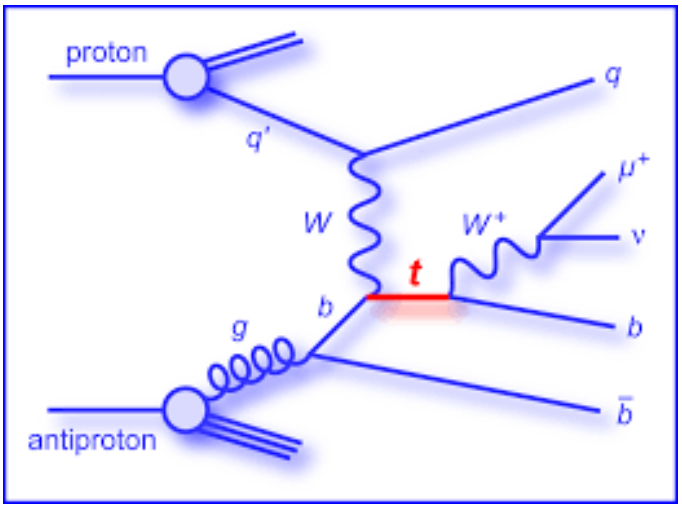
DEPARTMENT OF ELECTRICAL ENGINEERING

QUESTION BANK ON

CIRCUIT AND NETWORK THEORY

(3RD Semester)



UNIT: 1 BASICS OF CIRCUIT ANALYSIS

1. What are the classification of circuit elements?

The classification of circuit elements are

i) Active elements
ii) Passive elements.
iii) Lumped and distributed elements
iv) Bilateral and unilateral elements
v) Linear and non linear elements

2. What are active elements and passive elements?

The elements which can deliver energy are called **active elements**. These are voltage and current sources.

The elements which consume energy either by absorbing or storing are called **passive elements**. These are resistor, inductors and capacitors.

3. What are lumped and distributed elements?

Physically separate elements such as resistors, capacitors and inductors are called **lumped elements**.

A **distributed element** is one which is not separable for electrical purposes.

A transmission line has distributed resistance, capacitance and inductance along its length.

4. What are bilateral and unilateral elements?

In bilateral element, the voltage-current relation is the same for current flowing in either direction.

E.g: resistor, inductor and capacitor.

In a unilateral element, it has different relations between voltage and current for two possible directions of currents E.g: vacuum tube, silicon diode.

5. What are linear and non-linear elements?

An element is said to be linear, if it satisfies the linear current voltage relationship that is the relation between V and I is linear.

The elements which do not satisfy the Linear voltage-Current relationship is called as non-linear elements.

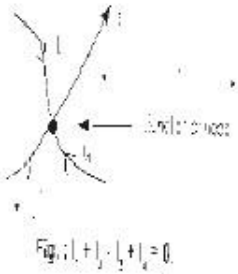
6. What are dependent and independent sources?

The electrical energy supplied by an dependent source depends on another source of electrical energy.

The electrical energy supplied by an independent source does not depend on another electrical source. They convert energy in some form to electrical energy.

7. State Kirchoff's current law?

Krichoff's current law states that "the algebraic sum of the currents meeting at a junction is equal to zero",



8. State Kirchoff's voltage law?

Krichoff's voltage law states "The algebraic sum of electromotive forces plus the algebraic sum of voltages across the impedances, in any closed electrical circuit is equal to zero".

Σ emf + Σ IZ = 0.

9. State Ohm's law?

Ohm's law states the ratio between the potential difference across two terminals of a conductor and the current through it remains constant, when the physical conditions of the conductor remain unchanged.

V = IR.

10. Define series and parallel connection?

If the resistors are connected end to end, the combination is said to be series.

If one end of all the resistors is joined to a common point and the other ends are joined to another common point, the combination is said to be parallel combination between two common points.

11. What are the advantages of parallel circuits?

The advantages of parallel connections are

1) The electrical appliances of different power ratings may be rated for the same voltage.
2) In case a break (open) occurs in any of the branch circuit it will not affect the other branch circuits.

12. Define ideal voltage source?

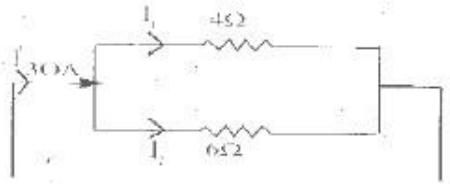
For ideal voltage source, source impedance is zero, such voltage source gives a constant voltage V irrespective of current drawn from it.

13. Define an ideal current source?

For an ideal current source, source impedance is infinite, such an ideal current source gives a constant current irrespective of voltage across it.

14.Two resistor of 4Q and 6Q are connected in parallel. If the total currerit is 30A. Find the current through each resistor.

Ans:



$$R_1 = 4\Omega, R_2 = 6\Omega, I = 30A$$

$$I_1 = \frac{IR_2}{R_1 + R_2}$$

$$I_1 = 30 \times \frac{6}{6+4} = 18A$$

W.K.T. $I = I_1 + I_2$

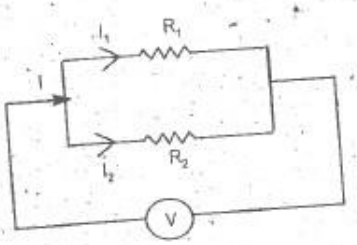
$30 = 18 + I_2$

$I_2 = 12A.$

,,,

15.Write the current division formula when only two resistance is connected in parallel?

Ans:



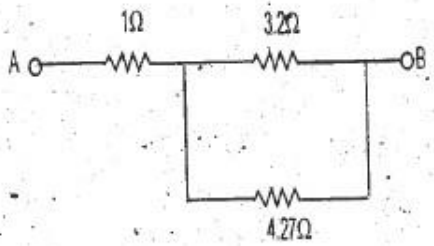
$$I_1 = \frac{IR_2}{R_1 + R_2}$$

$$I_2 = \frac{IR_1}{R_1 + R_2}$$

16. Comparison of series and parallel circuits.

Series Circuit	Parallel Circuit
1. The current is same through all the elements.	The current is divided, inversely proportional to resistance
2. The voltage is distributed.	The voltage is same across each element.
3. There is only one path for flow of current.	There are more than one path for the flow of current.
4. The total resistance is greater than the greatest	Total resistance is lesser than the smallest of the

17.In the figure determine the equivalent resistance.

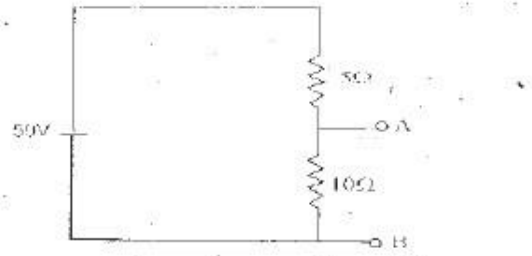


Ans: $\frac{3.2\times4.277}{3.2+4.277}=1.83\Omega$

$R_{req}=1+1.83$

$=2.83\Omega.$

18. What is the voltage across the 10Ω resistor?



Ans: Voltage across 10Ω, $V_{10}=50\times\frac{10}{5+10}=\frac{500}{15}=33.3V$.

20.What is an independent voltage source?

An independent voltage source is an ideal source characterized by a terminal voltage which is completely independent of the current through it.

21.What is an independent current source?

An independent current source is an ideal source in which the current through the element is completely independent of the voltage across it.

22.What are called dependent sources?

The sources in which voltage or current is dependent of the voltage or current existing at some other location in the circuit are called dependent sources. They are also known as controlled sources.

23.What is a node?

A node is a point in a network in which two or more elements have a common

24. What is a super node?

The region surrounding a voltage source which connects the two nodes directly is called super node.

25. What is principle node?

The meeting point of three or more elements is called principle node.

26. What is a closed path?

A closed path is a path, which starts at a node and travels through some part of the circuit and arrives to the same node without crossing a node more than once.

27. What is a node, a junction and a branch?

A node of a network is an equipotential surface at which two or more circuit elements are joined.

A junction is that point in a network where three or more circuit elements are joined.

A branch is that part of a network which lies between two junction points.

28. What is the difference between a loop and a mesh?

A loop is any closed path of a network. A mesh is the most elementary form of a loop and can not be further divided into other loops.

29. State voltage division rule.

Voltage across a resistor in a series circuit is equal to the total voltage across the series elements multiplied by the value of that resistor divided by the total resistance of the series elements.

30. State current division rule.

The current in any branch is equal to the ratio of the opposite parallel branch resistance to the total resistance value, multiplied by the total current in the circuit.

31. Define mesh.

A mesh is defined as a loop which does not contain any other loops within it.

32. What is a planar circuit?

A circuit is said to be planar, if it can be drawn on a plane surface without crossovers.

33. What is a non-planar circuit?

A circuit is said to be non-planar, if it cannot be drawn on a plane surface without a crossovers.

34. Define super mesh.

The loop existing, around a current source which is common to the two loops is called super mesh.

35. What are the advantages of sinusoids?

The advantages of sinusoids are :

1. The machines and appliances working on sine wave voltage and currents have better performance characteristics than with other wave shapes.
2. The rate of change of a sinusoidal quantity is small and hence does not induce large harmful EMFs in the associated circuits.
3. The derivatives and integrals of a sinusoid are also sinusoids.
4. The addition and multiplication of two sinusoids result in a sinusoid.

36. Define average value.

The average value of an alternating quantity is defined as that value which is obtained by averaging all the instantaneous values over a period of half cycle.

37. Define instantaneous value.

The value of an alternating quantity at a particular instant is known as instantaneous value. For example e_1 and e_2 are the instantaneous value of an alternating emf at instants t_1 and t_2 respectively.

38. Define cycle of an alternating quantity.

Each repetition of a set of positive and negative instantaneous values of the alternating quantity is called a cycle.

39. Define time period of an alternating quantity.

The time taken by an alternating quantity to complete its one cycle is known as its time period denoted by T. after every T seconds, the cycle of an alternating quantity repeats.

40. Define frequency of an alternating quantity.

The number of cycles completed by an alternating quantity per second is known as its frequency. It is denoted by f and is measured in cycles/second which is known as Hertz, denoted as Hz.

$$f = 1/T \text{ Hz}$$

41. Define peak value of an alternating quantity.

The maximum value attained by an alternating quantity during positive or negative half cycle is called its peak value. It is denoted as E_m or I_m.

Thus E_m is called peak value of the voltage while I_m is called peak value of the current.

42. Define RMS value or effective value of an alternating quantity.

The Root Mean Square (RMS) value or effective value is defined as the steady current (D.C) which, when flowing through a given circuit for a given time, produces the same amount of heat as produced by the alternating current, which when flowing through the same circuit for the same time.

43. Define peak factor.

The peak factor of any waveform is defined as the ratio of the peak value of the wave to the rms value of the wave.

Peak factor = maximum value / rms value

Peak factor = V_m / V_{rms}

44. Define form factor.

Form factor is defined as the ratio of rms value to the average value of the wave.

Form factor = rms value / average value

For a sinusoidal wave, form factor =

= 1.11

45. Define impedance and admittance.

The ratio of phasor voltage V to phasor current I is called impedance, Z.

Impedance (Z) = V / I

The reciprocal of impedance is called admittance, Y.

Admittance (Y) = 1 / Z (s) where s = $1\Omega^{-1}$ = 1 mho

46. **What are the different types of dependent or controlled sources?**

The different types of dependent or controlled sources are

(i) Voltage controlled voltage source (VCVS)

(ii)Current controlled voltage source (CCVS)

(iii) Voltage controlled current source (VCCS)

(iv) Current controlled current source(CCCS)

UNIT 2 : NETWORK REUDCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS

1. **State Thevenin's theorem.**
   Thevenin's theorem states that any two terminal linear network having a number of voltage sources, current sources and resistances can be replaced by a simple equivalent circuit consisting of a single voltage source in series with a resistance.

2. **State Norton's theorem.**
   Norton's theorem states that any two terminal linear network with current sources, voltage sources and resistances can be replaced by an equivalent circuit consisting of a current source in parallel with a resistance.

3. **State superposition theorem.**
   Superposition theorem states that in any linear network containing two or more sources, the response in any element is equal to the algebraic sum of the responses caused by individual sources acting alone, while the other sources are non operative.

4. **State maximum power transfer theorem.**
   The maximum power transfer theorem states that maximum power is delivered from a source to a load when the load resistance is equal to the source resistance.
   $$R_S = R_L$$

5. **State compensation theorem.**
   The compensation theorem states that any element in the linear, bilateral network, may be replaced by a voltage source of magnitude equal to the current passing through the element multiplied by the value of the element, provided currents and voltages in other parts of the circuit remain unaltered.

6. **State Reciprocity theorem.**
   Reciprocity theorem states that if an input is applied to a circuit, the ratio of response (output) in any element to the input is constant, even when the position of input and output are interchanged.

7. **List the applications of Thevenin's theorem.**
   The applications of Thevenin's theorem are :
   1. It is applied to all linear circuits, including electronic circuits represented by the controlled sources.
   2. This theorem is useful when it is desired to know the effect of the response in network or varying part of the network.

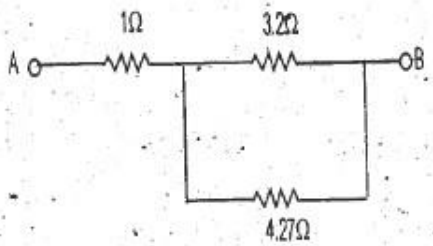
8. Where and why maximum power transfer theorem is applied?

Maximum power transfer theorem is used in systems where maximum power is transfer is needed. For example, in communication circuits power involved is sufficiently small. In some situations to match source impedance with load impedance.

9.Explain the purpose of Star-delta transformation?

The transformation of a given set of resistance in star to delta or vice versa proves extremely useful in. circuit analysis and the apparent complexity of a given circuit can sometime be very much reduced.

10.In the figure determine the equivalent resistance by using star delta transformation



Ans: $\frac{3.2\times4.277}{3.2+4.277}=1.83\Omega$

$R_{req} = 1 + 1.83$

$= 2.83\Omega.$

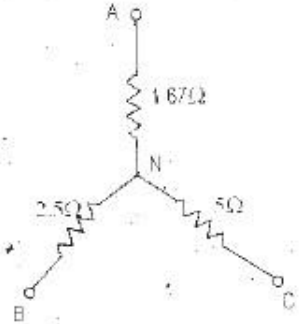
11.Convert given delta into equivalent star.

Ans: The equivalent star is given by

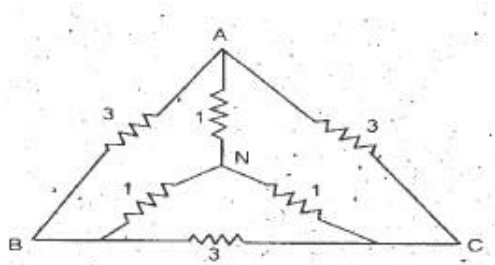
$R_1 = \frac{10\times5}{5+10+15} = 1.67\Omega$

$R_2 = \frac{15\times10}{5+10+15} = 5\Omega$

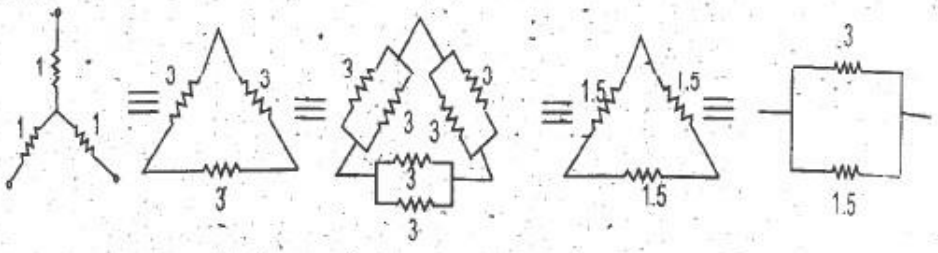
$R_3 = \frac{5\times15}{5+10+15} = 2.5\Omega$



11.For the network shown find the equivalent resistance between terminals B and C



Ans:



The resistance between B and C is

$$R_{BC} = \frac{3 \times 1.5}{3 + 1.5} = 1\Omega.$$

12. **What is Star and. Delta connection?**

One end of each resistance is connected at a point called star point and the other, three terminals are connected to A, B, C. This is called **star connection**.

When three resistances are connected end to end to form delta shape it is called **delta connection.**

13. What is the condition for maximum power transfer in DC and AC circuits?

Condition for maximum power transfer for DC circuit $P_{max} = V^2_{th} / 4 R_L$

Condition for maximum power transfer for AC circuit $P_{max} = V^2_{th} / 4 Z_L$

Where $Z_L = Z_{th}$

14. Superposition theorem is applicable only to …….. networks.

Answer: Linear.

15…….theorem is useful when the current in a one branch of a network is to be determined for different values of the branch resistance.

Answer:Thevenin's

16. **Find the thevenins equivalent for the circuit shown in fig.**

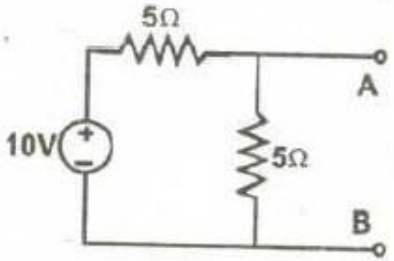
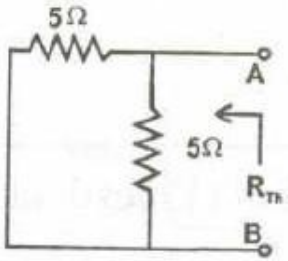
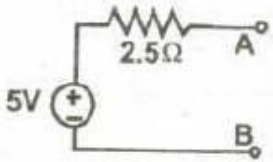


Fig. 2.367

Solution

$$R_{\text{Th}} = 5||5$$
$$= 2.5\Omega$$
$$V_{\text{Th}} = \frac{10}{(5+5)}(5V) = 5\text{ V}$$





17. Find the value of R_L for maximum power transfer.

To find R_L maximum power transfer we have to find R_{Th}

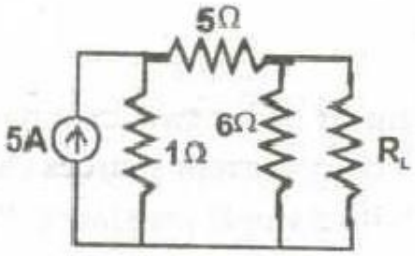


Fig.2.370

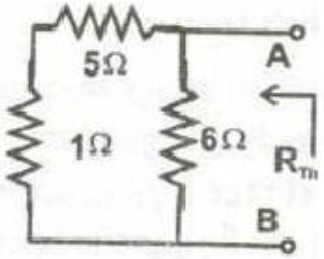
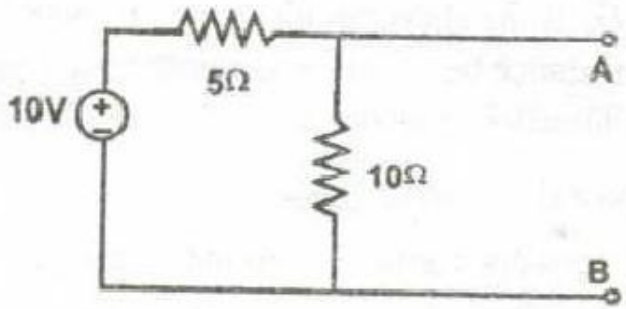


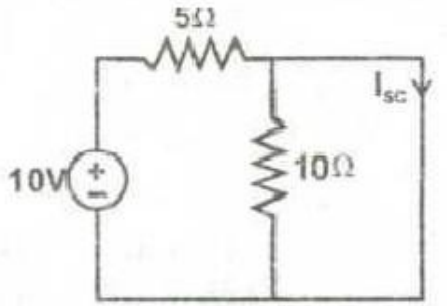
Fig.2.371

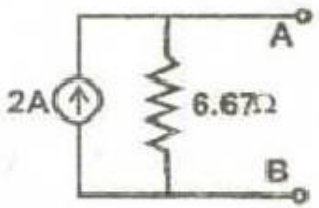
$$R_{\text{Th}} = 6||6 = 3\Omega$$

Therefore $R_L = 3\Omega$

18.Find the Nortons equivalent of the circuit shown in fig.

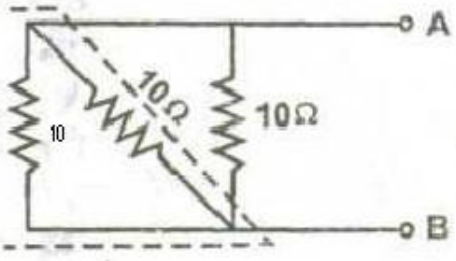


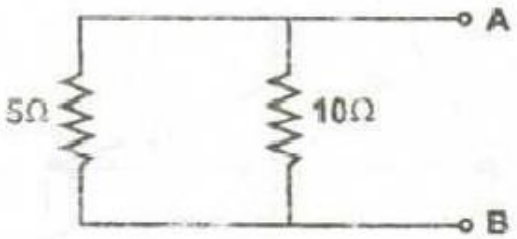




To find I_{sc} short AB , I_{sc} = 10 /5 =2A , R_{th} = (5x10)/(5+10)= 6.67ohms

19.The resistance between AB terminal is equal to ……..





R_{eq} = (10 x10)/(10+10) =5 ohms

R_{AB} = (5X10)/(5+10) = 3.33 ohms

20. The resistance between the terminal AB is 30ohms, the value of R is.....

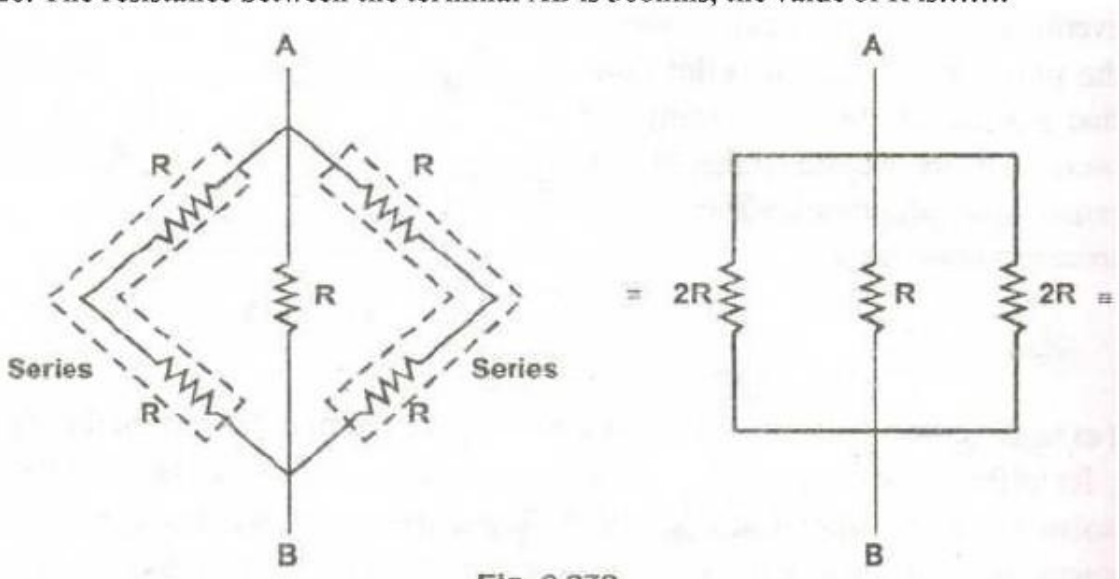


Fig. 2.378

$$\frac{1}{R_{eq}} = \frac{1}{2R} + \frac{1}{R} + \frac{1}{2R} = \frac{4}{2R} = \frac{2}{R}$$

$$\frac{1}{30} = \frac{2}{R} \qquad (\because \ R_{eq} = 30\Omega)$$

$$\boxed{R = 60\Omega}$$

21.Find the resistance between the points A and B for the circuit shown in fig.

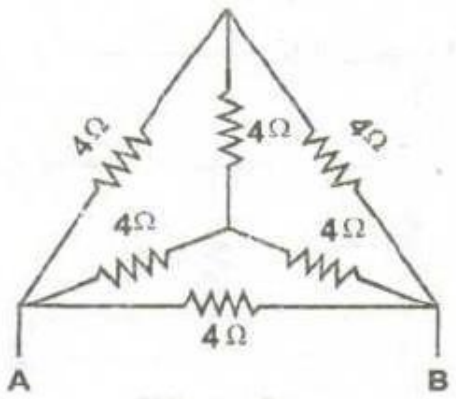


Fig.2.379

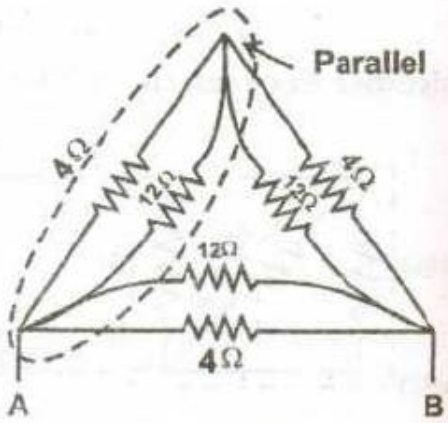


Fig.2.380

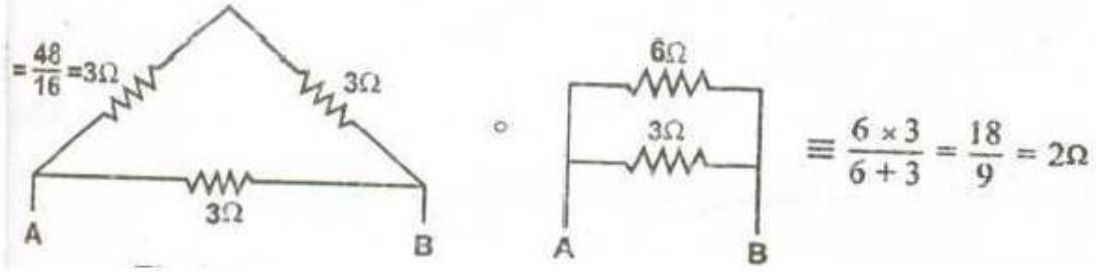
$$\frac{4 \times 12}{4+12} = \frac{48}{16} = 3$$

$$R_{AB} = R_A + R_B + \frac{R_A R_B}{R_C}$$

$$R_A = R_B = R_C = R$$

$$R_{AB} = 3R$$

$$= 3 \times 4 = 12$$



$$\equiv \frac{6 \times 3}{6+3} = \frac{18}{9} = 2\Omega$$

UNIT 3 : RESONANCE AND COUPLED CIRCUITS

1. What is the resonance?

In RLC -series, circuit the inductive and capacitive reactance have opposite signs. Hence when the reactances are varied there is a possibility that the inductive reactance may cancel the capacitive reactance and the circuit may behave as a purely resistive circuit. This condition is called resonance.

2. What is the resonant frequency?

The frequency at which the resonant condition occurs is known as the resonant frequency.

3. Write the expression for resonant frequency and current at resonance of a RLC series circuit? ,

Ans: Angular resonant frequency, $\omega_r = \frac{1}{\sqrt{LC}}$

Resonant frequency, $f_r = \frac{1}{2\pi\sqrt{LC}}$

Current at resonance, $I_r = \frac{V}{R}$

4. What is anti-resonance?

In RLC parallel circuit, the current is minimum at resonance whereas in series resonance the current-is maximum. Therefore the parallel resonance is called anti-resonance.

5. Write the characteristics of parallel resonance?

At resonance, admittance is minimum and equal to conductance, therefore current is minimum.

Below resonant frequency the circuit behaves as inductive circuit and above resonant frequency the circuit behaves as capacitive circuit.

At resonance the magnitude of current through inductance and capacitance will be Q times the current supplied by the source, but they are in phase opposition.

6. What are half power frequencies?

In-RLC circuits, the frequencies at which the power is half the -maximum/minimum power are called half power- frequencies.

7. 'Define Quality factor

The Quality factor is. defined as the ratio of maximum energy stored to the energy dissipated in one period.

Quality factor Q = 2Π X(maximum energy stored/energy dissipated in one period)

8. Find the resonant frequency in the ideal parallel LC circuit with L = 40mH and C-0.01 μF.

Ans: Resonant frequency, $f_r = \frac{1}{2\pi\sqrt{LC}}$

$$= \frac{1}{2\pi\sqrt{40\times10^{-3}\times0.01\times10^{-6}}}$$

$$= 7958\text{Hz}.$$

9. Define selectivity.

The selectivity is defined as the ratio of bandwidth and resonant frequency.

$$\text{Selectivity} = \frac{\beta}{\omega_r} \text{ or } \frac{1}{Q_r}$$

10. Determine the quality factor of a RLC series circuit with R = 10Ω, C=100μF and L=0.01mH.

Ans: Quality factor at resonance, $Q_r = \frac{1}{R}\sqrt{\frac{L}{C}} = \frac{1}{10}\sqrt{\frac{0.01}{100\times10^{-6}}}$

$$= 1$$

11. What is the tuned circuit?

In a coupled circuit, when capacitors are added to primary and secondary of coupled coils to resonate the coils to achieve maximum power transfer condition then the coupled circuit is called tuned coupled circuit.

12. What is single tuned and double tuned circuit?

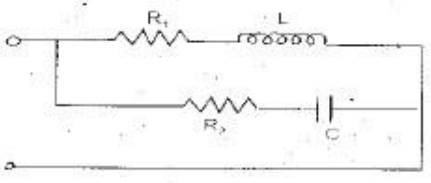
In a coupled circuit when a capacitor is added to secondary coil to resonate the secondary, the coupled circuit is called single tuned coupled circuit. In a coupled circuit when capacitors are added both to primary and secondary coils to resonate the primary and secondary, the coupled circuit is called double tuned coupled circuit.

13.Write the expression far resonant frequency for the RLC network shown: when Rj =R_2 = R and L=CR^2.

Ans: Resonant frequency,

$$f_r = \frac{1}{2\pi\sqrt{LC}}\sqrt{\frac{L-CR_1^2}{L-CR_2^2}}$$

when $L = CR^2$ the circuit will resonate at all frequencies.



14. What is dynamic resistance? Write the expression for dynamic resistance of RL circuit parallel with C.

The resistance of the RLC parallel circuit at resonance is called dynamic resistance. ,
For RL circuit parallel with C, the dynamic resistance is given by,

$$R_{dynamic} = \frac{L}{RC}$$

15.Define co-efficient of coupling.

The amount of coupling between to inductively coupled coils is expressed in terms of the coefficient of coupling, which is defined as

$$K = M / \sqrt{L_1 L_2}$$

16.**Write the expression for equivalent inductance of series connected magnetically coupled coils.**

For cumulative coupling effective inductance $L = L_1 + L_2 + 2M$

For differential coupling effective inductance $L = L_1 + L_2 - 2M$

17.What is the maximum possible mutual inductance of two inductively coupled coils with self inductances L_1 =25Mh, L_2 = 100Mh?

Maximum mutual inductance $M = \sqrt{L_1 L_2}$

$= \sqrt{25 \times 10^{-3} \times 100 \times 10^{-3}}$

$= 50m$

18.Define bandwidth.

The bandwidth is defined as the frequency difference between upper and lower cut off frequency.

Bandwidth $= f_2 - f_1$

where

f_1- lower cut-off frequency

f_2-upper cut-off frequency

19.What is ideal transformer?

An ideal transformer is a unity coupled lossless transformer in which the primary and secondary coils have infinite self inductance.

20.Write the condition for resonance in series RLC circuit.

1.A network is in resonance when the voltage and current at the network input terminals are in phase.

2.If inductive reactance of a network equals capacitive reactance then the network is said to be resonance.

21. Define half power frequencies.

The frequencies at which the power is half the maximum power are called half power frequencies.

Lower half power frequency $f_l = f_r - R / 4 \pi L$

Upper half power frequency $f_l = f_r + R / 4 \pi L$

22.Give the expression for quality factor of series RLC circuits.

The expression for quality factor of series RLC circuits is given by

$$Q = (1 / R) \sqrt{L/C}$$

23.Give the expression for quality factor of parallel RLC circuits.

The expression for quality factor of parallel RLC circuits is given by

$$Q = R^* \sqrt{C/L}$$

24. Define duality.

Two electrical network which are governed by the same type of equations are called duality.

25. State the dot rule for coupled circuits.

1. If both currents enter dotted ends of coupled coils or if both currents enter undotted ends, then the signs on the M- terms will be same as the signs on the L-terms
2. If one current enters a dotted end and the other an un dotted end, the sign on the M-terms will be opposite to the signs on the L –terms.

26. Define coupled circuit. Give the examples of coupled circuits.

The coupled circuits refer to circuits involving elements with magnetic coupling. If the flux produced by an element of a circuit links other elements of the same circuit or nearby circuit, then the elements are said to have magnetic coupling.

Examples : 1.Transistor 2. Transformer

27. What is perfect coupling?

Co-efficient of coupling is equal to one, that type of coupling is known as perfect coupling.

28.A series RLC circuit has R = 50Ω; L=100μH; and C = 300pF; v=20V.What is the current at resonance?

The current at resonance will be $I = V / R = 20 / 50 = 0.4A$

29. How the RLC series circuit behaves for the frequencies above and below resonant frequencies?

For frequencies below resonant frequency the capacitive reactance is more than the inductive reactance. Therefore the equivalent reactance is equal to capacitive and the circuit behaves like a RC circuit. For the frequencies above resonant frequency the inductive reactance is more than the capacitive reactance and the circuit behaves like a RL series circuit.

30. A series resonant circuit is capacitive at f=100Hz. The circuit will be inductive somewhere at

Answer: f is greater than 100Hz

UNIT 4: TRANSIENT RESPONSE FOR DC&AC CIRCUITS

1. Define transient response.

The transient response is defined as the response or output of a circuit from the instant of switching to attainment of steady state.

2, What is natural response?

The response of a circuit due to stored energy alone without external source is called natural response or source-free response.

3. What is the forced response?

The response of a circuit due to -ah external source is called forced response

4. How the RL circuit behaves for the step input?

At $t = 0^+$, the current through inductance is zero and so it behave as open circuit, At $t=\infty$, the voltage across inductance is zero and so it. -behave as short circuit.

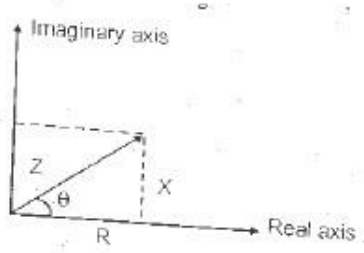
5. Define the time constant of RL circuit

The time constant of RL circuit is defined as the time taken by the current through the inductance to reach steady value if initial rate of rise is maintained.

8. What is an impedance triangle?

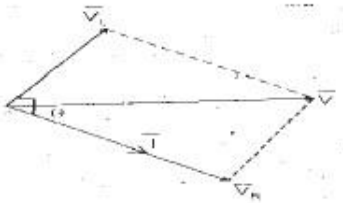
Real axis

The right-angled triangle formed by the resistance (R), reactance (X) and the impedance (Z) is called an impedance triangle.



9.Draw the phasor diagram of RL circuit.

The phasor diagram of RL circuit is



$\bar{V}$ → Reference phasor

$\bar{I}$ → lags $\bar{V}$ by an angle ϕ

$\overline{V_R}$ → In phase with $\bar{I}$

$\overline{V_L}$ → Leads $\bar{I}$ by an angle 90°

11. Define the apparent power.

The apparent power, is defined as the product of magnitude of voltage and magnitude of current.

12. What is power factor and reactive factor?

The power factor is defined as, the cosine of the phase difference between voltage and current.

(i.e) Power factor = cosΦ

The reactive factor of the circuit is defined as the sine of the phase angle.

(i.e) Reactive factor = sinΦ

13. What is the conductance and susceptance?

The inverse of resistance is called as the conductance.

$G=(1/R)$

The inverse of reactance is called as the susceptance.

$B=(1/X)$

14. Define the admittance.

The admittance, is the reciprocal of impedance. It is a complex quantity and denoted by Y. The real part of admittance is conductance and the imaginary part of admittance is susceptance. .

15. How the RC circuit behaves for the step input?

At $t = 0^+$, the voltage across capacitance is zero and so it behave as short circuit. At $t = \infty$ the current through the capacitance is zero and so it behave as open circuit.

16. Define the time constant of RC circuit.

The time constant of RC circuit is defined as the time taken by the voltage across the capacitance to reach steady value if initial rate of rise is maintained.

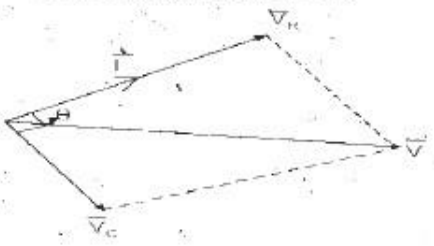
17. Write the expression for the impedance of the RC circuit in rectangular and polar form?

Impedance in rectangular form $Z= R+jX$ Impedance in polar form, $Z = |Z| \angle -\delta$

Here the current leads the applied voltage.

18. Draw the phasor diagram of RC circuit. '

Ans:



19. What is damping ratio? . . ..

The ratio of resistance- of the circuit and resistance for critical damping is called clamping ratio.

20. What is critical damping?

The critical damping is the condition of the circuit at which the oscillations in the response are just eliminated. This is possible by increasing the value of resistance in the circuit.

21. What is critical 'resistance?

The critical resistance is the value of the resistance of the circuit to achieve critical damping.

22. Write the expression for critical resistance and damping ratio of RLC/series circuit?

The expression for critical resistance and damping ratio of RLC/series circuit is

Ans: Critical resistance, $R_C = 2\sqrt{\frac{L}{C}}$

Damping ratio, $G = \frac{R}{R_C} = R/2\sqrt{\frac{C}{L}}$

23. What is the voltage triangle for a RLC series circuit?

A right angled triangle with sides V_R,V_L and V in which V is the hypotenuse is called voltage triangle.

24. Write the expression for the impedance of RLC circuit?

The expression for the impedance Z of the RLC circuit is given by

$$\bar{Z} = R + jX_L - jX_C = R + j(X_L - X_C) = R \pm jX$$

25. What are the methods of solving AC parallel circuit?

The methods of sloving AC parallel circuits can be solved by:

*Admittance method.
* Symbolic method
* Vector method.

26. Define dual networks.

Two networks are called dual networks if the mesh equations of one have the same form as the nodal equations of the other. The property of duality is a mutual property.

27.State the dual elements for inductance and mesh current.

Dual of inductance is capacitance.
Dual of mesh current is node voltage.

28. State the dual elements for resistance and capacitance.

Dual of resistance is conductance

29. Distinguish between steady state and transient state.

A circuit having constant sources is said to be in steady state if the currents and the voltages do not vary with time.

In a circuit containing energy storage elements, with change in excitation, the voltage and current change from one state to other state. The behaviour of the voltage or current when it is changed from one state to other is called transient state.

30. What is free and forced response.

When a circuit contains storage elements which are independent of the sources, the response depends upon the nature of the circuit. This response is called natural or free response.

The storage elements deliver the energy to the resistances. So, the response changes with time, gets saturated after some time. It is referred to as the transient response.

When we consider sources acting on a circuit, the response depends on the nature of such sources. This response is called forced response.

31. Find the laplace transform of $x(t) = u(t) + \delta(t)$

$L(x(t)) = L[\mathbf{u(t)}] + L[\boldsymbol{\delta(t)}]$

$= 1/s + 1 = (1+s)/s$

32. Write the integra-differential equation of an RLC series circuit with supply voltage E.

The integra-differential equation of an RLC series circuit with supply voltage E is given by

$$E = Ri + L\, di/dt + 1/C \int idt$$

33.In one time-constant, a capacitor discharges ……..percent of its initial charge.

Answer:63.2%

34.The power factor of the pure inductive circuit is …….

Answer: Zero.

35.Find the laplace transform of the following signals?

(i) $\delta(t)$ (ii) $u(t)$ (iii)$e^{-at}\, u(t)$

(i) $L[\boldsymbol{\delta(t)}] = \mathbf{1}$

(ii) $L[\mathbf{u(t)}] = \mathbf{1/s}$

(iii) $L[\mathbf{e^{-at}\, u(t)}] = \mathbf{1/s+a}$

UNIT 5: THREE PHASE CIRCUIT ANALYSIS

1. What is phase sequence?

Phase sequence of a polyphase system in the order in which the different phase quantities reach their maximum values.

2. What are the methods of connections of three phase windings?

The methods of connections of three phase windings are

(i) Independent connection.

(ii) Star connection.

(iii) Delta connection.

3. What is line current and Phase current?

The current flowing in the line is called the line current.
The current flowing in the phase is called the phase current.

4. What is line voltage and phase voltage?

The voltage between any two lines is called line voltage.
The voltage between any line and the neutral point is called the phase voltage

5. Give the line and phase values in star connection.

The relation between line voltage and phase voltage in a star connection is

$$E_L = \sqrt{3}\, E_{ph}$$

The relation between line current and phase current in a star connection is

$$I_L = I_{ph}$$

6. Give the line and phase values in delta connection.

The relation between line voltage and phase voltage in a delta connection is

$$E_L = E_{ph}$$

The relation between line current and phase current in a delta connection is

$$I_L = \sqrt{3}\, I_{ph}$$

7. Write few methods available for measuring power in a 3- phase load.

The few methods available for measuring power in a 3- phase load are

(i) One wattmeter method

(ii) Two wattmeter method

(iii) Three wattmeter method

8. List the methods used for power measurement with single wattmeter.

The methods used for power measurement with single wattmeter are

(i) Potential lead shift method.

(ii) T-method.

(iii) Artificial neutral method.

(iv) Current transformer method.

9. List the methods used for un balanced star connected load.

The methods used for un balanced star connected load are

(i) Equivalent delta method.

(ii) Mesh method.

(iii) Neutral voltage displacement method.

10. Write the expression for power factor in a balanced three phase circuit.

The expression for power factor in a balanced three phase circuit is given by

$$\text{Power factor} = \cos\left[\tan^{-1}\left(\sqrt{3}\,(W_2-W_1)/\,(W_1+W_2)\right)\right]$$

11. What are the advantages of three phase system?

(i) The generation and transmission of electrical power are more efficient.

(ii) The power transmission in a three phase circuit is constant rather than pulsating as in a single phase circuit.

(iii) Three phase motors start and run much better than single phase motors.

12. What is the power factor when two wattmeter readings are equal in a two wattmeter method of power measurement?

Power factor =1

13. Write expression for total power in a three phase system.

$$P_T = \sqrt{3}\, V_L I_L \cos\Phi$$

14. Write the expression for calculating real, reactive and apparent power of a three phase system.

i) Real power $P = \sqrt{3}\, V_L I_L \cos\Phi$
ii) Reactive power $Q = \sqrt{3}\, V_L I_L \sin\Phi$
iii) Apparent power $S = \sqrt{3}\, V_L I_L$

15. How are the wattmeter readings equal in two wattmeter method at UPF? Establish the condition mathematically.

$W_1 = E_L I_L \cos(30^\circ - \Phi^\circ)$

$W_2 = E_L I_L \cos(30^\circ + \Phi^\circ)$

Since $\Phi = 0$ at Unity power factor, $W1 = W_2$

16. **In a 3-phase circuit, what do you mean by balanced load?**
When the loads in all the phases are identical it is called balanced load.

17. When is a 3-phase supply system called balanced supply system?
When all the 3-phase voltages are equal in magnitude and displaced by 120° in space, the supply system is called 3-phase balanced system.

18. **In two wattmeter method of 3-phase power measurement, one of the meters gave reading after reversal of its current coil connection. What do you infer from this?**
The power factor is definitely less than 0.5.

19. **In two wattmeter method, what do you infer about the power factor when one wattmeter shows zero reading?**
The power factor is definitely 0.5.

20. What will be the readings of the two wattmeter used for measurement of power in a three – phase circuit at unity P.F?
$W_1 = (\sqrt{3}/2)\, E_L I_L$

$W_2 = (\sqrt{3}/2)\, E_L I_L$

i.e., Both wattmeter readings are equal to each other and each will read half the total power.

21. Compare balanced and unbalanced network.

Let the three – phase circuit consist of loads Z_1, Z_2 and Z_3 . If all the loads are equal in magnitude and phase angle and connected to a balanced supply system, it is called a balanced network.

If all the loads are different, it is called unbalanced network, even when the supply system is balanced.

e.g., for balanced load $Z_1 = Z_2 = Z_3$

for unbalanced load $Z_1 \neq Z_2 \neq Z_3$

22. **How can a wattmeter be used to measure reactive power?**

In case of balanced three phase circuit, the reactive power can be determined by using one wattmeter. The current coil of the wattmeter is connected in one line and its pressure coil is connected across the other two lines.

Let the reading of wattmeter be W_r.
Then the total reactive power = $\sqrt{3}\ W_r$

23. A three phase balanced star connected load has 400V line to line voltage and 10 amperes line current. Determine the line to neutral voltage and phase current.

Phase voltage = line voltage / $\sqrt{3}$ = 400 / $\sqrt{3}$ =231 volts
Phase current = line current = 10 amperes

********** ALL THE BEST**********

1. Kirchhoff s current law states that
(a) net current flow at the junction is positive
(b) Hebraic sum of the currents meeting at the junction is zero
(c) no current can leave the junction without some current entering it.
(d) total sum of currents meeting at the junction is zero
Ans: b

2. According to Kirchhoffs voltage law, the algebraic sum of all IR drops and e.m.fs. in any closed loop of a network is always
(a) negative
(b) positive
(c) determined by battery e.m.fs.
(d) zero
Ans: d

3. Kirchhoffs current law is applicable to only
(a) junction in a network
(b) closed loops in a network
(c) electric circuits
(d) electronic circuits
Ans: a

4. Kirchhoffs voltage law is related to
(a) junction currents
(b) battery e.m.fs.
(c) IR drops
(d) both (b) and (c)
(e) none of the above
Ans: d

5. Superposition theorem can be applied only to circuits having
(a) resistive elements
(b) passive elements
(c) non-linear elements
(d) linear bilateral elements
Ans: d

6. The concept on which Superposition theorem is based is
(a) reciprocity
(b) duality
(c) non-linearity
(d) linearity
Ans: d

7. Thevenin resistance Rth is found
(a) by removing voltage sources along with their internal resistances
(6) by short-circuiting the given two terminals
(c) between any two 'open' terminals
(d) between same open terminals as for Etk
Ans: d

8. An ideal voltage source should have
(a) large value of e.m.f.
(b) small value of e.m.f.
(c) zero source resistance
(d) infinite source resistance
Ans: c

9. For a voltage source
(a) terminal voltage is always lower than source e.m.f.
(b) terminal voltage cannot be higher than source e.m.f.
(c) the source e.m.f. and terminal voltage are equal
Ans: b

10. To determine the polarity of the voltage drop across a resistor, it is necessary to know
(a) value of current through the resistor
(b) direction of current through the resistor
(c) value of resistor
(d) e.m.fs. in the circuit
Ans: b

11. "Maximum power output is obtained from a network when the load resistance is equal to the output resistance of the network as seen from the terminals of the load". The above statement is associated with
(a) Millman's theorem
(b) Thevenin's theorem

(c) Superposition theorem
(d) Maximum power transfer theorem
Ans: d

12. “Any number of current sources in parallel may be replaced by a single current source whose current is the algebraic sum of individual source currents and source resistance is the parallel combination of individual source resistances”.
The above statement is associated with
(a) Thevenin’s theorem
(b) Millman’s theorem
(c) Maximum power transfer theorem
(d) None of the above
Ans: b

13. “In any linear bilateral network, if a source of e.m.f. E in any branch produces a current I in any other branch, then same e.m.f. acting in the second branch would produce the same current / in the first branch”.
The above statement is associated with
(a) compensation theorem
(b) superposition theorem
(c) reciprocity theorem
(d) none of the above
Ans: c

14. Which of the following is non-linear circuit parameter ?
(a) Inductance
(b) Condenser
(c) Wire wound resistor
(d) Transistor
Ans: a

15. A capacitor is generally a
(a) bilateral and active component
(b) active, passive, linear and nonlinear component
(c) linear and bilateral component
(d) non-linear and active component
Ans: c

16. “In any network containing more than one sources of e.m.f. the current in any branch is the algebraic sum of a number of individual fictitious currents (the number being equal to the number of sources of e.m.f.), each of which is due to separate action of each source of e.m.f., taken in order, when the remaining sources of e.m.f. are replaced by conductors, the resistances of which are equal to the internal resistances of the respective sources”.
The above statement is associated with

(a) Thevenin's theorem
(b) Norton's theorem
(c) Superposition theorem
(d) None of the above
Ans: c

17. Kirchhoff s law is applicable to
(a) passive networks only
(b) a.c. circuits only
(c) d.c. circuits only
(d) both a.c. as well d.c. circuits
Ans: d

18. Kirchhoff s law is not applicable to circuits with
(a) lumped parameters
(b) passive elements
(c) distributed parameters
(d) non-linear resistances
Ans: c

19. Kirchhoff s voltage law applies to circuits with
(a) nonlinear elements only
(b) linear elements only
(c) linear, non-linear, active and passive elements
(d) linear, non-linear, active, passive, time varying as wells as time-in-variant elements
Ans: d

20. The resistance LM will be
(a) 6.66 Q
(b) 12 Q
(c) 18Q
(d) 20Q
Ans: a

21. For high efficiency of transfer of power, internal resistance of the source should be
(a) equal to the load resistance
(b) less than the load resistance
(c) more than the load resistance
(d) none of the above
Ans: b

22. Efficiency of power transfer when maximum transfer of power c xerosis
(a) 100%
(b) 80%
(c) 75%

(d) 50%
Ans: d

23. If resistance across LM in Fig. 2.30 is 15 ohms, the value of R is
(a) 10 Q
(6) 20 Q
(c) 30 Q
(d) 40 Q
Ans: c

24. For maximum transfer of power, internal resistance of the source should be
(a) equal to load resistance
(b) less than the load resistance
(c) greater than the load resistance
(d) none of the above
Ans: a

25. If the energy is supplied from a source, whose resistance is 1 ohm, to a load of 100 ohms the source will be
(a) a voltage source
(b) a current source
(c) both of above
(d) none of the above
Ans: a

26. The circuit whose properties are same in either direction is known as
(a) unilateral circuit
(b) bilateral circuit
(c) irreversible circuit
(d) reversible circuit
Ans: b

27. In a series parallel circuit, any two resistances in the same current path must be in
(a) series with each other
(b) parallel with each other
(c) series with the voltage source.'
(d) parallel with the voltage source
Ans: a

28. The circuit has resistors, capacitors and semi-conductor diodes. The circuit will be known as
(a) non-linear circuit
(b) linear circuit
(c) bilateral circuit
(d) none of the above
Ans: a

29. A non-linear network does not satisfy
(a) superposition condition
(b) homogeneity condition
(c) both homogeneity as well as superposition condition
(d) homogeneity, superposition and associative condition
Ans: c

30. An ideal voltage source has
(a) zero internal resistance
(b) open circuit voltage equal to the voltage on full load
(c) terminal voltage in proportion to current
(d) terminal voltage in proportion to load
Ans: a

31. A network which contains one or more than one source of e.m.f. is known as
(a) linear network
(b) non-linear network
(c) passive network
(d) active network
Ans: c

32. The superposition theorem is applicable to
(a) linear, non-linear and time variant responses
(b) linear and non-linear resistors only
(c) linear responses only
(d) none of the above
Ans: c

33. Which of the following is not a nonlinear element ?
(a) Gas diode
(b) Heater coil
(c) Tunnel diode
(d) Electric arc
Ans:

34. Application of Norton's theorem to a circuit yields
(a) equivalent current source and impedance in series
(6) equivalent current source and impedance in parallel
(c) equivalent impedance
(d) equivalent current source
Ans: a

35. Millman's theorem yields
(a) equivalent resistance
(6) equivalent impedance
(c) equivalent voltage source

(d) equivalent voltage or current source
Ans: d

36. The superposition theorem is applicable to
(a) voltage only
(b) current “only
(c) both current and voltage
(d) current voltage and power
Ans: d

37. Between the branch voltages of a loop the Kirchhoff s voltage law imposes
(a) non-linear constraints
(b) linear constraints
(c) no constraints
(d) none of the above
Ans: b

38. A passive network is one which contains
(a) only variable resistances
(b) only some sources of e.m.f. in it
(c) only two sources of e.m.f. in it
(d) no source of e.m.f. in it
Ans: d

39. A terminal where three on more branches meet is known as
(a) node
(b) terminus
(c) combination
(d) anode
Ans: a

40. Which of the following is the passive element ?
(a) Capacitance
(b) Ideal current source
(c) Ideal voltage source
(d) All of the above
Ans: a

41. Which of the following is a bilateral element ?
(a) Constant current source
(b) Constant voltage source
(c) Capacitance
(d) None of the above
Ans: c

42. A closed path made by several branches of the network is known as
(a) branch

(b) loop
(c) circuit
(d) junction
Ans: b

43. A linear resistor having 0 < R < °o is a
(a) current controlled resistor
(6) voltage controlled resistor
(c) both current controlled and voltage controlled resistor
(d) none of the above
Ans: c

44. A star circuit has element of resistance R/2. The equivalent delta elements will be
(a) R/6
(b) fi?
(c) 2R
(d) 4R
Ans: b

45. A delta circuit has each element of value R/2. The equivalent elements of star circuit with be
(a) RIG
(b) R/3
(c) 2R
(d) 3R
Ans: a

56. In Thevenin's theorem, to find Z
(a) all independent current sources are short circuited and independent voltage sources are open circuited
(b) all independent voltage sources are open circuited and all independent current sources are short circuited
(c) all independent voltage and current sources are short circuited
(d) all independent voltage sources are short circuited and all independent current sources are open circuited
Ans: d

57. While calculating Rth in Thevenin's theorem and Norton equivalent
(a) all independent sources are made dead
(b) only current sources are made dead
(c) only voltage sources are made dead
(d) all voltage and current sources are made dead
Ans: a

58. The number of independent equations to solve a network is equal to
(a) the number of chords

(b) the number of branches
(c) sum of the number of branches and chords
(d) sum of number of branches, chords and nodes
Ans: a

59. The superposition theorem requires as many circuits to be solved as there are
(a) sources, nodes and meshes
(b) sources and nodes
(c) sources
(d) nodes
Ans: c

60. Choose the incorrect statement.
(a) A branch formed by the parallel connection of any resistor R and open circuit has the characteristic of an open circuit.
(b) A branch formed by the parallel connection of any resistor R and a short circuit has the characteristic of a short circuit.
(c) A branch formed by the series connection of any resistor R and an open circuit has the characteristic of an open circuit.
(d) A branch formed by the series connection of any resistor R and a short circuit has the characteristic of resistor R.
Ans: a

MAGNETIC CIRCUIT Multiple Choice Questions and Answers

1. An air gap is usually inserted in magnetic circuits to
(a) increase m.m.f.
(b) increase the flux
(c) prevent saturation
(d) none of the above
Ans: c

2. The relative permeability of a ferromagnetic material is
(a) less than one
(b) more than one
(c) more than 10
(d) more than 100 or 1000
Ans: d

3. The unit of magnetic flux is
(a) henry
(b) weber
(c) ampereturn/weber
(d) ampere/metre
Ans: b

4. Permeability in a magnetic circuit corresponds to_____in an electric circuit.
(a) resistance
(b) resistivity
(c) conductivity
(d) conductance
Ans: c

5. Point out the wrong statement.
Magnetic leakage is undesirable in electric machines because it
(a) lowers their power efficiency
(b) increases their cost of manufacture
(c) leads to their increased weight
(d) produces fringing
Ans: a

6. Relative permeability of vacuum is
(a) 1
(b) 1 H/m
(c) 1/4JI
(d) 4n x 10-‘ H/m
Ans: a

7. Permanent magnets are normally made of
(a) alnico alloys
(b) aluminium
(c) cast iron
(d) wrought iron
Ans: a

8. Energy stored by a coil is doubled when its current is increased by percent.
(a) 25
(b) 50
(c)41.4
(d) 100
Ans: c

9. Those magnetic materials are best suited for making armature and transformer cores which have_____permeability and_____hystersis loss.
(a) high, high
(b) low, high
(c) high, low
(d) low, low
Ans: c

10. The rate of rise of current through an inductive coil is maximum
(a) at 63.2% of its maximum steady value
(b) at the start of the current flow
(c) after one time constant
(d) near the final maximum value of current
Ans: b

11. When both the inductance and resistance of a coil are doubled the value of
(a) time constant remains unchanged
(b) initial rate of rise of current is doubled
(c) final steady current is doubled
(d) time constant is halved
Ans: a

12. The initial rate of rise of current through a coil of inductance 10 H when suddenly connected to a D.C. supply of 200 V is_____Vs
(a) 50
(b) 20
(c) 0.05
(d) 500
Ans: b

13. A material for good magnetic memory should have
(a) low hysteresis loss
(b) high permeability

(c) low retentivity
(d) high retentivity
Ans: d

14. Conductivity is analogous to
(a) retentivity
(b) resistivity
(c) permeability
(d) inductance
Ans: c

15. In a magnetic material hysteresis loss takes place primarily due to
(a) rapid reversals of its magnetisation
(b) flux density lagging behind magnetising force
(c) molecular friction
(d) it high retentivity
Ans: d

16. Those materials are well suited for making permanent magnets which have _____retentivity and_____coercivity.
(a) low, high
(b) high, high
(c) high, low
(d) low, low
Ans: b

17. If the area of hysteresis loop of a material is large, the hysteresis loss in this material will be
(a) zero
(b) small
(c) large
(d) none of the above
Ans: c

18. Hard steel is suitable for making permanent magnets because
(a) it has good residual magnetism
(b) its hysteresis loop has large area
(c) its mechanical strength is high
(d) its mechanical strength is low
Ans: a

19. Silicon steel is used in electrical machines because it has
(a) low coercivity
(b) low retentivity
(c) low hysteresis loss
(d) high coercivity
Ans: c

20. Conductance is analogous to
(a) permeance
(b) reluctance
(c) flux
(d) inductance
Ans: a

21. The property of a material which opposes the creation of magnetic flux in it is known as
(a) reluctivity
(b) magnetomotive force
(c) permeance
(d) reluctance
Ans: d

22. The unit of retentivity is
(a) weber
(b) weber/sq. m
(c) ampere turn/meter
(d) ampere turn
Ans: b

23. Reciprocal of reluctance is
(a) reluctivity
(b) permeance
(c) permeability
(d) susceptibility
Ans: b

24. While comparing magnetic and electric circuits, the flux of magnetic circuit is compared with which parameter of electrical circuit ?
(a) E.m.f.
(b) Current
(c) Current density
(d) Conductivity
Ans: b

25. The unit of reluctance is
(a) metre/henry
(b) henry/metre
(c) henry
(d) 1/henry
Ans: d

26. A ferrite core has less eddy current loss than an iron core because
(a) ferrites have high resistance
(b) ferrites are magnetic

1.The reactance offered by a capacitor to alternating current of frequency 50 Hz is If frequency is increased to 100 Hz, reactance becomes_____ohms.
(a) 2.5
(b) 5
(c) 10
(d) 15
Ans: c

2. The period of a wave is
(a) the same as frequency
(6) time required to complete one cycle
(c) expressed in amperes
(d) none of the above
Ans: b

3. The form factor is the ratio of
(a) peak value to r.m.s. value
(6) r.m.s. value to average value
(c) average value to r.m.s. value
(d) none of the above
Ans: b

4. The period of a sine wave is_____seconds.
Its frequency is
(a) 20 Hz
(b) 30 Hz
(c) 40 Hz
(d) 50 Hz
Ans: d

5. A heater is rated as 230 V, 10 kW, A.C. The value 230 V refers to
(a) average voltage
(b) r.m.s. voltage
(c) peak voltage
(d) none of the above
Ans: b

6. If two sinusoids of the same frequency but of different amplitudes and phase angles are subtracted, the resultant is
(a) a sinusoid of the same frequency
(b) a sinusoid of half the original frequency
(c) a sinusoid of double the frequency

(d) not a sinusoid
Ans: a

7. The peak value of a sine wave is 200 V. Its average value is
(a) 127.4 V
(b) 141.4 V
(c) 282.8 V
(d)200V
Ans: a

8. If two sine waves of the same frequency have a phase difference of JT radians, then
(a) both will reach their minimum values at the same instant
(b) both will reach their maximum values at the same instant
(c) when one wave reaches its maxi¬mum value, the other will reach its minimum value
(d) none of the above
Ans: c

9. The voltage of domestic supply is 220V. This figure represents
(a) mean value
(b) r.m.s. value
(c) peak value
(d) average value
Ans: a

10. Two waves of the same frequency have opposite phase when the phase angle between them is
(a) 360°
(b) 180°
(c) 90°
(d) 0°
Ans: b

11. The power consumed in a circuit element will be least when the phase difference between the current and
voltage is
(a) 180″
(b) 90°
(c) 60°
(d) 0°
Ans: b

12. The r.m.s. value and mean value is the same in the case of
(a) triangular wave
(6) sine wave
(c) square wave

(d) half wave rectified sine wave
Ans: c

13. For the same peak value which of the following wave will ‘have the highest r.m.s. value ?
(a) square wave
(b) half wave rectified sine wave
(c) triangular wave
(d) sine wave
Ans: a

14. For the same peak value, which of the following wave has the least mean value ?
(a) half wave rectified sine wave
(b) triangular wave
(c) sine wave
(d) square wave
Ans: a

15. For a sine wave with peak value Imax the r.m.s. value is
(a) 0.5 Imax
(b) 0.707
(c) 0.9
(d) 1.414 Lmax
Ans: b

16. Form Factor is the ratio of
(a) average value/r.m.s. value
(b) average value/peak value
(e) r.m.s. value/average value
(d) r.m.s. value/peak value
Ans: c

17. Form factor for a sine wave is
(a) 1.414
(b) 0.707
(c) 1.11
(d) 0.637
Ans: c

18. For a sine wave with peak value Emax_____8.30. the average value is
(a) 0.636 Emax
(b) 0.707 Emax
(c) 0.434 EWc
(d) lAUEmax
Ans: a

19. For a frequency of 200 Hz, the time period will be
(a) 0.05 s
(b) 0.005 s
(c) 0.0005 s
(d) 0.5 s
Ans: b

20. The phase difference between voltage and current wave through a circuit element is given as 30°. The essential condition is that
(a) both waves must have same frequency
(b) both waves must have identical peak values
(c) both waves must have zero value at the same time
(d) none of the above
Ans: a

21. The r.m.s. value of a sinusoidal A.C. current is equal to its value at an angle of_degrees.
(a) 90
(b) 60
(c) 45
(d) 30
Ans: c

22. Capacitive reactance is more when
(a) capacitance is less and frequency of supply is less
(b) capacitance is less and frequency of supply is more
(c) capacitance is more and frequency of supply is less
(d) capacitance is more and frequency of supply is more
Ans: a

23. In a series resonant circuit, the impedance of the circuit is
(a) minimum
(b) maximum
(c) zero
(d) none of the above
Ans: a

24. Power factor of an electrical circuit is equal to
(a) R/Z
(b) cosine of phase angle difference be-tween current and voltage
(c) kW/kVA
(d) ratio of useful current to total cur¬rent Iw/I
(e) all above
Ans: e

25. The best place to install a capacitor is
(a) very near to inductive load

(b) across the terminals of the inductive load
(c) far away from the inductive load
(d) any where
Ans: b

26. Poor power factor
(a) reduces load handling capability of electrical system
(b) results in more power losses in the electrical system
(c) overloads alternators, transformers and distribution lines
(d) results in more voltage drop in the line
(e) results in all above
Ans: e

27. Capacitors for power factor correction are rated in
(a) kW
(b) kVA
(c) kV
(d) kVAR
Ans: d

28. In series resonant circuit, increasing inductance to its twice value and reducing capacitance to its half value
(a) will change the maximum value of current at resonance
(6) will change the resonance frequency
(c) will change the impedance at resonance frequency
(d) will increase the selectivity of the circuit
Ans: d

29. Pure inductive circuit
(a) consumes some power on average
(b) does not take power at all from a line
(c) takes power from the line during some part of the cycle and then returns back to it during other part of the cycle
(d) none of the above
Ans: c

30. Inductance affects the direct current flow
(a) only at the time of turning off
(b) only at the time of turning on
(c) at the time of turning on and off
(d) at all the time of operation
Ans: c

31. Inductance of a coil Varies
(a) directly as the cross-sectional area of magnetic core
(b) directly as square of number of turns
(c) directly as the permeability of the core

(d) inversely as the length of the iron path
(e) as (a) to (d)
Ans: e

32. All the rules and laws of D.C. circuit also apply to A.C. circuit containing
(a) capacitance only
(b) inductance only
(c) resistance only
(d) all above
Ans: c

33. Time constant of an inductive circuit
(a) increases with increase of inductance and decrease of resistance
(b) increases with the increase of inductance and the increase of resistance
(c) increases with decrease of inductance and decrease of resistance
(d) increases with decrease of inductance and increase of resistance
Ans: a

34. Power factor of an inductive circuit is usually improved by connecting capacitor to it in
(a) parallel
(b) series
(c) either (a) or (b)
(d) none of the above
Ans: a

35. In a highly capacitive circuit the
(a) apparent power is equal to the actual power
(b) reactive power is more than the apparent power
(c) reactive power is more than the actual power
(d) actual power is more than its reactive power
Ans: c

36. Power factor of the following circuit will be zero
(a) resistance
(b) inductance
(c) capacitance
(d) both (b) and (c)
Ans: d

37. Power factor of the following circuit will be unity
(a) inductance
(b) capacitance
(c) resistance
(d) both (a) and (b)
Ans: c

38. Power factor of the system is kept high
(a) to reduce line losses
(b) to maximise the utilization of the capacities of generators, lines and transformers
(c) to reduce voltage regulation of the line
(d) due to all above reasons
Ans: d

39. The time constant of the capacitance circuit is defined as the time during which voltage
(a) falls to 36.8% of its final steady value
(b) rises to 38.6% of its final steady value
(c) rises to 63.2% of its final steady value
(d) none of the above
Ans: c

40. In a loss-free R-L-C circuit the transient current is
(a) oscillating
(b) square wave
(c) sinusoidal
(d) non-oscillating
Ans: c

41. The r.m.s. value of alternating current is given by steady (D.C.) current which when flowing through a given circuit for a given time produces
(a) the more heat than produced by A.C. when flowing through the same circuit
(b) the same heat as produced by A.C. when flowing through the same circuit
(c) the less heat than produced by A.C. flowing through the same circuit
(d) none of the above
Ans: b

42. The square waveform of current has following relation between r.m.s. value and average value.
(a) r.m.s. value is equal to average value
(b) r.m.s. value of current is greater than average value
(c) r.m.s. value of current is less than average value
(d) none of the above
Ans: a

43. The double energy transient occur in the
(a) purely inductive circuit
(b) R-L circuit
(c) R-C circuit
(d) R-L-C circuit
Ans: d

44. The transient currents are associated with the
(a) changes in the stored energy in the inductors and capacitors
(b) impedance of the circuit
(c) applied voltage to the circuit
(d) resistance of the circuit
Ans: a

45. The power factor at resonance in R-L- C parallel circuit is
(a) zero
(b) 0.08 lagging
(c) 0.8 leading
(d) unity
Ans: d

46. In the case of an unsymmetrical alternating current the average value must always be taken over
(a) unsymmetrical part of the wave form
(b) the quarter cycle
(c) the half cycle
(d) the whole cycle
Ans: d

47. In a pure resistive circuit
(a) current lags behind the voltage by 90°
(b) current leads the voltage by 90°
(c) current can lead or lag the voltage by 90°
(d) current is in phase with the voltage
Ans: d

48. In a pure inductive circuit
(a) the current is in phase with the voltage
(b) the current lags behind the voltage by 90°
(c) the current leads the voltage by 90°
(d) the current can lead or lag by 90°
Ans: b

49. In a circuit containing R, L and C, power loss can take place in
(a) C only
(b) L only
(c) R only
(d) all above
Ans: c

50. Inductance of coil
(a) is unaffected by the supply frequency
(b) decreases with the increase in supply frequency
(c) increases with the increase in supply frequency

(d) becomes zero with the increase in supply frequency
Ans: c

51. In any A.C. circuit always
(a) apparent power is more than actual power
(b) reactive power is more than apparent power
(c) actual power is more than reactive power
(d) reactive power is more than actual power
Ans: a

52. Which of the following circuit component opposes the change in the circuit voltage ?
(a) Inductance
(b) Capacitance
(c) Conductance
(d) Resistance
Ans:

53. In a purely inductive circuit
(a) actual power is zero
(b) reactive power is zero
(c) apparent power is zero
(d) none of above is zero
Ans: a

54. Power factor of electric bulb is
(a) zero
(b) lagging
(c) leading
(d) unity
Ans: d

55. Pure inductive circuit takes power from the A.C. line when
(a) applied voltage decreases but current increases
(b) applied voltage increases but current decreases
(c) both applied voltage and current increase
(d) both applied voltage and current decrease
Ans: a

56. Time constant of a circuit is the time in seconds taken after the application of voltage to each
(a) 25% of maximum value
(b) 50% of maximum value
(c) 63% of maximum value
(d) 90% of the maximum value
Ans: c

57. Time constant of an inductive circuit
(a) increases with increase of inductance and decrease of resistance
(b) increases with the increase of inductance and the increase of resistance
(c) increases with the decrease of inductance and decrease of resistance
(d) increases with decrease of inductance and increase of resistance
Ans: a

58. Time constant of a capacitive circuit
(a) increases with the decrease of capacitance and decrease of resistance
(b) increases with the decrease of capacitance and increase of resistance
(c) increases with the increase of capacitance and decrease of resistance
(d) increase with increase of capacitance and increase of resistance
Ans: d

59. Magnitude of current at resonance in R-L-C circuit
(a) depends upon the magnitude of R
(b) depends upon the magnitude of L
(c) depends upon the magnitude of C
(d) depends upon the magnitude of R, Land C
Ans: a

60. In a R-L-C circuit
(a) power is consumed in resistance and is equal to I R
(b) exchange of power takes place between inductor and supply line
(c) exchange of power takes place between capacitor and supply line
(d) exchange of power does not take place between resistance and the supply line
(e) all above are correct
Ans: e

61. In R-L-C series resonant circuit magnitude of resonance frequency can be changed by changing the value of
(a) R only
(b) L only
(c)C only
(d)LorC
(e) R,LorC
Ans: d

62. In a series L-C circuit at the resonant frequency the
(a) current is maximum
(b) current is minimum
(c) impedance is maximum
(d) voltage across C is minimum
Ans: a

63. The time constant of a series R-C circuit is given by
(a) R/C

(b) RC2
(c) RC
(d) R2C
Ans: c

64. If resistance is 20 Q. and inductance is 27 in a R-L series circuit, then time constant of this circuit will be
(a) 0.001 s
(b) 0.1 s
(c) 10 s
(d) 100 s
Ans: b

65. Which of the following coil will have large resonant frequency ?
(a) A coil with large resistance
(b) A coil with low resistance
(c) A coil with large distributed capacitance
(d) A coil with low distributed capacitance
Ans: c

66. If a sinusoidal wave has frequency of 50 Hz with 30 A r.m.s. current which of the following equation represents this wave ?
(a) 42.42 sin 3141
(b) 60 sin 25 t
(c) 30 sin 50 t
(d) 84.84 sin 25 t
Ans: a

67. The safest value of current the human body can carry for more than 3 second is
(a) 4 mA
(b) 9 mA
(c) 15 mA
(d) 25 mA
Ans: b

68. A pure inductance connected across 250 V, 50 Hz supply consumes 100 W. This consumption can be attributed to
(a) the big size of the inductor
(b) the reactance of the inductor
(c) the current flowing in the inductor
(d) the statement given is false
Ans: d

69. The input of an A.C. circuit having power factor of 0.8 lagging is 40 kVA The power drawn by the circuit is
(a) 12 kW

(b) 22 kW
(c) 32 kW
(d) 64 kW
Ans: c

70. The effective resistance of an iron-cored choke working on ordinary supply frequency is more than its true resistance because of
(a) iron loss in core
(b) skin effect
(c) increase in temperature
(d) capacitive effect between adjacent coil turns
Ans: a

71. In an AC. circuit, a low value of kVAR compared with kW indicates
(a) low efficiency
(b) high power factor
(c) unity power factor
(d) maximum load current
Ans: b

72. In AC. circuits, laminated iron is invariably used in order to
(a) reduce eddy current loss
(b) increase heat radiation
(c) make assembly cheap and easier
(d) reduce circuit permeability
Ans: a

73. The ratio of active power to apparent power is known as factor.
(a) demand
(b) load
(c) power
(d) form
Ans: c

74. All definitions of power factor of a series R-L-C circuit are correct except
(a) ratio of net reactance and impedance
(b) ratio of kW and kVA
(c) ratio of J and Z
(d) ratio of W and VA
Ans: a

75. The apparent power drawn by an A.C. circuit is 10 kVA and active power is 8 kW. The reactive power in the circuit is
(a) 4 kVAR
(b) 6 kVAR
(c) 8 kVAR

(d) 16 kVAR
Ans: b

76. What will be the phase angle between two alternating waves of equal frequency, when one wave attains maximum value the other is at zero value ?
(a) 0°
(b) 45°
(c) 90°
(d) 180°
Ans: c

77. The purpose of a parallel circuit resonance is to magnify
(a) current
(b) voltage
(c) power
(d) frequency
Ans: b

78. In an A.C. circuit power is dissipated in
(a) resistance only
(b) inductance only
(c) capacitance only
(d) none of the above
Ans: a

79. In a parallel R-C circuit, the current always_____the applied voltage
(a) lags
(b) leads
(c) remains in phase with
(d) none of the above
Ans: b

80. At very low frequencies a series R-C circuit behaves as almost purely
(a) resistive
(b) inductive
(c) capacitive
(d) none of the above
Ans: c

81. Skin effect occurs when a conductor carries current at_____frequencies.
(a) very low
(b) low
(c) medium
(d) high
Ans: d

82. At_____frequencies the parallel R-L circuit behaves as purely resistive.
(a) low
(b) very low
(c) high
(d) very high
Ans: d

83. In a sine wave the slope is constant
(a) between 0° and 90°
(b) between 90° and 180°
(c) between 180° and 270°
(d) no where
Ans: d

84. The power is measured in terms of decibles in case of
(a) electronic equipment
(b) transformers
(c) current transformers
(d) auto transformers
Ans: a

85. Capacitive susceptance is a measure of
(a) reactive power in a circuit
(b) the extent of neutralisation of reactive power in a circuit
(c) a purely capacitive circuit's ability to pass current
(d) a purely capacitive circuit's ability to resist the flow of current
Ans: c

86. Which of the following statements pertains to resistors only ?
(a) can dissipate considerable amount of power
(6) can act as energy storage devices
(c) connecting them in parallel in¬creases the total value
(d) oppose sudden changes in voltage
Ans: a

87. Which of the following refers to a parallel circuit ?
(a) The current through each element is same
(b) The voltage across element is in proportion to it's resistance value
(c) The equivalent resistance is greater than any one of the resistors
(d) The current through any one element is less than the source current
Ans: d

88. Aphasoris
(a) a line which represents the magnitude and phase of an alternating quantity
(b) a line representing the magnitude and direction of an alternating quantity
(c) a coloured tag or band for distinction between different phases of a 3-phase supply

(d) an instrument used for measuring phases of an unbalanced 3-phase load
Ans: a

89. A parallel AC. circuit in resonance will
(a) have a high voltage developed across each inductive and capacitive section
(b) have a high impedance
(c) act like a resistor of low value
(d) have current in each section equal to the line current
Ans: b

90. Wire-wound resistors are unsuitable for use at high frequencies because they
(a) create more electrical noise
(b) are likely to melt under excessive eddy current heat
(c) consume more power
(d) exhibit unwanted inductive and capacitive effects
Ans: d

91. The inductance of a coil can be increased by
(a) increasing core length
(b) decreasing the number of turns
(c) decreasing the diameter of the former
(d) choosing core material having high relative permeability
Ans: d

92. In a three-phase supply floating neutral is undesirable because it way give rise to
(a) high voltage across the load
(b) low voltage across the load
(c) unequal line voltages across the load
Ans: c

93. Which of the following waves has the highest value of peak factor ?
(a) Square wave
(b) Sine wave
(c) Half wave rectified sine wave
(d) Triangular wave
Ans: c

94. The frequency of domestic power supply in India is
(a) 200 Hz
(b) 100 Hz
(c) 60 Hz
(d) 50 Hz
Ans: d

95. The r.m.s. value of half wave rectified sine wave is 200 V. The r.m.s. value of full wave rectified AC. will be

(a) 282.8 V
(b) 141.4 V
(c) 111 V
(d) 100 V
Ans: a

96. The r.m.s. value of pure cosine function is
(a) 0.5 of peak value
(b) 0.707 of peak value
(c) same as peak value
(d) zero
Ans: b

97. Ohm is unit of all of the following except
(a) inductive reactance
(b) capacitive reactance
(c) resistance
(d) capacitance
Ans: d

98. The series and parallel resonance on L-C circuit' differs in that
(a) series resistance needs a low-resistance source for sharp rise in current
(b) series resonance needs a high-resistance source for sharp increase in current
(c) parallel resonance needs a low-resistance source for a sharp in¬crease in impedance
(d) parallel resonance needs a low-resistance source for a sharp rise in line current
Ans: a

99. The phosphors for which of the following pair are 180° out of phase for VL, VC and VR?
(a) Vc and VR
(b) VL and VR
(c) Vc and VL
(d) none of the above
Ans: c

100. The frequency of an alternating current is
(a) the speed with which the alternator runs
(b) the number of cycles generated in one minute
(c) the number of waves passing through a point in one second
(d) the number of electrons passing through a point in one second
Ans: c

101. A pure capacitor connected across an A.C. voltage consumed 50 W. This is due to
(a) the capacitive reactance in ohms

(b) the current flowing in capacitor
(c) the size of the capacitor being quite big
(d) the statement is incorrect
Ans: d

102. The power factor of a D.C. circuit is always
(a) less than unity
(b) unity
(c) greater than unity
(d) zero
Ans: b

103. The product of apparent power and cosine of the phase angle between circuit voltage and current is
(a) true power
(b) reactive power
(c) volt-amperes
(d) instantaneous power
Ans: a

104. The equation of 50 Hz current sine wave having r.m.s. value of 60 A is
(a) 60 sin 25 t
(b) 60 sin 50 t
(c) 84.84 sin 3141
(d) 42.42 sin 314 t
Ans: c

105. An A.C. voltage is impressed across a pure resistance of 3.5 ohms in parallel with a pure inductance of impedance of 3.5 ohms,
(a) the current through the resistance is more
(b) the current through the resistance is less
(c) both resistance and inductance carry equal currents
(d) none of the above
Ans: c

106. In a pure inductive circuit if the supply frequency is reduced to 1/2, the current will
(a) be reduced by half
(b) be doubled
(c) be four times as high
(d) be reduced to one fourth
Ans: b

118. In a pure capacitive circuit if the supply frequency is reduced to 1/2, the current will
(a) be reduced by half
(b) be doubled

(c) be four times at high
(d) be reduced to one fourth
Ans: a

119. When an alternating current passes through an ohmic resistance the electrical power converted into heat is
(a) apparent power
(b) true power
(c) reactive power
(d) none of the above
Ans: b

120. In each of the three coils of a three phase generator, an alternating voltage having an r.m.s. value of 220 V is induced. Which of the following values is indicated by the voltmeters ?
(a) 220 V
(b) 220V3V
(c) 220/V3 V
(d) none of the above
Ans: a