SHRI ANGALAMMAN COLLEGE OF ENGG& TECH
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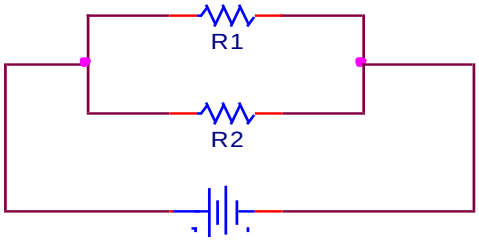
EE 1151- CIRCUIT THEORY

UNIT I BASIC CIRCUITS ANALYSIS

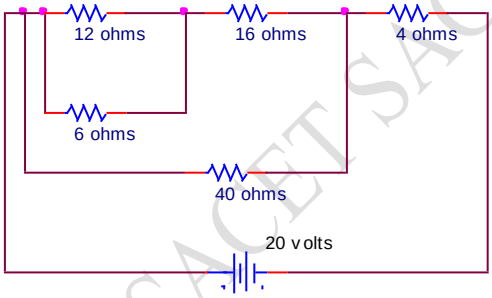
PART A

1. State ohm's law.
2. State kirchoff's law.
3. Which law is applicable for branch current method?
4. What is the matrix formation equation for mesh and nodal method?
5. Compare series and parallel circuits.
6. A 5Ω and 15Ω resistors are connected in series to the 50 V battery and 20 Ω and 15 Ω resistors are connected in parallel to the same battery. Determine the total resistance value?
7. Draw the phasor diagram for RL and RC circuits
8. What is meant by network?
9. What is called branch?
10. What is called node?
11. Define power factor?
12. Mention the application of electrical circuits?
13. List the methods for writing the circuit equation?
14. What is the drawback in mesh method?
15. What is the application of series circuits?
16. Differentiate mesh and nodal analysis.
17. What is meant by active element?
18. Is the silicon diode, is uni-lateral element? Why?
19. Give examples of passive elements?
20. Differentiate active and passive elements?

21. Two resistors are connected in parallel and a voltage of 200volts is applied to the terminals. The total current taken is 25A and the power dissipated in one of the resistors is 1500Watts. What is the resistance of each element?



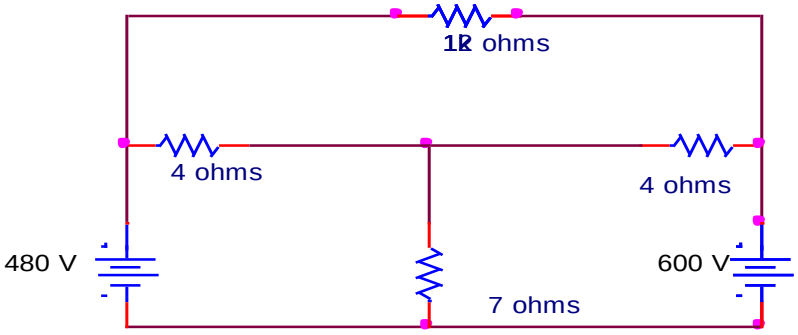
22. Calculate the equivalent resistance of the following combination of resistor and source current.



23. Compare AC and DC circuit
24. Let Z= (8+j6) Ω, convert this into polar form.
25. Define active and reactive power in AC circuits.

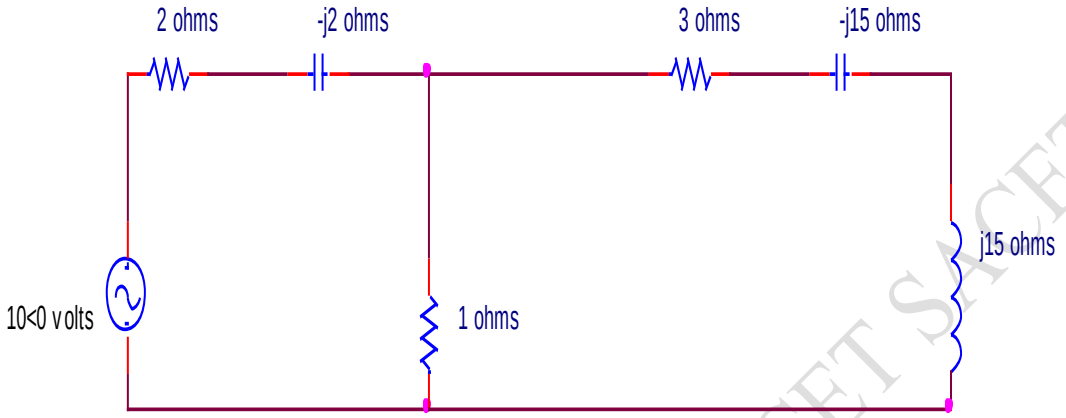
Part-B

1. Write the mesh equations for the circuit shown in the figure and determine the current in 12Ω resistor.



(12)

2. Apply mesh current method and determine currents through the resistors of the network shown in figure.



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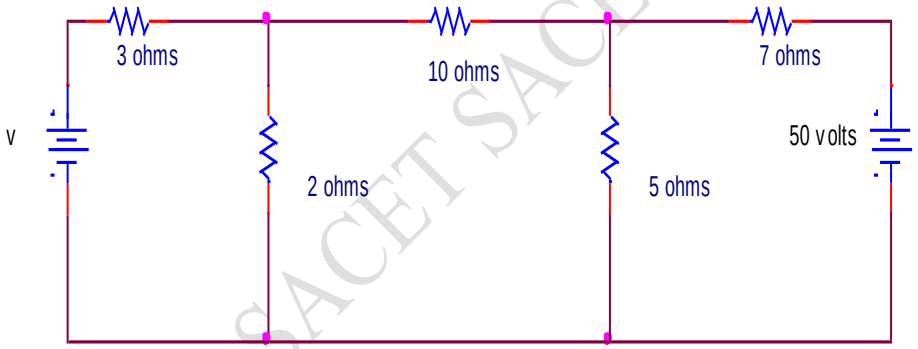
3) Find the voltages V in the circuit shown in figure which makes the current in the 10 Ω resistor to be zero by using nodal analysis

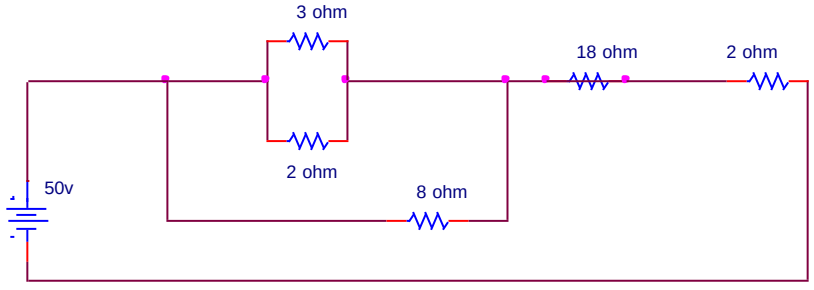


4) A Wheat stone bridge circuit is made up of the following resistors AB=3Ω BC=6Ω and CD=15 Ω and DA=7 Ω .A 30 V battery is connected between A&C.find the current through a 10Ω galvanometer connected between B&D using loop method. (12)

5) (i) Compare series and parallel method (6)

. (ii) Derive the equation of nodal voltage method by using 3 nodes and form the matrix. (6)

6. (i) Find the Equivalent resistance and the current in each resistance.(6)



(ii) Derive the equation of 2 loop circuit and form the matrix using mesh current method. (6)

7. Explain the following

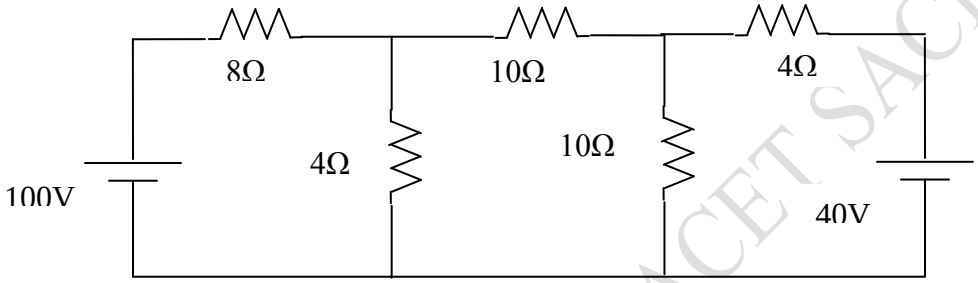
(i) active elements (ii) passive elements

(iii) bilateral&uni lateral (iv)open circuit

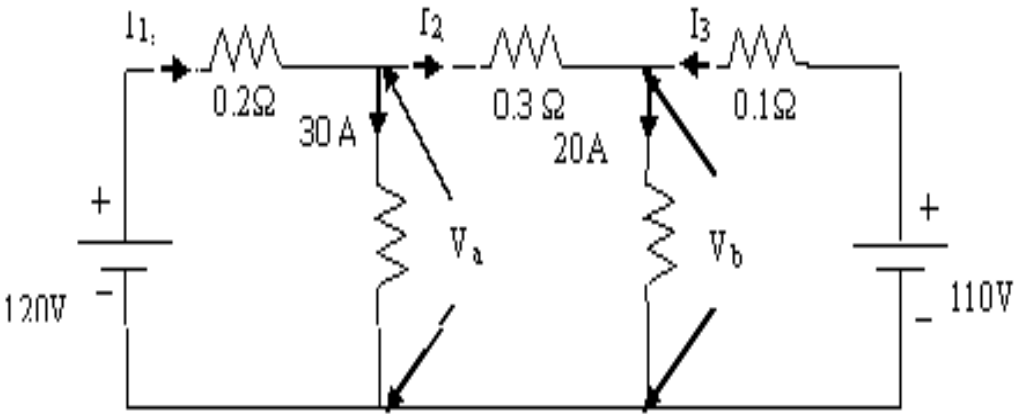
(v)short circuit (vi)network (6X 2)

8.Derive the matrix equation for 3 loop circuit?

9. Write the mesh equation for the network shown in figure by inspection and find the power absorbed by 8Ω resistor. (12)



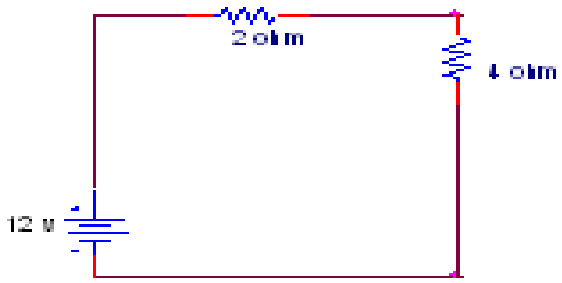
10.Find the currents I_1 , I_2, I_3 and the voltages V_a and V_b in the network of figure by using nodal analysis. (12)



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

PART-A

1. State Super Position Theorem
2. State Thevenins Theorem
3. State Norton's Theorem
4. State Maximum power transfer theorem
5. State Millman's Theorem
6. State Reciprocity Theorem
7. For the network shown in the following fig, convert the voltage source into current source

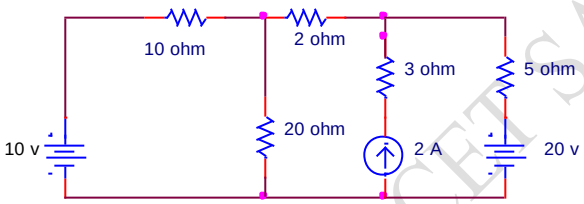


8. Draw the equivalent circuit for Norton's theorem
9. Compare Thevenin's theorem and Norton's theorem
10. How to change the (a) current source into voltage source (b) voltage source into current source?
11. Give one example problem of voltage to current source transformation?
12. Which theorem is used to find the maximum power for a linear/nonlinear network?
13. With example explain the transformation of three voltage source is in series with three resistance combination?
14. Write the formula for star to delta transformation.
15. Write the formula for delta to star transformation.
16. Draw the phase angle diagram of R, Y, B in star connection?
17. Write the formula for finding the Thevenin's resistance
18. What is the formula for load current in Norton's Theorem?

19. Draw the equivalent circuit of Norton's Theorem
20. What is the current formula for Maximum power transfer theorem?
21. Draw the equivalent circuit for Thevenin's theorem
22. What are the steps followed in Compensation Theorem?
23. When the maximum power transfer will occur?
24. Which theorem is valid for linear circuit?
25. Which theorem is applicable for linear / bilateral networks?

PART-B

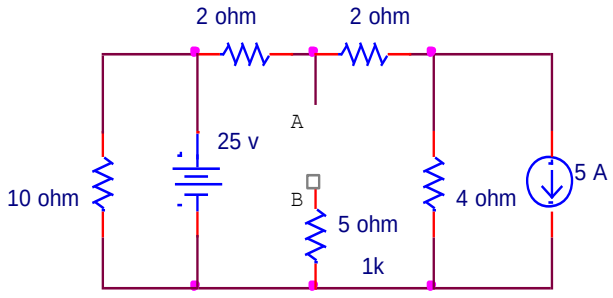
1. (a) Find the Voltage Across the 2Ω resistor by using super position theorem (8)



(b) Write the steps involved in the superposition theorems (4)

2. Two generators with emfs 200 V and 250 V and armature resistance of 2 Ω and 1Ω respectively are in parallel supplying a load resistance of 10 Ω.find (a) current Supplied by each generator (b) load current and (c) load voltage. Use super Position theorem (12)

3. (a) For the circuit shown below find the Thevenin's equivalent circuit ,preserving terminals A and B .Calculate the current through a 2 Ω resistor connected across the terminals AB (8)



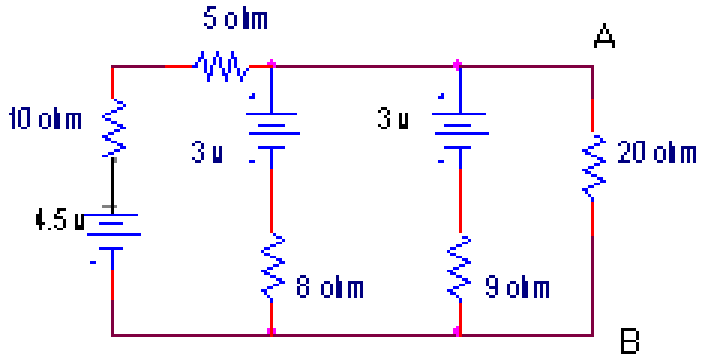
(b) Write the steps involved in the Thevenin's theorem (4)

4. (a) Explain reciprocity theorem (6)

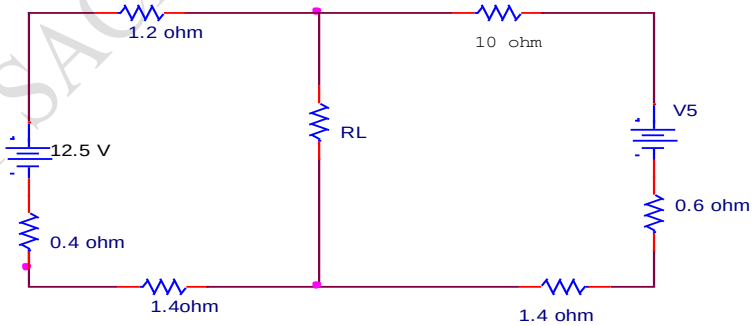
   (b) Write the steps involved in the Norton's theorem (6)

5. (a) Write short notes on Maximum power transfer theorem (4)

   (b) Find the voltage between points A&B in the fig below using Norton's theorem (8)

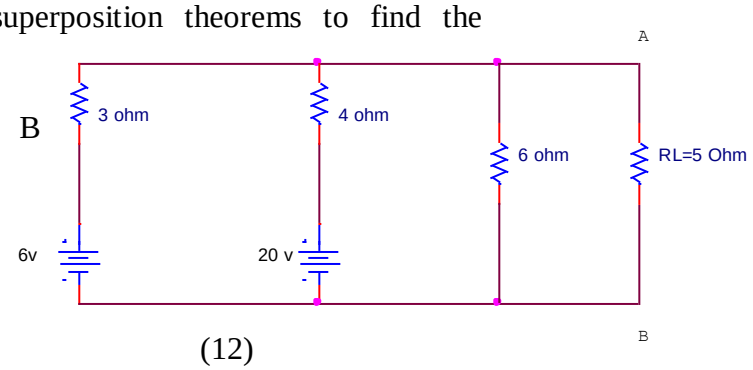


6. (a) For the circuit of the fig find the value R_L for maximum power delivered to it. Calculate also the maximum load power. (8)



   (b) State the condition of Millman's theorem for voltage source (4)

7. Use superposition theorems to find the voltage across the terminals A and B and also the current through R_L = 5 Ω



(12)

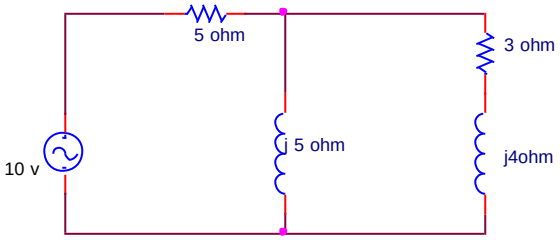
8. Write short notes on (i)Star to Delta conversion (6)

(ii)Delta to Star conversion (6)

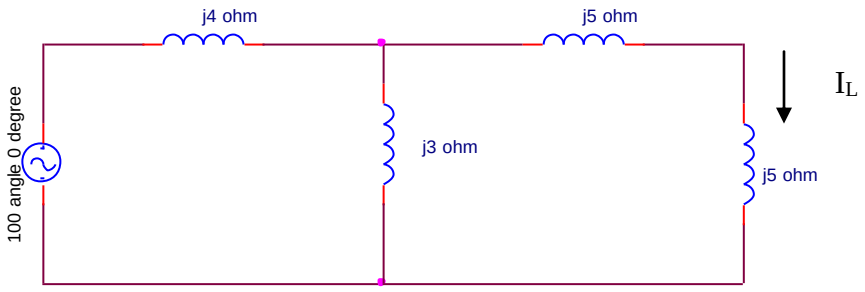
and also derive the conditions

9. (i) Write short notes on substitution theorem (4)

(ii) In the network shown in the fig (a) the 5 Ω resistor is changed to 8 Ω determine the change in the current through (3+j4) Ω impedance using Thevenin's theorem. (8)



10. For the circuit shown in figure, determine the load current by applying Thevenin's theorem. (12)



UNIT III RESONANCE AND COUPLED CIRCUITS

PART-A

1. Write the condition of resonance.
2. Define band width.
3. Draw the series resonance circuit and the phasor diagram.
4. Draw the parallel resonance circuit and the phasor diagram.
5. Compare series and parallel resonance circuits.
6. Two inductively coupled coils have self inductance L_1=45 mH and L_2=150 mH. If the co-efficient of coupling is 0.5, (i) find the value of mutual inductance between the coils and (ii) what is the maximum possible mutual inductance?
7. Define mutual inductance.
8. Determine the value of capacitive reactance and impedance at resonance. When R = 10ohm, C =25μF and L =10mH
9. Define of quality factor.
10. Define coefficient of coupling?
11. Write about coupled circuits.
12. For which condition, the net reactance is capacitive?
13. Write the equation for maximum power absorption
14. When the series A.C circuit is at resonance?
15. Mention the relationship between Q-factor and bandwidth

16. A coil of resistance 2ohm and inductance 0.01H is connected in series with capacitor C. If maximum current occurs at 25Hz find C?
17. What is resonance frequency and Bandwidth of a series RLC circuit in which R=5ohm, L=40mH, C=1μF?
18. Define Series Resonance
19. What is meant by parallel resonance?
20. Draw the reactance curves for inductive load
21. In rectangular form, what is the value of impedance and admittance
22. Draw the frequency response of R-L circuit and explain
23. In a parallel RL circuit R=3ohm and X_L =4ohm.What is the value of admittance?
24. What do you understand by damped frequency?
25. What is the maximum possible mutual inductance of two inductively coupled coils with self inductance L_1=25mH and L_2=100mH?

PART –B

1. (i) Derive the resonant frequency of series circuit. (6)
   (ii) Short notes on Q- factor and its effect on band width. (6)

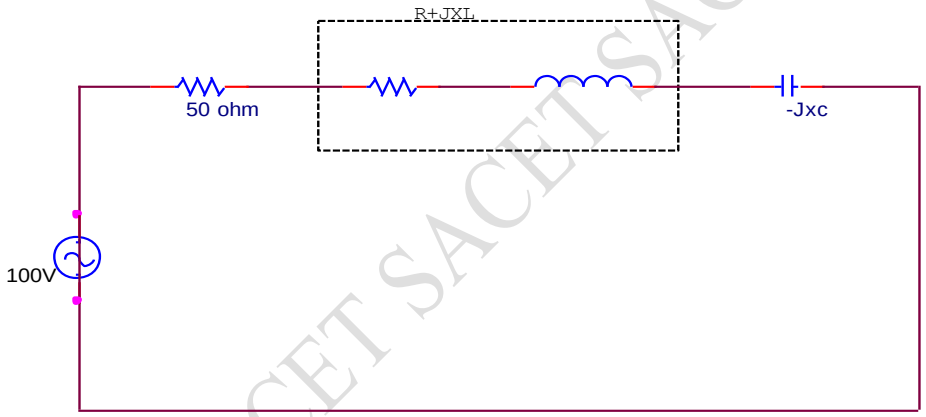
2. (i) Compare series and parallel resonance circuits (6)
   (ii) Give the short notes on (a) co-efficient of coupling and (b) dot convention (6)

3. (i) Derive the band width of RLC circuit. (6)
   (ii) A coil having a resistance of 50 Ω and an inductor of 0.2 H is connected in series with a variable capacitor across a 60 V, 50 Hz supply .Calculate the capacitance required to produce resonance and the corresponding values of (a)current (b)voltage across the coil and the capacitor (c)the power factor (d)Q-factor. (6)

4. (i) Derive the Q-factor of parallel resonance circuit. (4)

(ii) One RLC circuit has R= 30 Ω, L=40 mH and C= 50 μF. Find the resonant frequency .Under resonant conditions, Calculate the current and voltage drops across the R, L, and C if applied voltage is 120 V. (8)

5. (i) A 50 Ω resistor is connected in series with an inductor having internal resistance ,a Capacitor and 100 V variable frequency supply as shown in fig. At a frequency of 200Hz, the maximum current of 0.7A flows through the circuit and voltage across the C is 200 V .Determine the circuit constants (8)



(ii) Derive the resonant frequency of parallel circuit. (4)

6. (i) A series RLC circuit consists of 50 Ω resistance ,0.2 H inductance and 10 μF capacitor with the applied voltage of 20 V .Determine the resonant frequency, Q-factor of the circuit and compute the lower and upper frequency limits and also find the band width of the circuit. (8)

(ii) Write a short notes on multi winding coupled circuit. (4)

7. (i) Give the short notes on coupled circuit and inductively coupled circuit. (6)

(ii) Explain Q-factor and band width.. (6)

8. A series circuit consisting of a 12Ω resistor, 84.4μF capacitor and a variable inductor is connected to a 100V, 50 cycle source. a)For the condition of resonance, determine the inductance current and voltage drop across the inductor, b) determine the inductance current and the voltage drop across the inductor when this voltage drop is a maximum, (12)

9. A series RLC circuit with R=10Ω, L =10 mH & C=1μF has an applied voltage of 200 V at resonant frequency. Calculate the resonant frequency, the current in the circuit and the voltages a cross the elements at resonance. Find also the quality factor and bandwidth. (12)

10. A current source is applied to a parallel combination of R, L & C, where R =10Ω, L =1H, & C=1μ F.

A) Compute the resonant frequency.

B) Find the quality factor.

C) Calculate the value of the bandwidth.

Compute the lower and upper half frequency points of the band width . (12)

UNIT IV TRANSIENT RESPONSE OF DC AND AC CIRCUITS

Part-A

1. What is the difference between balanced and unbalanced circuits?
2. In the measurement of three phase power using two wattmeter method, when both the wattmeter read same values, what is the value of power factor of the load?
3. Explain how to solve unbalanced neutral isolated three phase load connected to a balanced supply?
4. Give the relation connecting the power factor angle with the two wattmeter readings.
5. What is floating neutral?
6. Write the types of unbalanced load?
7. Write about symmetrical component method?
8. What is meant by positive sequence component?
9. What is meant by negative sequence component?
10. What is zero sequence component?

11. The two line currents taken by an unbalanced delta connected load are Ia=10∠-120 A, Ib=5 ∠150 A. What is the line current Ic?
12. What is meant by phase sequence?
13. Define positive phase sequence
14. What are the identification colours of RYB?
15. What are the main objectives of interconnection of the phases?
16. What are the types of interconnections?
17. Write the relation between phase voltage and line voltage in star connected system.
18. Write the relation between phase voltage and line voltage in delta connected system.
19. Write the condition for balanced star connected load
20. Draw the circuit diagram for balanced delta connected load
21. A balanced star connected load of (3-j4ohm) impendance is connected to 400 V three phase supply. What is the real power consumed?
22. A symmetrical three phase, 400 V system supplies a balanced mesh connected load. The current in each branch circuit is 20A and the phase angle is 40 degree lag. Fine (a) the line current (b) the total power
23. What are the four methods can be analyzed in unbalanced star connected load
24. Define three phase balance load
25. Explain balance supply system

Part-B

1. Explain three phase power measurement by 2 wattmeter method for star and delta connected load and determine the power equation and draw the phasor diagram. (12)

2. (i) Explain three phase power measurement by 3ammeter and 3 volt meter method (6)
(ii) Give the short notes on balanced star-delta and delta-star conversion. (6)

3. (i) Derive the expression for balanced star connected load and draw the phaser diagram. (6)

(ii) Give the short notes on symmetrical components and un-symmetrical components. (6)

4. (i) Explain three phase power measurement by 2 wattmeter method and determine the power factor equation (6)

(ii) Two wattmeter method is used to measure power in a 3 phase load, the wattmeter readings are 400 W and -35 W .Calculate (i) total active power (ii) power factor and (iii) reactive power (6)

5. (i) Derive the expression for balanced delta connected load and draw the phasor diagram. (6)

(ii)A balanced star connected load of (3-j4) Ω impedance is connected to 400 v three phase supply. What is the real power consumed? (6)

6. (a) Derive the expression for un balanced star connected load and draw the phaser Diagram. (6)

(b) A balanced star connected load of (8+j6) Ω /phase is connected to a 3 phase, 230 V, 50c/s supply. Find the line current, power factor and power (6)

7. (a) Derive the expression for un - balanced delta connected load and draw the phaser diagram. (6)

(b) Derive the expression for total power in a 3 phase balanced circuit. (6)

8. (i)A balanced delta connected load takes a line current of 15 A when connected to a balanced 3 phase 400 v system. A wattmeter with its current coil in one line and Potential coil between the two remaining lines read 2000W. Describes the load Impedance. . (6)

(ii) In a balanced 3 phase system, the power is measured by 2 wattmeter method and the Ratio of two wattmeter method is 2:1.Determine the power and power factor. . (6)

9. (a) Derive the expression for 3 wire star connected unbalanced load. . (6)

   (b) Derive the expression for 4 wire star connected unbalanced load. (6)

UNIT V ANALYSING THREE PHASE CIRCUITS

Part-A

1. Define transient response.
2. Define forced response.
3. Compare steady state and transient state
4. Define transient state and transient time
5. Draw the DC response of R-L circuit and the response curve.
6. Draw the DC response of R-C circuit and the response curve
7. Draw the DC response of R-L –C circuit and the response curve
8. Draw the sinusoidal response of R-L circuit and write the differential equation.
9. Draw the sinusoidal response of R-C circuit and write the differential equation.
10. Draw the sinusoidal response of R-L -C circuit and write the differential equation.
11. Define Laplace transform.
12. Write 2 properties of Laplace transformations.
13. Give an example for forced response
14. Define source – free response
15. Define Zero- Input response
16. Define Zero – State response
17. Write the boundary conditions for the inductance
18. Write the boundary conditions for the capacitance
19. What are the effects of switching on resistor
20. Write the steps to be involved in the determination of initial conditions
21. Define damping ratio?
22. Sketch the current given by $i(t)= 5 – 4\ e^{-20t}$

23. What are the three cases involved in R-L-C transients

24. Distinguish between free response and forced response

25. Define a time constant?

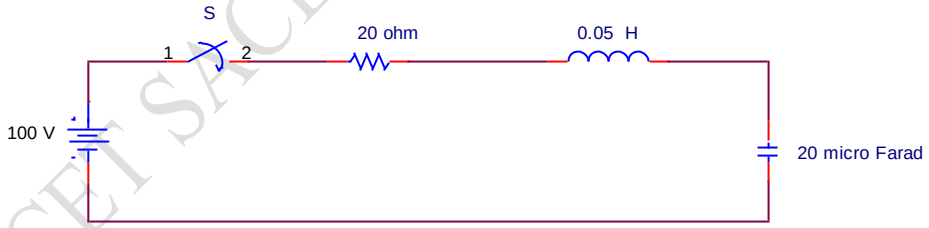
Part-B

1. (i)Draw the DC response of R-L circuit and derive the power equation of resistor and inductor. . (6)

(ii)Draw the DC response of R-C circuit and derive the power equation of resistor and capacitor. . (6)

2. Draw the DC response of R-L-C circuit and derive the equation of over damped, under damped and critically damped. (12)

3. The circuit shown in figure consists of resistance, inductance and capacitance in Series with a 100 V constant source. When the switch is closed at t = 0, find the Current transient. (12)



4. Draw the sinusoidal response of R-L circuit and determine the current equation.(12)

5. Draw the sinusoidal response of R-C circuit and determine the current equation(12)

6. Draw the sinusoidal response of R-L-C circuit and determine the current equation (12)

7. The circuit consisting of a series RLC elements with R=10 Ω, L=0.5 H and C=200 μF has a sinusoidal voltage V=150 sin (200t+ Φ).If the switch is closed when Φ =30˚ .Determine the current equation. (12)

8.(i) The circuit consists of series RL elements with R= 150 Ω and L=0.5H. The switch is closed when Φ=30˚.Determine the resultant current when voltage=150 cos (100t+ Φ) V. (6)

(ii) Write short notes on transient analysis. (6)