MIZORAM PUBLIC SERVICE COMMISSION

TECHNICAL COMPETITIVE EXAMINATIONS FOR PRINCIPAL, GOVT. INDUSTRIAL TRAINING INSTITUTE UNDER LABOUR, EMPLOYMENT, SKILL DEVELOPMENT & ENTREPRENEURSHIP DEPARTMENT, GOVERNMENT OF MIZORAM, JANUARY-2024

ELECTRICAL ENGINEERING

PAPER-I

Time Allowed : 3 hours

FM : 200

SECTION - A *(Multiple Choice questions) (100 Marks)*

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

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

1. The maximum power that a 12 V DC source with an internal resistance of 2 Ω can supply to a resistive load is

(a) 12 W
(b) 18 W
(c) 36 W
(d) 48 W

2. The value of current at resonance in a series RLC circuit is governed by

(a) R
(b) L
(c) C
(d) All of these

3. The power in a series RLC circuit will be half of that at resonance when the magnitude of the current is equal to

(a) $\frac{V}{2R}$
(b) $\frac{V}{\sqrt{3}R}$
(c) $\frac{V}{\sqrt{2}R}$
(d) $\frac{\sqrt{2}V}{R}$

4. 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) $h_{12}=h_{21}$

5. 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

6. A dc voltage source is connected across a series RLC circuit. Under steady-state conditions the applied dc voltage drops entirely across the

(a) R only
(b) L only
(c) C only
(d) R and L

7. In the two-wattmeter method of 3-phase power measurement, the load is resistive. The readings of the wattmeters are W_1 and W_2. Then,
   (a) W_1 may be greater than W_2 (b) W_1 may be less than W_2
   (c) $W_1=W_2$ (d) None of the above
8. The impedance of a circuit is 10 ohms. If the inductive susceptance is 1 S, then inductive reactance of the circuit is _____.
   (a) 10 Ω (b) 1 Ω
   (c) 100 Ω (d) None of the above
9. The voltage and current in an AC series circuit are $230\angle 0^\circ$ volts and $100\angle 30^\circ$ respectively. The circuit will be _____.
   (a) Resistive (b) Inductive
   (c) Capacitive (d) In resonance
10. In an R-L series AC circuit, XL=R. The phase angle is
   (a) 90° (b) 30°
   (c) 45° (d) Cannot be predicted
11. At $t=0^+$ with zero initial condition, which of the following acts as open circuit?
   (a) Inductor (b) Capacitor
   (c) Resistor (d) All of the above
12. When the sole purpose of an alternating current is to produce heat, the selection of conductor is based on
   (a) Peak value of current (b) Average value of current
   (c) RMS value of current (d) Any of the above
13. Two resistances R_1 and R_2 give combined resistance of 4.5 ohms when in series and 1 ohm when in parallel. The resistance are
   (a) 3 ohms and 6 ohms (b) 3 ohms and 9 ohms
   (c) 1.5 ohms and 3 ohms (d) 1.5 ohms and 0.5 ohms
14. Which one of the following statements is correct? A waveguide can be considered to be analogous to a
   (a) Low pass filter (b) High pass filter
   (c) Band pass filter (d) Band stop filter
15. A transmission line is distortionless if
   (a) $RL=\frac{1}{GC}$ (b) $RL=GC$
   (c) $LG=RC$ (d) $RG=LC$
16. The Maxwell's equation $\nabla\times H=J+\frac{\partial \bar{D}}{\partial t}$ is based on
   (a) Ampere's law (b) Gauss's law
   (c) Faraday's law (d) Coulomb's law
17. The depth of penetration of wave in a lossy dielectric increases with increasing.
   (a) Conductivity (b) Permeability
   (c) Wavelength (d) Permittivity

18. A transmission line whose characteristics impedance is a purely resistive

(a) Must be a lossless line
(b) Must be a distortionless line
(c) May not be a lossless line
(d) May not be a distortionless line

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

(a) Mica
(b) Zinc sulphide
(c) Antimony
(d) Copper

20. Metals approach superconductivity conditions

(a) near absolute zero temperature
(b) near critical temperature
(c) at triple point
(d) under the conditions of high temperature and pressure

21. Eddy current losses may be minimized by

(a) Decreasing the resistance of magnetic medium
(b) Decreasing the permeability of magnetic medium
(c) Increasing the resistivity of magnetic medium
(d) None of these

22. The unit of permeance is

(a) Weber
(b) Weber-meter
(c) Weber/meter
(d) Weber/ampere/turn

23. 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

24. The phenomena of "creeping" occurs in

(a) Ammeters
(b) Voltmeters
(c) Wattmeters
(d) Watt-hour meters

25. In a LVDT, the two secondary voltages

(a) are independent on the core position
(b) vary unequally depending on the core position
(c) vary equally depending on the core position
(d) are always in phase quadrature

26. A 150 mA meter has accuracy of 2 percent. Its accuracy while reading 75 mA will be

(a) $\pm 1\%$
(b) $\pm 2\%$
(c) $\pm 4\%$
(d) $\pm 20\%$

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

(a) 1 mV
(b) 2.5 mV
(c) 2.5 μV
(d) 12 mV

28. Loading effect in primarily caused by instruments having

(a) High resistance
(b) High sensitivity
(c) Low sensitivity
(d) High range

29. A Wheatstone bridge requires a change of 6 ohms in the unknown arm of the bridge to produce a change in deflection of 3 mm of the galvanometer. The sensitivity of the instruments is

(a) 0.5 percent
(b) 2.0 percent
(c) 0.5 mm/ohm
(d) 2.0 ohm/mm

30. For a given frequency, the deflecting torque of an induction ammeter is directly portional to

(a) $current^2$ (b) $current^3$

(c) $\sqrt{current}$ (d) $current$

31. Suppose that resistors R1 and R2 are connected in parallel to give an equivalent resistor R. If resistors R1 and R2 have tolerance of 1% each, the equivalent resistor R for resistors R1= 300 Ω and R2 = 200 Ω will have tolerance of

(a) 0.5% (b) 1%

(c) 1.2% (d) 2%

32. In a balance 3-phase system, 2 wattmeter methods is used to measure the power. If reading of one wattmeter is twice of other, the load impedance angle (in radian) is

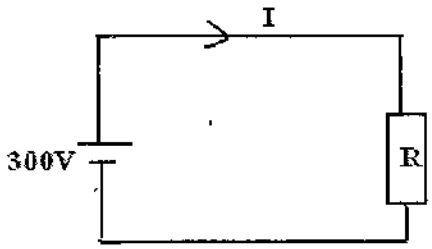
(a) $\frac{\pi}{12}$ (b) $\frac{\pi}{8}$

(c) $\frac{\pi}{6}$ (d) $\frac{\pi}{3}$

33. For circuit shown below, R = 25 + I/2. The value of I is

(a) 10 A (b) 9.5 A

(c) 10.25A (d) 9A



34. The circulating current in parallel LC circuit at any resonant frequency is

(a) directly proportional to the frequency (b) inversely proportional to the frequency

(c) Independent of frequency (d) None of these above

35. The voltage applied across a capacitance is triangular in waveform. The waveform of the current is

(a) triangular (b) rectangular

(c) sinusoidal (d) trapezoidal

36. The coupling between two magnetically coupled coils is said to be ideal if the coefficient of coupling is

(a) 0 (b) 0.5

(c) 1 (d) 2

37. An RLC series circuit has $R=1\ \Omega$, $L=1H$, and $C=1F$. The damping ratio of the circuit will be

(a) 0.5 (b) more than unity

(c) unity (d) zero

38. The capacitance and inductance per unit length of a 110 km line operating at 110 kV are 0.01 μF and 2 mH. The surge impedance of the line is:

(a) 443.6 (b) 447.2

(c) 223.6 (d) None of these.

39. .If the fault current is 2000A the relay setting 50% and the C.T ratio is 400/5,then the plug setting multiplier will be

(a) 25A (b) 15 A

(c) 50A (d) none of the above

40. Three resistances each of R ohm are connected in delta. Their equivalent star value for each resistance is

(a) R (b) 3R

(c) R/3 (d) 2R

41. If X is the system reactance and R its resistance the power transferred is maximum when

(a) $X=R$ (b) $X=\sqrt{2R}$

(c) $X=\sqrt{3R}$ (d) $X=2R$

42. The Laplace transformation method enables one to find the response of a network in

(a) the transient state only (b) the steady state only

(c) both transient and steady state (d) none of these

43. The dual of a parallel R-C circuit is a

(a) series R-C circuit (b) series R-L circuit

(c) parallel R-C circuit (d) parallel R-L circuit

44. The number of 2uF,400V capacitors needed to obtain a capacitance value of 1.5uF rated for 1600 V is

(a) 12 (b) 8

(c) 6 (d) 4

45. The force between two charges is 200 N. If the distance between the charges is doubled, the force will be

(a) 400N (b) 100N

(c) 200N (d) 50N

46. Which quantity is solenoidal in the electromagnetic theory?

(a) Electric field intensity (b) Electric flux density

(c) Magnetic flux density (d) Magnetic field intensity

47. Which of the following conditions is true for even function?

(a) $f(t)=-f(t\pm T/2)$ (b) $f(t)=-f(-t)$

(c) $f(t)=-f(t)$ (d) $f(t)=-f(T)$

48. When the moving coil in a Dynamometer type wattmeter deflects _____.

(a) pointer doesn't move (b) current flows

(c) voltage is generated (d) pointer moves

49. The spring material used in a spring control device should have the following property.

(a) Should be non-magnetic and have low specific resistance

(b) Most be of low temperature co-efficient

(c) Should not be subjected to fatigue

(d) All of the above

50. Which of the following method is used for the measurement of Medium Resistance?

(a) Direct-Deflection method (b) Anderson Bridge

(c) Kelvin's double bridge method (d) Carey-Foster bridge method

SECTION - B *(100 Marks)*

All questions carry equal mark of 10 each.

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

1. (a) What are ceramic materials? Differentiate between two types of ceramics having their permittivity less than 12 and greater than 12. **(1+3=4)**

(b) Give the general electrical and magnetic characteristics of ferrites. List its applications. **(4+2=6)**

2. Explain the current conduction mechanism in a semiconductor. Explain how doping changes the conductivity of a semiconductor? Show that the Fermi level lies halfway between the valences and conduction band of an intrinsic semiconductor. **(4+3+3=10)**

3. Explain with a neat diagram the working of a permanent magnet moving coil instrument. What are its advantages and disadvantages? **(7+3=10)**

4. (a) How are moving iron instrument classified? Briefly explain any one of its types. **(2+6=8)**

(b) What are the errors caused by the driving system in single phase energy meter? **(2)**

5. (a) Find the Y parameters for the network shown in Fig.1. **(5)**

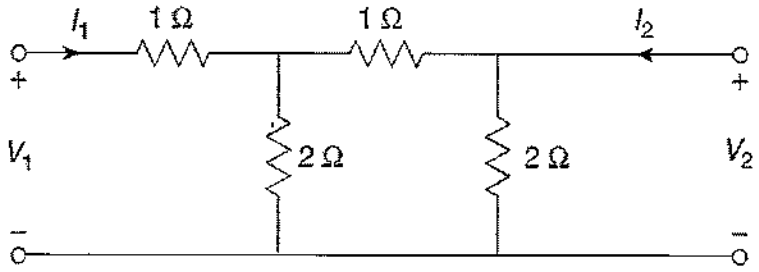


Fig.1

(b) In the network of Fig.2, the switch is initially at the position 1. On the steady state having reached, the switch is changed to the position 2. Find current i(t). **(5)**

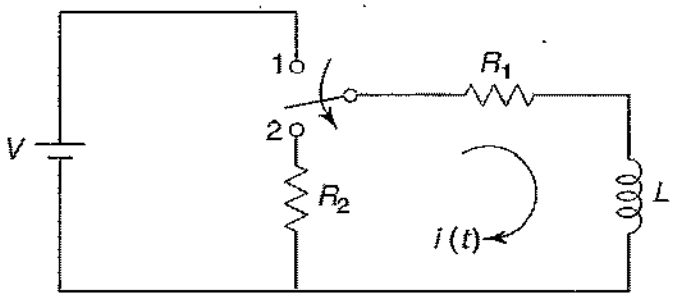


Fig.2

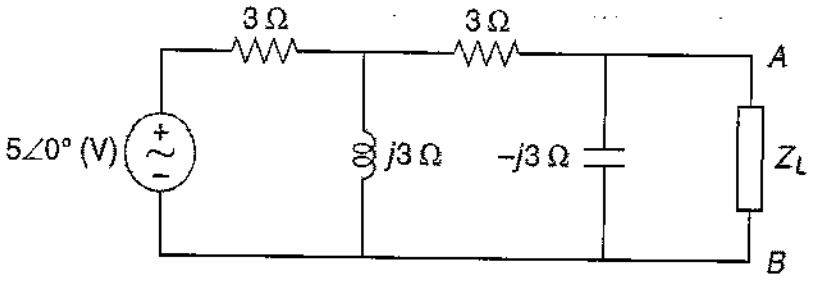
6. Explain the principle of operation of Permanent Magnet Moving Coil (PMMC) instrument with proper circuit diagram and also derive the torque equation developed by PMMC. **(10)**

7. (a) Explain hysteresis loop in magnetic materials. **(5)**

(b) Explain the formation of p-type semiconductors. **(5)**

8. (a) Explain ABCD-parameter in terms of h and Y parameter. **(6)**

(b) In the network shown Fig., find the value of Z_L to which the maximum power can be delivered. Hence, find the value of the maximum power. **(4)**



9. (a) Explain hysteresis loop with neat sketch. **(6)**

(b) State the properties of conducting materials. **(4)**

10. Explain the construction and working principle of an induction type energy meter. Show that number of revolutions of the disc in induction type energy meter is proportional to energy consumed. **(10)**

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