VETRI VINAYAHA COLLEGE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

I-YEAR/II-SEMESTER- EEE&ECE

EE6201- CIRCUIT THEORY

Two Marks with Answers

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UNIT- I- BASIC CIRCUITS ANALYSIS

1. What is a graph of network?

When all elements in a network are replaced by lines with circles of dos 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. Give the properties of tree in a graph.

* It consists of all the nodes of the graph
* If the graph has N no of nodes the tree will have N-I 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. Define KCL

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

7. Define KVL

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

8. What is meant by linear and nonlinear elements?

Linear element shows the linear characteristics of voltage Vs current. Nonlinear element the current passing through it does not change linearity with the linear change in applied voltage at a particular frequency.

9. What is meant by active and passive elements?

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

10. Mention the disadvantages of Ohm's Law.

It does not apply to all non metallic conductors It also does not apply to non linear devices such as zener diode, vacuum tubes etc.It is true for metal conductors at constant temperature. If the temperature changes the law is not applicable.

11. What is a super node?

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

12. What is principle node?

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

13. What is a closed path?

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

14. State voltage division rule.

Voltage across a resistor in 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.

15. State current division rule.

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

16. Define mesh.

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

17. What is a planar circuit?

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

18. Define super mesh.

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

UNIT- II -NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS

1. Sate superposition theorem.

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

2. State Thevenins theorem

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

4. State maximum 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 w en the position of excitation and response are interchanged.

10. State the steps to solve the Thevenin's theorem.

Remove the load resistance and find the open circuit voltage V_{OC} Deactivate the consta t sources (fro 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} Reconnect the load resistance across the load terminals.

11.State the steps to solve the 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?

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

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

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

14. What is the maximum power in a circuit?

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

15. Write some applications of maximum power transfer theorem.

Power amplifiers Communication system Microwave transmission

16.What is the limitation of superposition theorem?

This theorem is valid only for linear systems. This theorem can be applied for calculating the current through or voltage across in particular element. But this superposition theorem is not applicable for calculation of the power.

17. What are the limitations of maximum power transfer theorem?

The maximum efficiency can be obtained by using this theorem is only 50% . It is because of 50% of the power is unnecessarily wasted in Rth.Therefore this theorem only applicable for communication circuits and not for power circuits where efficiency is greater importance rather than power delivered.

18. State voltgae division rule.

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

$$V_1=(R_1)*V/ (R_1+R_2)$$

19. State current division rule.

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.

$$I_1=(R_2)*I/(R_1+R_2)$$

20. Define source transformtion.

The current and voltage sources may be inter changed without affecting the remainder of the circuit, this technique is the source transformation. It is the tool for simplifying the circuit.

21. List the applications of Thevinins theorem.

It is applied to all linear circuits including electronic circuits represented by the controlled source.This theorem are useful when t is desired to know the effect of the response in network or varying part of the network.

22. Explain the purpose of star delta transformation.

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

UNIT- III- RESONANCE AND COUPLED CIRCUITS

1. What is meant by Resonance?

An A.C circuit is said to be resonance if it behaves as a purely resistive circuit. The total current drawn by the circuit is then in phase with the applied voltage, and the power factor will then unity. Thus at resonance the equivalent complex impedance of the circuit has no j component.

2.Write the expression for the resonant frequency of a RLC series circuit.

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

3.What is resonant frequency?

The frequency at which resonance occurs is called resonant frequency.At resonant frequency $X_L=X_C$

4. Define series resonance.

A resonance occurs in RLC series circuit called series resonance. Under resonance condition, the input current is in phase with applied voltage.

5. Define Quality factor.

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

6. What are half power frequencies?

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

7. Write the characteristics of series resonance.

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

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14. Define selectivity.

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

15. 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.

16. Write the characteristics of parallel resonance.

At resonance admittance in min and equal to conductance therefore the current is min. Below resonant frequency the circuits behave 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.

17. What is Bandwidth and sel ctivity?

The frequency band within the limits of lower and upper half frequency is called bandwidth.**BW=f_2-f_1** Selectivity is the ratio of f_r to the bandwidth

Selectivity= f_r / (f_2-f_1)

18. What are coupled circuits?

It refers to circuit 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.

19. What are coupled circuits?

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

20. Define self inductance.

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

21. 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.

22. Define coefficient of coupling.

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

23. 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.

24. State dot rule for coupled circuit.

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. 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.

25. Define coefficient of coupling.

The amount of coupling between to inductively coupled coils is expressed in terms of the coefficient of coupling. **$K=M/\sqrt{L1L2}$**

UNIT- IV- TRANSIENT RESPONSE FOR DC CIRCUITS

1. What is transient state?

If a network contains energy storage elements, with change in excitation, the current and voltage change from one state to other state the behavior of the voltage or current when it is changed from one state to another state is called transient state.

2. What is transient time?

The time taken for the circuit to change from one steady state to another steady state is called transient time.

3. What is transient response?

The storage elements deliver their energy to the resistances, hence the response changes with time, get sturated after sometime, and are referred to the transient response.

4. Define time constant of RLC circuit.

The time taken to reach 63.2% of final value in a RL circuit is called the time constant of RL circuit.**Time constant=L/R**

5. Define time constant of RC circuit.

The time to taken to reach 36.8% of initial current in an RC circuit is called the time constant of RC circuit.**Time constant=RC**

6. What is meant by natural frequency?

If the damping is made zero then the response oscillates with natural frequency without any opposition, such a frequency is called natural frequency of oscillations.

7. Define damping ratio.

It is the ratio orf actual resistance in the circuit to the critical resistance.

8.Write down the condition, for the response of RLC series circuit to be under damped for step input.

The condition for the response of RLC series circuit to be under damped step input is

$$(R/2L)^2>(1/LC)$$

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10.Write down the few applications of RL, RC, RLC circuits. Coupling circuits

* Phase shift circuits Filters
*Resonant circuits AC bridge
*circuits Transformers

11. 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.

12. 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.

13. What is forced response?

The response of the circuit due to the external source is called forced response.

14. Define apparent power.

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

UNIT- V- THREE PHASE CIRCUITS

1. Define line current and phase current.

The current flowing through the line is called line current The current flowing through the phase is called phase current

2. Define line and phase voltag

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

3. Give the line and phase values in star connection

The relation between line and phase voltage in star connection is $\mathbf{E_L=\sqrt{3}E_{ph}}$

The relation between line current and phase current in a star connection is $\mathbf{I_L=I_{ph}}$

4. Give the line and phase values in delta connection

The relation between line voltage and phase voltage in a delta connection is $\mathbf{E_L=E_{ph}}$

The relation between line current and phase current in delta connection is $\mathbf{I_L=\sqrt{3}I_{ph}}$

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

Potential lead shift method T- method Artificial neutral method Current transformer method

6.List the methods for unbalanced star connected load

Equivalents delta method Mesh method Neutral voltage displacement method

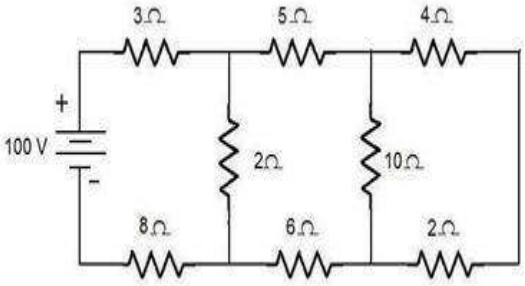
7.Write the methods of connections of 3 phase windings?

Independent connection Star connection and Delta connection

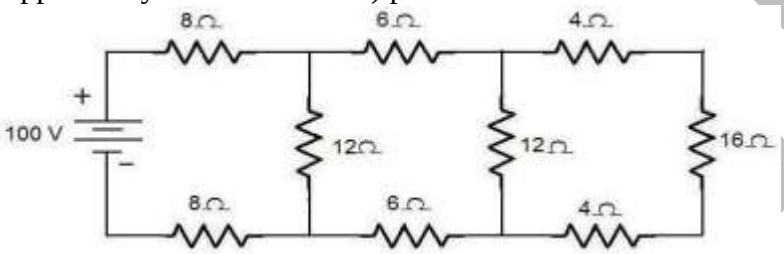
UNIT- I- BASIC CIRCUITS ANALYSIS

Part – B

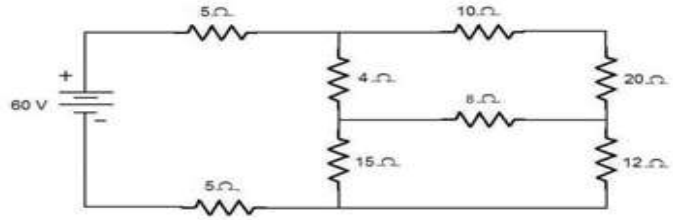
1.Find the current through each branch by network reduction technique.



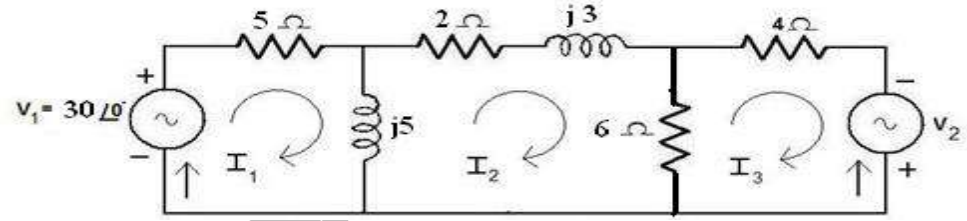
2.Calculate a) the equivalent resistances across the terminals of the supply, b) total current supplied by the source and c) power delivered to 16 ohm resistor in the circuit shown in figure.



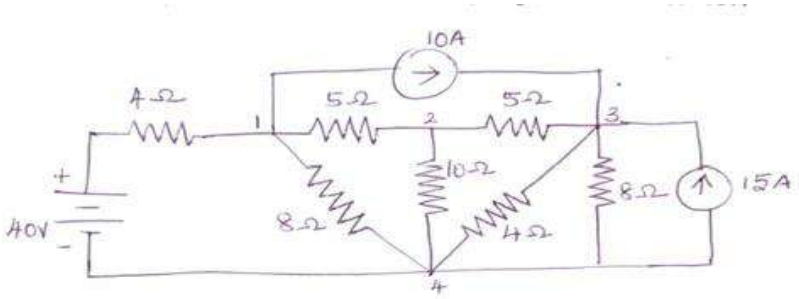
3.In the network shown below, find the current delivered by the battery.



4.Determine the value of V2 such that the current through the impedance (2+j3) ohm is zero.



5.Use Nodal Voltage method and find the power dissipated in the 10 Ω resistance on the circuit shown in th fig.

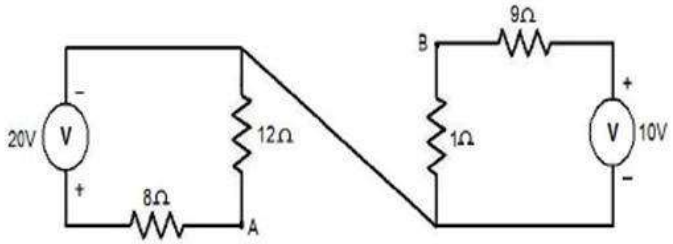


UNIT- II -NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS

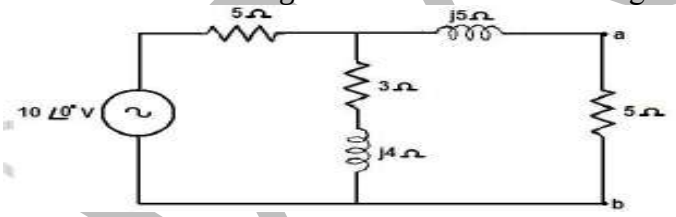
Part – B

1. Derive expressions for star connected arms in terms of delta connected arms and delta connected
arms in terms of star connected arms.

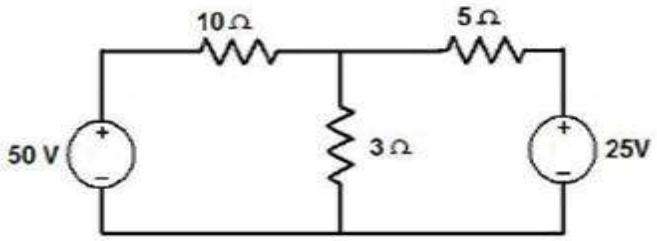
2. Determine Thevenin's equivalent across the terminals AB for the circuit shown in figure below.



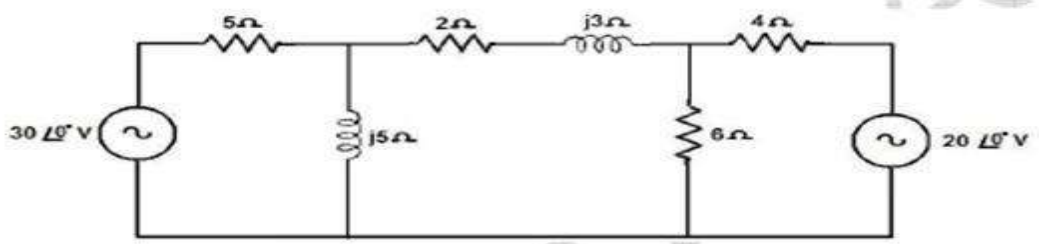
3.Find the current through branch a-b network using Thevenin's theore



4.Find the current in each resistor using superposition principle of figure.

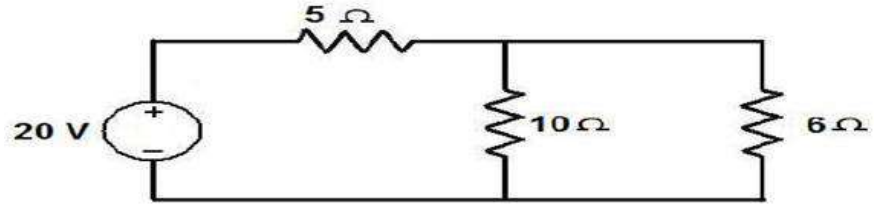


5.Using superposition theorem calculate current through (2+j3) ohm impedance branch of the circuit shown.

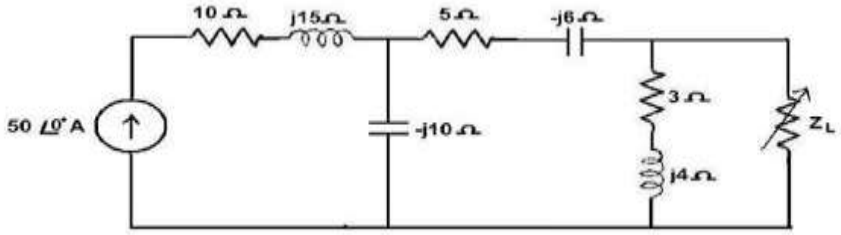


6.State and explain reciprocity theorem.

7. Using Norton's theorem, find current through 6 ohm resistance shown in figure.



8.Determine the maximum power delivered to the load in the circuit.



UNIT- III- RESONANCE AND COUPLED CIRCUITS

Part – B

1.Explain and derive bandwidth and half power frequencies for a series RLC Ciruit as a function of resonant frequency.

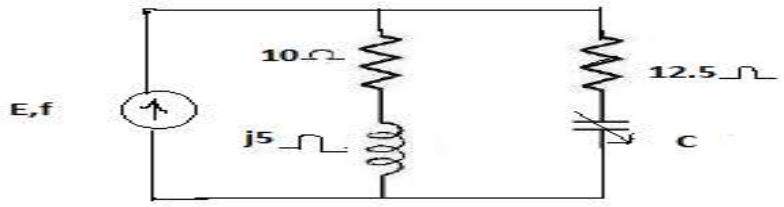
2.A series RLC circuit has the following parameter values: R = 10 ohms; L=1 H and C = 1 μF.
   a) Compute the resonant frequency in radians/sec.
   b) Calculate the quality factor of the circuit.
   c) What is the value of the bandwidth?

3.A constant voltage at a frequency of 1 MHz is applied to an inductor in series with a variable capacitor. When the capaccittorr is set to 500pF, the current has the maximum value, while it is reduced to one half when the capacitance is 600pF. Find (i) the resistance (ii) the inductance (iii) the Q factor of the inductor.

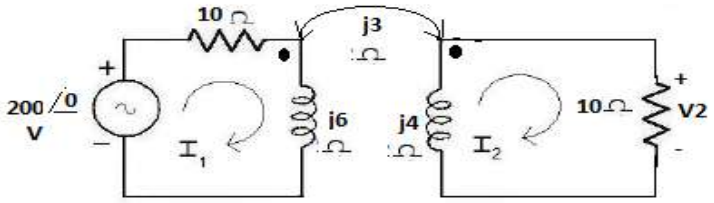
4.A current source is applied to a parallel combination of R, L and C. where R = 10 ohms, L = 1 H and C= 1 μF.
   a. Compute the resonant frequency
   b. Find the quality factor.
   c. Calculate the value of the bandwidth.
   d. Compute the lower and upper half frequency points of the bandwidth.

5.A coil of 20 Ω resistance has an inductance of 0.2 H and is connected in parallel with a condenser of 100 μF capacitance. Calculate the frequency at which the circuit will act as a non – inductive resistance of R ohms. Find also the value of R.

6.Determine the value of the capacitance C in order that the circuit in the figure is resonant at 6366 Hz.



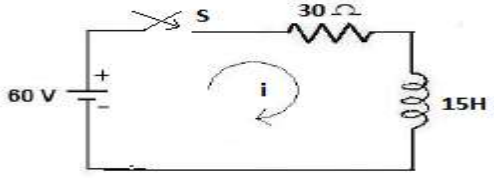
7. a)Two identical coupled coils in series has an equivalent inductance values of 0.084H and 0.0354H, Find the values of L1, L2, M and K . b) In the circuit find the phasor voltage V2.



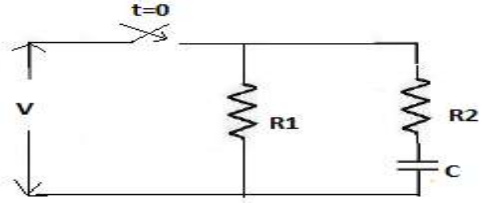
<u>UNIT- IV- TRANSIENT RESPONSE FOR DC CIRCUITS</u>

<u>Part – B</u>

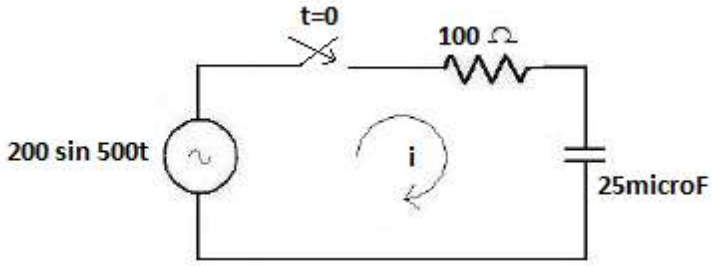
1. Derive the expression for RLC transient circuits.
2. A series RL circuit with R =30ohm and L =15H has a constant voltage E =60v is applied at t=0 as shown. Determine the current I, voltage across the resistor and inductor.



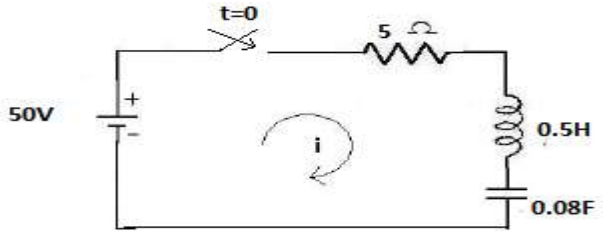
3. Find how long it takes after the key is closed before the total current from the supply reaches 25mA when v=10volt,R1 =500ohm, R2 =700 ohm and c=100μF.



4.In the circuit shown in figure, Find current i(t) assume initial charge in the capacitor is zero.



5.In the circuit shown in figure, Find the transient current when the switch is closed at t=0. Assume zero initial conditions.



6.For a source free RLC series circuit the initial voltage across C is 10v and the initial current through L is zero if L=20mH,C=0.5μF and R= 100 ohm, Evaluate i(t).

7.The Z-parameters of a two port network are Z11 =25ohm, Z22=40ohm, z12=z21=10ohm.Find the Y-parameters.

UNIT- V- THREE PHASE CIRCUITS

Part – B

1.With a neat circuit and phasor diagram explain the three phase power measurement by two wattmeter method and also derive the expression for Power Factor.

2. A balanced star connected load of (8+j6) ohms per phase is connected to a three phase 230V, 50 Hz supply. Find the line current, PF, power, reactive Volt amperes and total volt amperes.

3. A three phase delta connected load has Zab = (100+j0) ohms, Zbc = (-j100) ohms and Zca = (70.7+j70.7) ohms and is connected to a balanced three phase 400V supply. Determine the line currents Ia, Ib, Ic. Assume the phase sequence as abc.

4. a) A balanced delta connected load takes a line current of 15A when connected to a balanced 3 phase 400V system. A watt meter with its current coil in one line and potential coil between the two remaining lines read 2000 Watts. Describe the load impedance.

5. Determine the power and power factor, if the two watt meters read. (i) 1000 watts each, both positive. (ii) 1000 Watts each of opposite sign.

6.The power input to a 2000V, 50 Hz three phase motor running on full load at an efficiency of 90% is measured by two watt meters which indicate 300KW and 100KW respectively. Calculate (i) input power (ii) power factor (iii) line current (iv) HP output.

7.Three impedance each of 10 ohms resistance and 5 ohms inductive reactance are connected in delta to a 400V, 3 phase supply. Determine the current in each phase and in each line. Calculate also the total power drawn from the supply and the p.f of the load.

8. A wye load with ZA=3+j0, ZB=2+j3 and ZC=2-j1 ohms is connected to a 3 phase 4 wire, 100 volts, CBA system. Find the currents in all the four lines.

9. Determine the line currents for the unbalanced delta connected load consisting of ZRY =(30+j40), ZYB = (8-j4) and ZBR = (15+j12) ohms. Assume the phase sequence to be RYB, E=200 volts.

******* All The Best ********