?
    (a) The two curl equations
    (b) The two divergence equations
    (c) Both the curl and divergence equations
    (d) The two curl equations combined with the continuity equation

19. The Maxwell's equation $\nabla \times H = J + \dfrac{\partial \overline{D}}{\partial t}$ is based on -
    (a) Ampere's law (b) Gauss's law
    (c) Faraday's law (d) Coulomb's law

20. A transmission line of 50 W characteristic impedance is terminated with a 100 W resistance. The minimum impedance measurement is equal to -

(a) 0   (b) 25 W

(c) 50 W   (d) 100 W

21. The area of hysteresis loop is the measure of -

(a) permitivity   (b) permeance

(c) energy loss per cycle   (d) magnetic flux

22. In the left hand rule, forefinger always represents -

(a) voltage   (b) current

(c) magnetic field   (d) none of these

23. Which one of the following materials is a ceramic material?

(a) Mica   (b) Zinc sulphide

(c) Antimony   (d) Copper

24. German silver is an alloy of -

(a) copper, silver and aluminium   (b) silver, tin and tungsten

(c) copper, manganese and nickel   (d) copper, zinc and nickel

25. Ferrimagnetic materials generally find application as -

(a) conductors   (b) insulators

(c) superconductors   (d) semiconductors

26. Dielectric loss in ferrites is -

(a) very low   (b) very high

(c) zero   (d) infinite

27. Dielectric materials are used primarily for -

(a) insulation   (b) charge storage

(c) reducing dielectric loss   (d) none of these

28. As compared to Si, the electron mobility in GaAs is -

(a) slower by about five times   (b) same

(c) faster by about six times   (d) faster by about 200 times

29. The magnetic permeability is maximum for -

(a) paramagnetic materials   (b) ferromagnetic materials

(c) diamagnetic materials   (d) none of these

30. 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 materials

31. For which one of the following materials, is Hall coefficient zero?

(a) Metal   (b) Insulator

(c) Intrinsic semiconductor   (d) Alloy

32. All magnetic materials lose their magnetic properties when -

(a) Cooled to low temperature   (b) Heated to high temperature

(c) Kept in an aluminium box   (d) Kept in vacuum

33. Which one of the following is not a permanent magnetic material?

    (a) Chromium steel   (b) Silicon iron

    (c) Cobalt steel   (d) Alnico

34. Bohr magneton is a unit of -

    (a) Magnetic energy   (b) Permanent dipole moment due to spin

    (c) Polarisability   (d) Hysteresis loss

35. An air gap provided in the iron core of an inductor prevents -

    (a) flux leakage   (b) hysteresis loss

    (c) core saturation   (d) heat generation

36. Ferrites are the materials which have -

    (a) Low permeability and low dielectric loss   (b) Low permeability and high dielectric loss

    (c) High permeability and low dielectric loss   (d) High permeability and high dielectric loss

37. For an insulating materials, dielectric strength and dielectric loss should be respectively -

    (a) High and high   (b) Low and high

    (c) High and low   (d) Low and low

38. Which of the following materials is preferred for transformer cores operating in microwave range?

    (a) Ferrite   (b) Silicon steel

    (c) Superalloy   (d) Copper

39. Magnetic recording tape is most commonly made from -

    (a) small particle of iron   (b) silicon iron

    (c) ferric oxide   (d) silver nitrate

40. Assuming the Fermi level E_F to be independent of temperature, E_F may be defined as the level with an occupancy probability of -

    (a) 0%   (b) 50%

    (c) 75%   (d) 100%

41. Upto about 4% silica is added in iron to be used as a soft magnetic material. The major reason for this is to -

    (a) increase permeability of the material   (b) increase electrical resistivity of the material

    (c) increase the coercive force   (d) increase the saturation flux density

42. When placed in a field, the diamagnetic material -

    (a) increase the flux density   (b) decrease the flux density

    (c) does not alter the flux density   (d) none of these

43. An intrinsic semiconductor at a temperature of absolute zero behaves like an insulator because of -

    (a) Non-availabilty of free electrons   (b) Non-recombination of electrons with holes

    (c) Low drift velocity of free electrons   (d) Low (almost zero) electron energy

44. Fermi level in a P-type semiconductor lies close to -

    (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

45. The magnetic field required to reduce the residual magnetisation to zero is called -

    (a) Retentivity   (b) Coercivity

    (c) Hysteresis   (d) Saturation magnetisation

46. With an increase in temperature, the Fermi level in an intrinsic semiconductor -
   (a) Moves closer to the conduction band edge
   (b) Moves closer to the valence band edge
   (c) Moves into the conduction band
   (d) Remains at the centre of the forbidden gap

47. Superposition theorem is valid only for -
   (a) linear circuits
   (b) non-linear circuits
   (c) both (a) and (b)
   (d) neither (a) nor (b)

48. Maximum power is transferred when the load resistance is -
   (a) equal to source resistance
   (b) equal to half of the source resistance
   (c) equal to zero
   (d) none of these

49. The nodal method of circuit analysis is based on -
   (a) KVL and Ohm's law
   (b) KCL and Ohm's law
   (c) KVL and KCL
   (d) both (a) & (b)

50. A practical voltage source consists of an ideal voltage source in -
   (a) Series with an internal resistance
   (b) Parallel with an internal resistance
   (c) Both (a) and (b)
   (d) Neither (a) nor (b)

51. If the voltage across a given capacitor is increased, the amount of stored charge -
   (a) increases
   (b) decreases
   (c) remains same
   (d) is exactly doubled

52. 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

53. The superposition theorem is essentially based on the concept of -
   (a) duality
   (b) linearity
   (c) reciprocity
   (d) non-linearity

54. While calculating R_{th}, constant-current sources in the circuit are
   (a) replaced by 'opens'
   (b) replaced by 'shorts'
   (c) treated in parallel with other voltage sources
   (d) converted into equivalent voltage sources

55. The Norton equivalent of a circuit consists of a 2 A current sources in parallel with a 4 W resistor. Thevenin equivalent of this circuit is a _____ volt source in series with a 4 W resistor.
   (a) 2
   (b) 0.5
   (c) 6
   (d) 8

56. The algebraic sum of all the currents meeting a junction is equal to -
   (a) 1
   (b) -1
   (c) zero
   (d) can't say

57. A series resonant circuit has an inductive reactance of 1000 W, a capacitive reactance of 1000 W and a resistance of 0.1 W. If the resonant frequency is 10 MHz, then the bandwidth of the circuit will be-
   (a) 1 kHz
   (b) 10 kHz
   (c) 1 MHz
   (d) 0.1 kHz

58. An electric circuit with 10 branches and 7 nodes will have -
   (a) 3 loop equations
   (b) 4 loop equations
   (c) 7 loop equations
   (d) 10 loop equations

59. Cauer and Foster forms of realizations are used only for -

(a) driving point reactance functions
(b) transfer reactance functions
(c) driving point impedance functions
(d) transfer impedance functions

60. Consider the network given below:
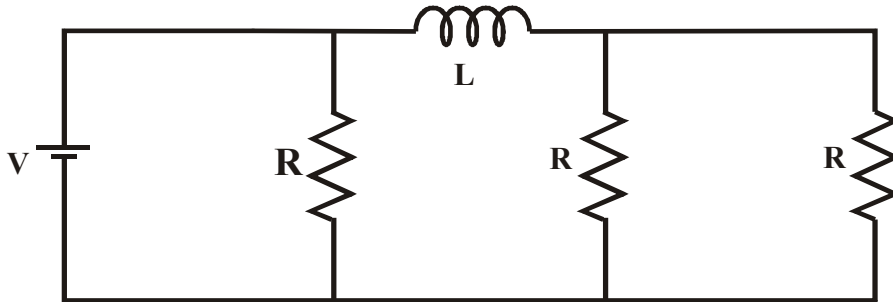
The time constant of the circuit is -

(a) $\dfrac{L}{2R}$
(b) $\dfrac{2L}{R}$

(c) $\dfrac{L}{3R}$
(d) $\dfrac{3L}{R}$

61. When network are connected in series, it is convenient to use -

(a) Z-parameter
(b) Y-parameter
(c) h-parameter
(d) g-parameter

62. In an RLC parallel circuit the impedance at resonance is -

(a) Maximum
(b) Minimum
(c) Zero
(d) Infinity

63. The condition for the electrical symmetry in the network is -

(a) $h_{12} = - h_{21}$
(b) $AD - BC = 1$
(c) $Z_{12} = Z_{21}$
(d) $A = D$

64. In a network made up of linear resistors and ideal voltage sources, values of all resistors are doubled. Then the voltage across each resistor is -

(a) Doubled
(b) Halved
(c) Decreased four times
(d) Not changed

65. Driving point impedance $Z(S) = \dfrac{S(S^2 + 1)}{S^2 + 4}$ is not realizable because the -

(a) number of zeros is more than the number of poles
(b) poles and zeros lie on the imaginary axis
(c) poles and zeros do not alternate on imaginary axis
(d) poles and zeros are not located on the real axis

66. The number of independent loops for a network with n-nodes and b-branches is -

(a) $n - 1$
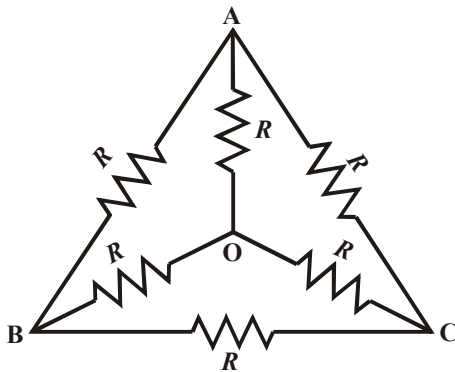(b) $b - n$
(c) $b - n + 1$
(d) independent of no. of nodes

67. A two port network is reciprocal, if and only if -

(a) $Z_{11} = Z_{12}$
(b) $BC - AD = -1$
(c) $Y_{12} = -Y_{21}$
(d) $h_{12} = h_{21}$

68. The dual of parallel RC circuit is -

(a) series RC circuit

(b) series RL circuit

(c) parallel RC circuit

(d) parallel RL circuit

69. The effective resistance between the terminal A and B in the circuit shown in the figure is -

(a) R

(b) R – 1

(c) R/2

(d) 6/11R

70. Two, two port network are connected in cascade. The combination is to be represented as a single two port network. The parameters of the network are obtained by the multiplying the individuals -

(a) Z-parameter matrix

(b) h-parameter matrix

(c) Y-parameter matrix

(d) ABCD parameter matrix

71. Which of the following theorems can be applied to any network- linear or non-linear, active or passive, time-variant or time-invariant?

(a) Thevenin theorem

(b) Norton theorem

(c) Tellegen theorem

(d) Superposition theorem

72. Voltage transfer function of simple RC integrator has -

(a) a finite zero and a pole at infinity

(b) a finite zero and a pole at the origin

(c) a zero at the origin and a finite pole

(d) a zero at infinity and a finite pole

73. A Hurwiz polynomial has -

(a) zeros only in the left half of the s-plane

(b) poles only in the left half of the s-plane

(c) zeros anywhere in the s-plane

(d) poles on the jw axis only

74. If a unit step current is passed through a capacitor what will be the voltage across the capacitor?

(a) 0

(b) A step function

(c) A ramp function

(d) A impluse function

75. In the network shown in below, what is the current I in the direction shown?
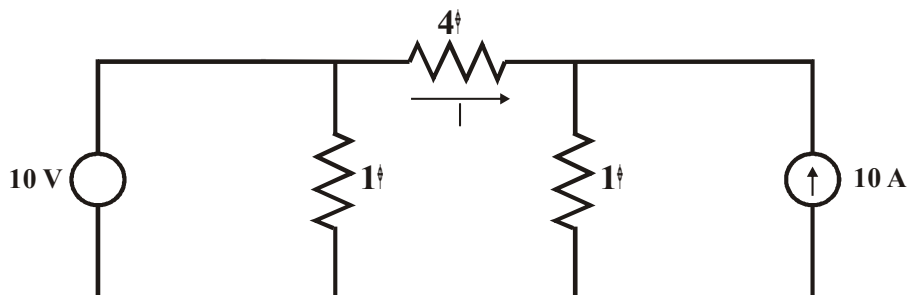
(a) 0

(b) 1/3 A

(c) 5/6 A

(d) 4 A

76. Which of the following are integrating instrument?

(a) Ammeters

(b) Voltmeters

(c) Wattmeters

(d) Ampere-hour and watt-hour meters

77. An induction meter can handle current upto -

(a) 10 A

(b) 30 A

(c) 60 A

(d) 100 A

78. The household energy meter is -

(a) an indicating instrument

(b) a recording instrument

(c) an integrating instrument

(d) none of these

79. An ammeter is a -

(a) secondary instrument

(b) absolute instrument

(c) recording instrument

(d) integrating instrument

80. A moving iron instrument can be used for -

(a) D.C. only

(b) A.C only

(c) both D.C. and A.C.

(d) none of these

81. For measuring a very high resistance we should use -

(a) Kelvin's double bridge

(b) Wheat stone bridge

(c) Megger

(d) None of these

82. For measurement on high voltage capacitors, the suitable bridge is -

(a) Wein bridge

(b) Modified De Sauty's bridge

(c) Schering bridge

(d) None of these

83. In an Anderson bridge, the unknown inductance is measured in terms of -

(a) known inductance and resistane

(b) known capacitance and resistance

(c) known resistance

(d) known inductance

84. To avoid the effect of stray magnetic field in A.C. bridge we can use -

(a) magnetic screening

(b) Wagner earthing device

(c) Wave filters

(d) All of these

85. A power factor meter has -

(a) one current circuit and two pressure circuits

(b) one current circuit and one pressure circuit

(c) two current circuits and one pressure circuit

(d) none of these

86. In a Weston frequency meter, the magnetic axes of the two fixed coils are -

(a) parallel

(b) perpendicular

(c) inclined at 60^0

(d) inclined at 120^0

87. A 150 mA meter has accuracy of 52%. Its accuracy while 75 mA will be -

(a) 5 1%

(b) 5 2%

(c) 5 4%

(d) 5 20%

88. A 10 bit A/D converter is used to digitize an analog signal in the 0 to 5 V range. The maximum peak ripple voltage that can be allowed in the d.c. supply voltage is -

(a) nearly 10 mV

(b) nearly 50 mV

(c) nearly 25 mV

(d) nearly 5.0 mV

89. Torque/weight ratio of an instrument indicates -

 (a) selectivity   (b) Accuracy

 (c) Fidelity   (d) Sensitivity

90. An energy-meter having a meter constant of 1200 revolutions per kWh is found to make 5 revolutions in 75 s. The load power is -

 (a) 500 W   (b) 100 W

 (c) 200 W   (d) 1000 W

91. The phenomena of 'creeping' occurs in -

 (a) Ammeters   (b) Voltmeters

 (c) Wattmeters   (d) Watt-hour meters

92. The basic principle of D'Arsonval instrument is the same as the principle of a -

 (a) Moving iron instrument   (b) PMMC instrument

 (c) Induction instrument   (d) Moving coil instrument

93. Data acquisition systems are usually of -

 (a) analog type   (b) digital type

 (c) integrating type   (d) hybrid type

94. The voltage coil of a single phase house service energy meter -

 (a) is highly resistive

 (b) is highly inductive

 (c) is highly capacitive

 (d) has a phase angle equal to load power factor angle

95. A 12 bit A/D converter has a range 0 – 10 V. What is the approximate resolution of the converter?

 (a) 1 mV   (b) 2.5 mV

 (c) 1.5 μV   (d) 12 mV

96. Commonly used instrument in power system measurement are

 (a) induction   (b) moving coil or iron

 (c) rectifier   (d) electrostatic

97. Which of the following is an analogue transducer?

 (a) Strain gauge   (b) Thermistor

 (c) LVDT   (d) All of these

98. Which of the following will happen if a voltmeter is connected like an ammeter in series to the load?

 (a) there will be almost no current in the circuit   (b) the measurement will be too high

 (c) the meter will burn out   (d) a very high current will flow

99. Which of the following bridges is used to measure power factor?

 (a) Wein's bridge   (b) Maxwell bridge

 (c) Schering bridge   (d) Kelvin bridge

100. A potentiometer works on -

 (a) heating effect   (b) magnetic effect

 (c) electromagnetic induction   (d) none of these

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