

**NOORUL ISLAM COLLEGE OF ENGINEERING
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**

SHORT QUESTIONS AND ANSWERS

EC 1202 - CIRCUIT ANALYSIS

III Semester Electronics & Communication Engineering

Verified By,

HOD/EEE

Prepared By,

Mr. TIBBIE PON SYMON .V.A

Mr. BEN JOHN STEPHEN.S

Lecturers/EEE

UNIT 1

CIRCUIT ANALYSIS

1 What is a graph of a network ?

When all the elements in a network is replaced by lines with circles or dots at both ends.

2 What is tree of a network?

It is an interconnected open set of branches which include all the nodes of the given graph.

3 Properties of a tree in a graph

- It consist of all the nodes of the graph
- If the graph has N no: of nodes the tree will have N-1 branches
- There will be no closed path in the tree
- There can be many possible different trees for a given graph depending on the no: of nodes and branches

4 Define Ohms Law.

The potential difference across any two ends of a conductor is directly proportional to the current flowing between the two ends provided the temperature of the conductor remains constant.

5 Define quality factor.

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

6 What are half power frequencies?

In RLC circuits the frequencies at which the power is half the max /min power are called half power frequencies.

7 Define selectivity.

It is defined as the ratio of bandwidth and resonant frequency.

8 Write the characteristics of series resonance.

- a) At resonance impedance is mim and equal to resistance therefore current is max.
- b) Before resonant frequency the circuit behave as capacitive circuit and above resonant frequency the circuit will behave as inductive circuit.
- c) At resonance the magnitude of voltage across inductance and capacitance will be Q times the supply voltage but they are in phase opposition.

9 What is anti resonance.

In RLC parallel circuit the current is min at resonance whereas in series resonance the current is max. therefore the parallel resonance is called anti resonance.

10 Define Ohms law

The potential difference across any two ends of a conductor is directly proportional to the current flowing between the two ends provided the temperature of the conductor remains constant.

11 Write the characteristics of parallel resonance.

- a) At resonance admittance is min and equal to conductance therefore the current is min.
- b) Below resonant frequency the circuit behave as inductive circuit and above resonant frequency the circuit behave as capacitive circuit.
- c) 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.

12. Define KCL

- KCL states that the algebraic sum of currents in a node is zero.

13. Define KVL.

- KVL states that the algebraic sum of voltages in a closed path is zero.

14. What is meant by linear and nonlinear elements?

Linear elements shows linear characteristic of voltage Vs Current.
Nonlinear element the Current passing through it does not change linearly with the linear change in applied voltage at a particular frequency

15. What is meant by active and Passive elements?

If a circuit element has the capability of enhancing the energy level of a signal passing thorough it is called an active element.
Passive elements do not have any intrinsic means of signal boosting.

16. Unilateral and bi lateral elements

If the magnitude of the current passing through an element is affected due to change in the polarity of the applied voltage is called Uni lateral elements.

If the current magnitude remains the same even if the applied EMFs polarity is changed is called bilateral elements.

17. What is a Dual Network?

In an electrical circuit itself there are pairs of terms, which can be interchanged to get new circuits. Such pair of dual terms is given below

Current – voltage
Open – Short
L – C
R – G
Series – Parallel
Voltage source – Current source
KCL – KVL

18. Steps to draw a Dual Network.

- In each loop of a Network place a node
- Draw the lines connecting adjacent nodes passing through each element and also to the reference node

19. What is Band width and Selectivity ?

The frequency band within the limits of lower and upper half frequency is called Bandwidth.

$$B.W = f_2 - f_1$$

Selectivity is the ratio of f_r to the B.W

$$\text{Selectivity} = f_r / (f_2 - f_1)$$

20. Properties of a series RLC circuit.

- The applied voltage and the resulting current are in phase, which also means that the p.f of RLC circuit is unity.
- The net reactance is zero at resonance and the impedance does have the resistive part only.
- The current in the circuit is max: and is V/R amperes
- At resonance the circuit has got minimum impedance and max: current
- Frequency of resonance is given by $f_r = 1/(2\pi\sqrt{LC})$

21. Properties of a parallel RLC circuit.

- PF is unity
- Current at resonance is $(V/(L/RC))$ and is in phase with the applied voltage. The value of current at resonance is minimum.
- Net impedance at resonance is max: & is equal to L/RC
- The admittance is min: and the net susceptance is zero at resonance.

UNIT 2

NETWORK THEOREMS AND TRANSFORMATIONS

1 State superposition theorem.

It states that the response of a linear circuit with multiple sources is given by algebraic sum of responses due to individual sources acting alone.

2 State Thevenin's theorem.

It states that any linear bilateral network can be replaced by a single voltage source, V_{th} , in series with a single impedance, Z_{th}

3 State Norton's theorem.

It states that any linear bilateral network can be replaced by a single Current source, I_N , in parallel with a single impedance, Z_{th}

4 State max power transfer theorem.

Max. Power is transferred to load impedance if the Load impedance is the complex conjugate of the source impedance.

5 State reciprocity theorem.

It states that in a linear, bilateral ,single source circuit the ratio of excitation to the response is constant when the position of excitation and response are interchanged.

6 State compensation theorem.

- a. Let I be the current through an impedance Z in a branch of circuit.
- b. It states that the change in current due to change in impedance in a branch will be produced by a compensation voltage source in the same branch with polarity opposing the original current.

7 State Millman's theorem.

It states that if n number of voltage sources with internal impedance are in parallel then they can be combined to give a voltage source with an equivalent emf and internal impedance.

8 State Tellegen's theorem.

It states that the summation of all the product of branch voltage and its current of a circuit is zero.

9 Steps to solve Superposition Theorem

- Take only one independent voltage or current source
- Obtain the branch currents
- Repeat the above for other sources
- To determine the net branch current just add the currents obtained above.

10 Steps to solve Thevenin's Theorem

- Remove the load resistance and find the open circuit voltage V_{OC}
- Deactivate the constant sources (for voltage source remove it by internal resistance & for current source delete the source by OC) and find the internal resistance (R_{TH}) of the source side looking through the open circuited load terminals
- Obtain the Thevenin's equivalent circuit by connecting V_{OC} in series with R_{TH}
- Re connect the load resistance across the load terminals

11 Steps to solve Norton's Theorem

- Remove the load resistor and find the internal resistance of the source N/W by deactivating the constant source
- Short the load terminals and find the short circuit current
- Norton's equivalent circuit is drawn by keeping R_{TH} in parallel with I_{SC}

12 What is the load current in a Norton's circuit?

$$I_L = (I_{SC} \cdot R_{TH}) / (R_{TH} + R_L)$$

13 What is the load current in a Thevenin's circuit?

$$I_L = V_{OC} / (R_{TH} + R_L)$$

14 What is the max power in a circuit ?

$$\text{Max: power} = V_{OC}^2 / 4 R_{TH}$$

15 What is the power equation of Tellegen's Theorem?

$$\sum V_b I_b = 0, \text{ where } b=1 \text{ to } n$$

16 Steps to solve Reciprocity Theorem

- The branches b/w which reciprocity is to be established are to be selected first
- The current in the branch is obtained using conventional n/w analysis
- The voltage source is interchanged b/w the branches concerned
- The current in the branch where the voltage source was existing earlier is calculated

17 Steps to solve Max: power transfer Theorem

- Remove the load resistance and find Thevenin's resistance
- Find the V_{TH}
- Max: power is given by $V_{OC}^2 / 4 R_{TH}$

18 What is critical resistance?

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

19 What is meant by linear and nonlinear elements?

Linear elements shows linear characteristic of voltage Vs Current.

Nonlinear element the Current passing through it does not change linearly with the linear change in applied voltage at a particular frequency

UNIT 3 RESPONSE OF ELECTRIC CIRCUITS

1 What is transient?

The state of the circuit from the instant of switching to attainment of steady state is called transient state.

2 Why transients occurs in electric circuits.

The inductance will not allow sudden change in current and the capacitance will not allow sudden change in voltage. Hence in inductive and capacitive circuits transient occurs during switching operation.

3 What is free and forced response.

The response of the circuit due to stored energy alone is called free response. The response of a circuit due to an external source is called forced response.

4 What is complementary function?

The part of the response which becomes zeroes as t tends to infinite is called complementary function.

5 What is particular solution?

The part of the solution which attains a steady value as t tends to infinity is called particular solution.

6 Define time constant of RL circuit.

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

7 Define time constant of RC circuit.

The time constant 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.

8 What is damping ratio.

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

9 What is critical damping.

It 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.

10 What is critical resistance?

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

11 Define ideal voltage source.

In ideal conditions the voltage across a voltage source should be constant for whatever current delivered by the source.

12 Define ideal current source.

It should deliver constant current for whatever voltage across its terminals.

13 What is natural and damped frequency.

- a. The response of a circuit is completely oscillatory with a frequency in the absence of resistance and this frequency is called natural frequency.
- b. The response of under damped circuit is oscillatory with a frequency and these oscillations are damped as t tends to infinity. The frequency of response is called damped frequency.

14 What is meant by source transformation?

The voltage source can be converted in to equivalent practical current source and vice versa with same terminal behavior.

15 What is a band pass filter?

A band pass filter is one which passes frequencies between two designated cut-off frequency and attenuates all other frequencies.

16 What s an Ideal filter?

An Ideal filter should have Zero attenuation in the pass band.

17 What s a band elimination filter?

A band elimination filter is one frequencies lying b/w f_1 and f_2 are attenuated and all other frequencies are passed.

18 What does series aiding mean.

When two coils are connected in series the current enters at dotted end in both the coils and so the self and mutual induced emf will have same polarity.

19 What does series opposing mean.

When two coils are connected in series the current enters at dotted end in one coils and leaves at another coil so the self and mutual induced emf will have opposite polarity.

20 What is property of additivity and homogeneity.

- i) The property of additivity says that the response in a circuit due to number of sources is given by the sum of individual sources acting alone.
- ii) The property of homogeneity says that if all the sources are multiplied by a constant then the response is also multiplied by the same constant

21 What are ideal elements?

The ideal elements are resistors which oppose the flow of current, the inductor opposes to change in current. Capacitor offers only opposition to change in voltage.

UNIT 4

COUPLED AND THREE PHASE CIRCUITS

1 What are coupled circuits.

It refers to circuits involving elements with magnetic coupling. If the flux produced by an element of a circuit links other elements of the same circuit then the elements are said to be magnetic coupling.

2 What are coupled coils.

When two or more coils are linked by magnetic flux, then the coils are called coupled coils.

3 Define self-inductance.

When permeability is constant the self inductance of a coil is defined as the ratio of flux linkage and current.

4 Define mutual inductance.

When permeability is constant the mutual inductance between two coupled coils is defined as the ratio of flux linkage in one coil due to common flux and current through another coil.

5 Define coefficient of coupling.

In coupled coils the coefficient of coupling is defined as the fraction of the total flux produced by one coil linking another coil.

6 What is DOT convention?

The sign of mutual induced emf depends on the winding sense and the current through the coil. The winding sense is decided by the manufacturer and to inform the user about the winding sense a dot is placed at one end of each coil. When current enter at dotted end in one coil then the mutual induced emf in the other coil is positive at dot end.

7 State dot rule for coupled coils.

- a. It states that in coupled coils current entering at the dotted terminal of one coil induce an emf in second coil which is +ve at dotted terminal of second coil.
- b. Current entering at the un dotted terminal of one coil induce an emf in second coil which is +ve at un dotted terminal of second coil.

8 What is balanced voltage.

In poly phase system when the magnitude of phase voltages are equal and the phase difference between consecutive phasors are equal then the voltages are called balanced voltages.

9 What are balanced impedance.

When the impedances of all the phases of a three-phase load are equal then the impedances are called balanced impedance.

10 What is phase sequence?

In a set of rotating phasors, the order of reaching reference point is called phase sequence.

11 Write the relation between the line and phase value of voltage and current in a balanced star connected load.

In star connected load the line current and phase current are same. In balanced star connected system the magnitude of line is $\sqrt{3}$ times the phase voltage and it leads the phase voltage by 30degree.

12 Write the relation between the line and phase voltage of voltage current in a balanced delta connected load.

In a delta connected system the line voltage and phase voltage are same. In balanced delta connected load the magnitude of line current is $\sqrt{3}$ times the phase current and it lags the phase current by 30 degree.

13 What is neutral shift voltage?

In three wire star connected load ,the load neutral is not connected to source neutral. Therefore when the load is unbalanced the load neutral will not be at zero potential. The voltage of load neutral with respect to source neutral is called neutral shift voltage.

14 Write the relation between the power factor and wattmeter readings in two-wattmeter method of power measurement.

- a. When the wattmeter readings are equal the power factor is unity.
- b. When one of the wattmeter reading is zero the power factor is 0.5.
- c. When both the readings are +ve the pf will be greater than 0.5.

15 What are ideal elements?

The ideal elements are resistors which oppose the flow of current, the inductor opposes to change in current. Capacitor offers only opposition to change in voltage.

16 Define energy.

It is the capacity to do work.

17 Define power.

It is the rate at which work is done.

18 Define charge.

It is the characteristic property of the elementary particles of the matter.

19 What is meant by source transformation?

The voltage source can be converted in to equivalent practical current source and vice versa with same terminal behavior.

20 Define form factor.

It is the ratio between rms voltage and average value of a periodic wave form.

21 Define peak factor.

It is the ratio of peak value and the rms value of a periodic waveform.

UNIT 5

TWO PORT NETWORKS AND FILTERS

1. What is a Filter?

A Filter is an electrical network that can transmit signals within a specified frequency range

2. What is cutoff frequency?

The frequency that separates the pass and attenuation bands

3. What is an Ideal filter?

An Ideal filter would transmits signals under the pass band frequencies without attenuation and completely suppressed the signal with attenuation band of frequencies with sharp cutoff profile.

4. What is meant by practical filters?

Practical filters do not ideally transmit the pass band signal un attenuated due to absorption reflection or due to other loss

5. What are the properties of filters

- Characteristic impedance
- Pass band characteristic
- Cutoff frequency characteristic

6. What are the use of Filters?

- Used in various stages in TV receivers
- Audio amplifiers
- Electronic measuring equipments
- In thyristor controlled circuits
- In AM detection

7. Classification of Filters.

- Lowpass filter
- Highpass filter
- Bandpass filter
- Band stop filter

8. What is driving point impedance?

It is defined as the ratio of transform voltage to current at the same port.

9. What is Transfer impedance?

It is defined as the ratio of transform voltage at one port to the current transform at the other port.

10. What is the condition for a stable system?

The system is said to be stable if and only if all the poles does not lie on the right half of the s-plane.

11. What is a TWO PORT n/w?

A Two port n/w is simply a n/w inside a black box and the n/w has only two pairs of accessible terminals, one pair is for input and the other for output. Such a building block is common in electronic system, power transmission system

12. What is Z-parameters?

$$\text{We have } \begin{bmatrix} z_{11} & z_{12} \\ z_{21} & z_{22} \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} V_1 \\ V_2 \end{bmatrix}$$

Where $\begin{bmatrix} z_{11} & z_{12} \\ z_{21} & z_{22} \end{bmatrix}$ are the Z parameters.

13. What are Y- parameters?

We have
$$\begin{bmatrix} y_{11} & y_{12} \\ y_{21} & y_{22} \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = \begin{bmatrix} I_1 \\ I_2 \end{bmatrix}$$

Where $\begin{bmatrix} y_{11} & y_{12} \\ y_{21} & y_{22} \end{bmatrix}$ is called as Y parameters or short circuit parameters.

14. What are ABCD parameters?

Where $\begin{bmatrix} A & B \\ C & D \end{bmatrix}$ is the ABCD parameters or transmission parameters

15. What are hybrid parameters?

We have
$$\begin{bmatrix} h_{11} & h_{12} \\ h_{21} & h_{22} \end{bmatrix} \begin{bmatrix} I_1 \\ V_2 \end{bmatrix} = \begin{bmatrix} V_1 \\ I_2 \end{bmatrix}$$

Where $\begin{bmatrix} h_{11} & h_{12} \\ h_{21} & h_{22} \end{bmatrix}$ is the hybrid parameters

16. Which parameter is widely used in transmission line theory?

ABCD parameters

17. What is the condition for reciprocity for Z and Y parameters?

$$Z_{12}=Z_{21} \text{ and } Y_{12}=Y_{21}$$

18. What is the condition for symmetry for Z and Y parameters?

$$Z_{11}=Z_{22} \text{ and } Y_{11}=Y_{22}$$

19. What is a low pass filter?

A low pass filter is one which passes all the frequencies upto cut off frequency, and attenuates all other frequencies.

20. What is a high pass filter?

A high pass filter is one which attenuates all the frequencies below a designated cutoff frequency and passes all frequencies above cut-off.

16 MARKS QUESTION

1. Explain different types of powers and draw the power triangle?
2. Explain over damped, under damped and critically damped conditions for a series RLC circuit?
3. Derive an expression for the DC transient for RC circuit and also for voltage and power across each element?
4. what is meant by the term time constant?
5. Define poles and zeroes of a system?
6. write an expression for calculating real, reactive and apparent power in an ac circuit?
7. State superposition theorem and reciprocity theorems with examples?
8. State thevenin's theorem and Norton's theorems with examples?
9. Explain Kirchhoff's Voltage and Current laws with examples?
10. Find the equivalent delta for a star system?
11. Tabulate the analogy between magnetic and electric circuit?
12. Explain in detail about the Mutual inductance self inductance and coupling and coefficient of coupling?
13. Explain the open circuit and short circuit parameters in a two port network?
14. Explain the hybrid parameters and transmission parameters in a two port network?
15. What is image parameters and explain in detail?
16. What is a filter? Give the types.
17. Explain in detail the types of filters?
18. Which system draws less current if one system is star connected and the other is delta connected when they have equal resistance? And find the power loss in the system?
19. What do the Fourier coefficient represent? And explain in detail.
20. Give the Laplace transform equation for a step, ramp, parabolic and impulse functions?
21. Derive an expression for current $i(t)$ for series R-L circuit when the step input is applied?
22. Derive the response equation for a series RLC circuit/
23. Derive the response equation for a parallel RLC circuit?
24. Derive the relation between coefficient of coupling and the self inductance and mutual inductance?
25. Explain in detail about the time constant in RL circuit and explain about the dual and duality of a circuit
