7. SUBJECT DETAILS

7.4 ELECTRICAL CIRCUITS

7.4 ELECTRICAL CIRCUITS

7.4.1 OBJECTIVES AND RELEVANCE

This course introduces the basic concepts of circuit analysis which is the foundation for all subjects of the electrical engineering discipline. The emphasis of this course is laid on the basic analysis of circuits which includes single phase circuits, magnetic circuits, theorems, transient analysis and network topology.

7.4.2 SCOPE

The scope of this subject is to provide an insight into the working and applications of electrical machines, transmission lines and modeling of various other systems. Also, it provides clear and concise exposure to the principles and applications of electrical circuits to solve complex networks in the field of electrical engineering.

7.4.3 PREREQUISITES

This subject recommends continuous practice of various networks. It needs requisite knowledge about mathematical fundamentals and applications of advanced mathematics like Fourier transform, Laplace transform, differential equations and vectors, complex analysis. Also circuit elements and basic electrical laws.

76.4.1 JNTU SYLLABUS

UNIT-I

OBJECTIVE

- To know the basic electrical circuit parameters and their representation
- Volt-amp relationships for passive elements
- Knowledge of dependent and independent voltage and current sources
- To know the simple circuit reduction techniques having single source with series-parallel combinations
- To obtain source transformations
- Applications of star-delta transformation for network reduction and vice versa

SYLLABUS

Circuit concept, R-L-C parameters, voltage and current sources, independent and dependent sources, source transformation, voltage, current relationship for passive elements.

Kirchoff's laws, network reduction techniques: series, parallel, series parallel, star-to-delta or delta-to-star transformation. Nodal analysis, mesh analysis, super node and super mesh for D.C. excitations.

UNIT-II

OBJECTIVE

- The sinusoidal signal
- Phasor representation of sources and elements
- j-notation, its applications
- Phasor relationships of voltage and current in case of passive elements
- Definitions of impedance, admittance, and immittance
- Sinusoidal steady state analysis using phasor method
- Phasor diagrams
- Instantaneous power, average power, apparent power, real power, reactive power, complex power

SYLLABUS

R.M.S and average values and form factor for different periodic wave forms, steady state analysis of R, L and C (in series, parallel and series parallel combinations) with sinusoidal excitation, concept of reactance, impedance, susceptance and admittance, phase and phase difference, concept of power factor, real and reactive powers, J-notation, complex and polar forms of representation, complex power.

UNIT-III

OBJECTIVE

- Locus diagrams with variation in source frequency, values of R, L, and C
- Parallel resonant circuit
  Series resonant circuit
- Knowledge of quality factor, bandwidth and selectivity of resonant circuit
- Q - factor of other types of resonant forms
- Faraday's laws of induction, Lenz's law
- Orientation of coils for different coefficient of couplings
- Definition of mutual induction and relation to self inductances
- Analogy of magnetic circuits with electric equivalents
- Analysis of magnetic circuits
- Ideal transformer
- Equivalent circuits of transformer
- Practical transformer

SYLLABUS

Locus diagrams - series R-L, R-C, R-L-C and parallel combination with variation of various parameters - Resonance - Series, parallel circuits, concept of band width and Q factor.

Magnetic circuits: Faraday's laws of electromagnetic induction, concept of self and mutual inductance, dot convention, coefficient of coupling, composite magnetic circuit: analysis of series and parallel magnetic circuits

UNIT-IV

OBJECTIVE

- Basic definitions of graph, link, tree, and chord
- Definition of tie set
- Incident matrix, fundamental loop matrix, tie set analysis, formulation of matrices and their solutions
- Definitions of cut set
- Cut set analysis, formulation of matrices and their solutions
- Duality
- Methods to find dual elements and dual network

SYLLABUS

Definitions: Graph, tree, basic cutset and basic tieset matrices for planar networks, loop and nodal methods of analysis of networks with dependent and independent voltage and current sources, duality and dual networks.

UNIT-V

OBJECTIVE

- Importance of application of theorems in circuit analysis
- Statement and application of superposition theorem, maximum power transfer theorem, substitution theorem, reciprocity theorem, compensation theorem, Thevenin's theorem, Norton's theorem, Millman's theorem, Tellegen's theorem

- Importance of application of theorems in circuit analysis
- Statement and application of superposition theorem, maximum power transfer theorem, substitution theorem, reciprocity theorem, compensation theorem, Thevenin's theorem, Norton's theorem, Millman's theorem, Tellegen's theorem

SYLLABUS

Tellegen's , Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power Transfer, Millman's and Compensation theorems for D.C. excitations.

7.4.4.2 GATE SYLLABUS

UNIT-I

KCL, KVL, concept of ideal voltage and current sources.

UNIT- II& III

Sinusoidal steady state analysis, resonance in electrical circuit.

UNIT-IV

Not applicable

UNIT-V

Network theorems

7.4.4.3 IES SYLLABUS

UNIT-I&II

Circuit elements, KVL and KCL

UNIT-III

Resonance circuit

UNIT-IV

Not applicable

UNIT-V

Network theorems and applications

7.4.5 SUGGESTED BOOKS

TEXT BOOKS

T1 Engineering Circuit Analysis, William Hayt and Jack E. Kemmerly, McGraw Hill, 5th Edition.
T2 Electric Circuits, A. Chakrabarthy, Dhanipat Rai & Sons.
T3 Network theory, Sudhakar and Shymmohan, TMH Publications.

REFERENCE BOOKS

R1 Network Analysis, Vanvalkenburg, PHI.
R2 Linear circuit analysis (time domain phasor, and Laplace transform approaches) Second edition, RAYMOND A.DeCARLO and PEN-MIN-LIN, Oxford University Press, 2004.
R3 Electric Circuit theory, K. Rajeswaran, Pearson Education, 2004.
R4 Network Theory, N. Srinivasulu.
R5 NetworkTheory, N.C. Jagan and C.Lakshminarayana
R6 Electric Circuits J. Edminister and M. Nahvi, Schaum's outlines, TMH, 1999.

R7 Network Theory, C.L. Wadhwa, New Age International Publishers.
R8 A text of Electrical Technology Vol.1, B.L. Thereja, S.Chand & Co.
R9 Network Analysis, C.K. Mithal, Khanna Publishers.
R10 "Circuits", Carlson, Thomson Publishers

7.4.6 WEBSITES

Do not confine yourself to the list of websites mentioned here alone. Be cognizant and keep yourself abreast of the others too. The given list is not exhaustive.

1. www.mit.edu
2. www.soe.stanford.edu
3. www.grad.gatech.edu
4. www.gsas.harward.edu
5. www.eng.ufl.edu
6. www.iitk.ac.in
7. www.iitd.ernet.in
8. www.iitb.ac.in
9. www.iitm.ac.in
10. www.iitr.ac.in
11. www.iitg.ernet.in
12. www.bits-pilani.ac.in
13. www.bitmesra.ac.in
14. www.psgtech.edu
15. www.iisc.ernet.in
16. www.circuit-magic.com
17. www.ieee.org

7.4.7 EXPERTS' DETAILS

The Expert Details which have been mentioned below are only a few of the eminent ones known Internationally, Nationally and Locally. There are a few others known as well.

INTERNATIONAL

1. Mr. Clayton R. Paul, B.S., M.S., Ph.D.,
   Professor of Electrical and Computer Engineering, Dept. of Electrical and Computer Engg.
   School of Engineering, Mercer University, Macon, Georgia - 31207, Ph.:(912) 301-2213
   www.faculty.mercer.edu/paul_cr
2. Mr. Joseph A. Edminister, Emeritus of Electrical Engineerings, Uni. of Akron, Akron, Ohio

NATIONAL

1. Dr. D.Ganesh Rao - Prof. & Head, Deptt. of Telecommunication Engg., M.S. Ramayya Instt. of Tech., Bangalore
2. Prof. S.C. Dutta Roy, Deptt. of Electrical Engg., IIT, Delhi.
3. Mr. A.Nagoor Kani, 52, Seshachalam Street, Saidapet, Chennai.

REGIONAL

1. Prof. N.S. Murthy, Dept. of ECE, NIT, Warangal.
2. Mr. K.V.Srinivasa Rao, HoD, Dept. of ECE, Aurora Engineering College, Bhongir, Nalgonda

7.4.8 JOURNALS

INTERNATIONAL

1. IEEE transactions on circuits and systems
2. IEEE proceedings circuits, devices and systems

3. International journal of circuit theory and applications (Ireland)
4. IEEE transactions on electron devices
5. Circuits, systems and signal processing (USA)

NATIONAL

1. Electrical India
2. Power engineering

7.4.9 FINDINGS AND DEVELOPMENTS

INTERNATIONAL

1. M.J Gander and A.E Ruehli, "Optimized waveform relaxation methods for RC type circuits" IEEE Transactions on Circuits and systems-I; vol.51,No.4 pp 755-768 April 2004.

   Waveform Relaxation has been widely used in circuit theory for the solution of large systems of ordinary and partial differential equations. This paper proposes a near optimized WR algorithm which greatly accelerates the convergence. Based on this WR technique many circuit solvers were built.

2. Sigmond Singer, Shaul Ozeri, Doron Shmilovitz, "A pure realization of loss free resistor" IEEE Transactions on Circuits and systems vol 51 no.8, pp 1639-1647, Aug 2004.

   Practically the input characteristic is not pure resistive due to the ripple and filtering effects. A method which enables reduction of the ripple to negligible values and the eliminations of the input filter is presented, which facilitates realization of practical circuits with nearly pure input resistive characteristic.

3. J.Paul, A. Vander Wagt, and C.L.Conrad, " A layout structure for matching many integrated resistors," IEEE Transactions on Circuits and systems-I, vol 51,No 1 pp186-190, jan 2004.

   It proves that a mirrored shuffle layout pattern for an array of many resistors can cancel systematic gradient errors in resistor value up to second order.

4. F. Filippetti and M. Artioli, "Ime : 4-Term formula method for the symbolic analysis of linear circuits," IEEE Transactions on Circuits and systems-I, vol 51,No.3, pp526-538, march 2004.

   Symbolic analysis is defined as a technique to generate closed form analytic expressions with some or all parameters left lateral. This paper is intended to show a general method called Inhibition method (IMe) which follows a hierarchical structuration that is halfway logical and halfway physical.

5. W.S.Lu, "A unified approach for the design of 2-D digital filters via semidefinite programming," IEEE Transactions on Circuits and systems-I vol 49, no.6,pp814-826, june 2002.

   This paper attempts to demonstrate that a modern optimization methodology know as semidefinite programming can be served as the algorithmic care of a unified design tool for a variety of two dimensional digital filters.

NATIONAL

1. Jared Jones “Trusting integrated circuits in metering applications”, Electrical India sep 2003 vol. 43 no.12 pp 46-48.
Electricity meter manufacturers are revolutionizing the industry by designing electronic meters in place of electromechanical meters. Many manufacturers (AD) are trusting ICs to prevent failures.

2. Tribhuvan kabra, “ Fire safe electrical wires” Electrical India Oct 2003 vol. 43 no.13 pp 36-38.
Electrical cables are the lifetime of electricity. The Indian electrical wire and cable industry is growing by nearly 30% every year, and recently there were some new brilliant ideas brought in by them.

3. International copper promotional council(IPC) – “ Ensure electrical safety by proper housewiring”, Electrical India Oct 2004 vol. 44 no.10 pp 56-59.
Unsafe house wiring could eventually lead to electrical failure, causing fire and destroying life and costly equipments. This article presents some safety methods of housewiring.

4. Thoughts of Dr.A.P.J.Abdul kalam, “ Providing quality power to the nation”, Electrical India Dec 2004 vol. 44 no.12 pp 38-43. It’s the focus article of the annual addition which gives the thoughts of Dr. A. P. J. Abdul Kalam on power quality.

7.4.10 SESSION PLAN

Sl. No.	Topics in JNTU Syllabus	Modules and Sub-modules	Lecture	Suggested Books	Remarks
		UNIT-I (INTRODUCTION TO ELECTRICAL CIRCUITS)			
1	Circuit concept	Main objectives of the subject Introduction to electrical circuits Current - definition Voltage - definition Power - definition Energy – definition Relation between parameters Network - definition	L1	T3-Ch1, R1-Ch1 R3-Ch1	
2	R-L-C parameters	R, L and C definitions in geometrical point of view Circuit point of view Energy point of view	L2	T3-Ch1, R4-Ch1 R3-Ch1	IES
3	Voltage and Current sources	Definitions and examples	L3	T3-Ch1, R1-Ch1 R3-Ch1	GATE
4	Independent sources	Independent sources Concept and examples	L4	T3-Ch1, R1-Ch1 R8-Ch1	GATE
5	Dependent sources	Dependent sources Concept and examples	L5	T3-Ch1, R1-Ch1 R8-Ch1	GATE
6	Source transformation	Source transformation Introduction and examples	L6	T3-Ch1, R1-Ch2 R3-Ch2	GATE
7	Voltage - current relationship for passive elements	Relationship for R and L – explanation	L7	T3-Ch1, R1-Ch1 R3-Ch1	
		Relationship for C - explanation Problems solutions	L8	T3-Ch1, R1-Ch1 R3-Ch1	
8	Kirchoff’s laws	KCL definition - explanation and examples KVL definition - explanation and examples	L9	T3-Ch1, R1-Ch1 R3-Ch2	
		Problems on KCL and KVL	L10	T3-Ch1, R1-Ch1 R3-Ch2	GATE IES

9	Network reduction techniques - series, parallel, series - parallel	Network reduction techniques Series – examples Parallel – examples Series and parallel - examples	L11	T3-Ch1, R1-Ch1 R3-Ch2	
10	Star to delta or Delta to star transformation	Y-Δ transformation – explanation Method and examples	L12	T3-Ch1, R1-Ch3 R3-Ch2	
		ΔY transformation – explanation Method and examples	L13		
		Numerical problems solution on the related topics from the JNTU/ GATE / IES questions	L14		

Sl. No.	Topics in JNTU Syllabus	Modules and Sub-modules	Lecture	Suggested Books	Remarks
11	Loop and Nodal methods of analysis of networks with dependent and independent voltage and current sources	Introduction Loop analysis method Examples	L15	T3-Ch11,R3-Ch5 T1-Ch2	GATE IES
		Introduction Nodal analysis method Examples	L16	T3-Ch11,R3-Ch5 T1-Ch2	GATE IES
		Problems on Loop and Nodal analysis	L17	T3-Ch11,R3-Ch5 T1-Ch2	GATE IES
		UNIT-II(SINGLE PHASE A.C CIRCUITS)			
12	Single phase AC circuits	Objectives Introduction to single phase AC circuits with examples	L18	T3-Ch2, R3-Ch3 R3-Ch 2	
13	RMS and average values and form factor for different periodic wave forms	Periodic waveforms RMS value – definition and examples Average value – definition and examples Form factor – definition and examples	L19	T3-Ch2, R3-Ch3 R3-Ch2	
14	Steady state analysis of R, L and C (in series, parallel combinations) with sinusoidal excitation	Steady state analysis of Resistance in series with sinusoidal excitation and Problems	L20	T3-Ch3, R8-Ch6 R3-Ch3	GATE IES
		Inductance in series with sinusoidal excitation and Problems	L21	T3-Ch3, R8-Ch6 R3-Ch3	GATE IES
		Capacitance in series with sinusoidal excitation and Problems	L22	T3-Ch3, R8-Ch6 R3-Ch3	GATE IES
		RL in series with sinusoidal excitation RC in series with sinusoidal excitation Problems	L23	T3-Ch3, R8-Ch6 R3-Ch3	GATE IES

	Parallel Combinations with sinusoidal excitation Problems	L24	T3-Ch4, R8-Ch6 R3-Ch3	GATE IES
	Problems	L25	T3-Ch4, R8-Ch6 R3-Ch3	
	Numerical problems solution on the related topics from the JNTU/ GATE / IES questions	L26		

Sl. No.	Topics in JNTU Syllabus	Modules and Sub-modules	Lecture	Suggested Books	Remarks
15	Concept of reactance, impedance, susceptance and admittance	Reactance – definition and examples Impedance – definition and examples Susceptance – definition and examples Admittance – definition and examples	L27	T3-Ch4, T2-Ch9 T1-Ch8	GATE IES
16	Phase and phase difference	Phase – definition and examples Phase difference – definition and examples	L28	R1-Ch4, T3-Ch2 R8-Ch6	GATE IES
17	Concept of power factor, Real and reactive powers	Introduction Power factor – definition and examples Real power – definition and examples Reactive power – definition and examples Problems	L29	T3-Ch4, T2-Ch9 T1-Ch8	GATE IES
		Numerical problems	L30	T3-Ch4, R1-Ch6	
18	J-notation, complex and polar forms of representation, complex power	Introduction and explanation J -notation with examples Complex and polar forms of representation with examples Complex power with examples	L31	T3-Ch3, T3-Ch4 R3-Ch3,R9-Ch12	GATE IES
UNIT-III (LOCUS DIAGRAMS , RESONANCE& MAGNETIC CIRCUITS))					
19	Locus diagrams - series RL, RC, RLC and parallel combination with variation of various parameters	Introduction to Locus diagram Series RL Circuit - explanation and examples	L32	T3-Ch5, R3-Ch3 R8-Ch6	
		Series RC Circuit - explanation and examples	L33	T3-Ch5, R3-Ch3 R8-Ch6	
		Series RLC Circuit - explanation and examples	L34	T3-Ch5, R3-Ch3 R8-Ch6	
		Parallel combination with variation of various parameters and examples	L35	T3-Ch5, R3-Ch3 R8-Ch6	
		Parallel combination with variation of various parameters and examples Contd..	L36	T3-Ch5, R3-Ch3 R8-Ch6	
20	Resonance – Series, parallel circuits	Introduction Series resonance circuits with examples	L37	T3-Ch5, R3-Ch3 R8-Ch8	GATE IES
		Parallel Resonance circuits with examples	L38	T3-Ch6, R8-Ch8 R3-Ch3	GATE IES

21	Concept of band width and Q-factor	Introduction Band width - definition and examples Q-factor - definition and examples	L39	T3-Ch5, T3-Ch6 R3-Ch3,R9-Ch13	

Sl. No.	Topics in JNTU Syllabus	Modules and Sub-modules	Lecture	Suggested Books	Remarks
22	Magnetic circuits - Faraday's laws of electromagnetic induction	Objectives Introduction to magnetic circuits Faraday's laws Examples	L40	T3-Ch1, T3-Ch1 R8-Ch8	
23	Concept of self and mutual inductance	Definition of self and mutual inductance Problems on self and mutual inductance	L41	R1-Ch10 T3-Ch14,R3-Ch1	
		Problems on self and mutual inductance and Faradays laws	L42	R1-Ch10 T3-Ch14,R3-Ch1	
24	Dot convention	Dot convention method - Introduction Problems on dot convention	L43	T3-Ch14 R1-Ch10,R3-Ch1	
25	Co-efficient of coupling	Co-efficient of coupling – definition Problems on co-efficient of coupling	L44	T3-Ch14 R1-Ch10,R3-Ch1	
26	Composite magnetic circuits – analysis of series and parallel magnetic circuit	Composite magnetic circuits – introduction Series – magnetic circuits	L45	R1-Ch1, R3-Ch2 T3-Ch1	
		Problems on series magnetic circuits	L46	R1-Ch1, R3-Ch2 T3-Ch1	
		Parallel magnetic circuits	L47	R1-Ch1, R3-Ch2 T3-Ch1	
		Problems on parallel magnetic circuits	L48	R1-Ch1, R3-Ch2 T3-Ch12	
		Numerical problems	L49		
		UNIT-IV (NETWORK TOPOLOGY)			
27	Network topology	Objectives Introduction to network topology	L50	T3-Ch10,R3-Ch5 R8-Ch4	
28	Definitions - Graph, tree, basic cut-set and basic tie set matrices for planar networks	Definitions: Graph, tree, link, chord Incident matrix, fundamental loop matrix, problems	L51	T3-Ch10,R3-Ch5 R8-Ch4	GATE IES
		Basic tie set definition and examples, formulation of matrices, solution methods, problems	L52	T3-Ch10,R3-Ch5 R8-Ch4	GATE IES
		Basic cut set definition and examples, formulation of matrices, solution methods Problems	L53	T3-Ch10,R3-Ch5 R8-Ch4	GATE IES
29	Loop and Nodal methods of analysis	Introduction Loop analysis method Examples	L54	T3-Ch11,R3-Ch5 T1-Ch2	GATE IES

	of networks with dependent and independent voltage and current sources	Introduction Nodal analysis method Examples	L55	T3-Ch11,R3-Ch5 T1-Ch2	GATE IES
		Problems on Loop and Nodal analysis	L56	T3-Ch11,R3-Ch5 T1-Ch2	GATE IES

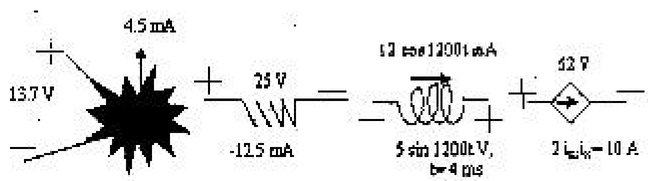
Sl. No.	Topics in JNTU Syllabus	Modules and Sub-modules	Lecture	Suggested Books	Remarks
30	Duality and dual networks	Introduction Duality definition and examples Dual networks definition and examples Examples	L57	T3-Ch11, R3-Ch7 T1-Ch3	
		Problems on Duality and dual networks	L58	T3-Ch11, R3-Ch7 T1-Ch3	
		Numerical problems solution on the related topics from the JNTU questions	L59		
UNIT-V (NETWORK THEOREMS WITH A.C & D.C.)					
31	Network theorems - super position theorem (DC)	Objectives Introduction to network theorems Super position theorem definition and explanation Problems	L60	T3-Ch12, R3-Ch6 R5-Ch3	GATE IES
32	Thevenins theorem (DC)	Introduction Thevenins theorem definition and explanation Problems	L61	T3-Ch12, R3-Ch6 R8-Ch3	GATE IES
33	Norton's theorem (DC)	Introduction Norton's theorem definition and explanation Problems	L62	T3-Ch12, R3-Ch6 R8-Ch3	GATE IES
34	Maximum power Transfer theorem (DC)	Introduction Maximum power Transfer theorem definition and explanation Problems	L63	T3-Ch13, R3-Ch6 R8-Ch3	GATE IES
35	Tellegen's theorem (DC)	Introduction Tellegen's theorem definition and explanation Problems	L64	T3-Ch13, R3-Ch6 R8-Ch3	GATE IES
36	Reciprocity theorem (DC)	Introduction Reciprocity theorem definition and explanation Problems	L65	T3-Ch12, R3-Ch6 R8-Ch3	GATE IES
37	Millman's theorem (DC)	Introduction Millman's theorem definition and explanation Problems	L66	T3-Ch13, R3-Ch6 R8-Ch3	GATE IES
38	Compensation theorems for DC excitations	Introduction Compensation theorem definition and explanation Problems	L67	T3-Ch13, R3-Ch6 R8-Ch3	GATE IES
		Numerical problems	L68		

Sl. No.	Topics in JNTU Syllabus	Modules and Sub-modules	Lecture	Suggested Books	Remarks
39	Network theorems - super position theorem (AC)	Objectives Introduction to network theorems Super position theorem definition and explanation Problems	L69	T3-Ch12, R3-Ch6 R5-Ch3	GATE IES
40	Thevenins theorem (AC)	Introduction Thevenins theorem definition and explanation Problems	L70	T3-Ch12, R3-Ch6 R8-Ch3	GATE IES
41	Norton's theorem (AC)	Introduction Norton's theorem definition and explanation Problems	L71	T3-Ch12, R3-Ch6 R8-Ch3	GATE IES
42	Maximum power Transfer theorem (AC)	Introduction Maximum power Transfer theorem definition and explanation Problems	L72	T3-Ch13, R3-Ch6 R8-Ch3	GATE IES
43	Tellegen's theorem (AC)	Introduction Tellegen's theorem definition and explanation Problems	L73	T3-Ch13, R3-Ch6 R8-Ch3	GATE IES
44	Reciprocity theorem (AC)	Introduction Reciprocity theorem definition and explanation Problems	L74	T3-Ch12, R3-Ch6 R8-Ch3	GATE IES
45	Millman's theorem (AC)	Introduction Millman's theorem definition and explanation Problems	L75	T3-Ch13, R3-Ch6 R8-Ch3	GATE IES
46	Compensation theorems for AC excitations	Introduction Compensation theorem definition and explanation Problems	L76	T3-Ch13, R3-Ch6 R8-Ch3	GATE IES
		Numerical problems	L77		

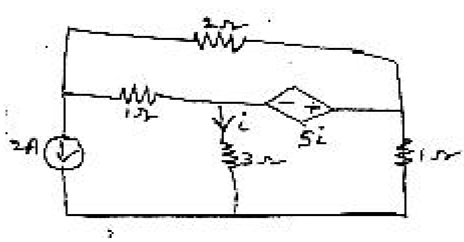
7.4.11 QUESTION BANK

UNIT-I

1. i Name three passive elements of eletrical circuits and deduce the relationship between voltage and current fop each passive elements.
   ii Distigush between ideal and practical voltage source and draw thrir V-I characterstic.
   iii Determine the power being absobed by each of the circuit element shown in Figure.1. **(Dec 12)**



2. i Using Mesh analysis find the magnitude of the current dependent source and current through the 2Ω resistor as shown in Figure.2



   ii Find the power loss in the resistors of the network for the Figure.3 shown using nodal analysis.**(Dec 12)**

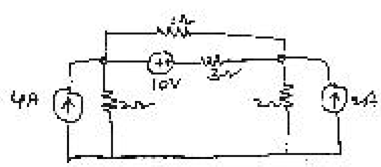
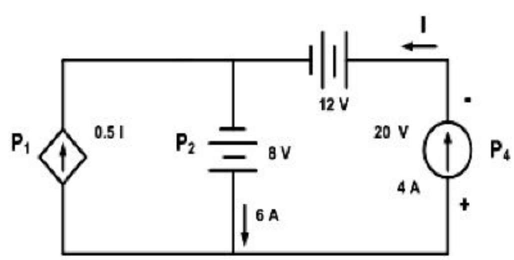


Figure.3

3. i. Calculate the power absorbed by each component in the circuit shown in below Figure. **(Dec 11)**



   ii. Consider the resistance shown below Figure (a). A voltage v(t) of waveform given in Figure (b) is applied at its terminals. Obtain the waveform of current through it.

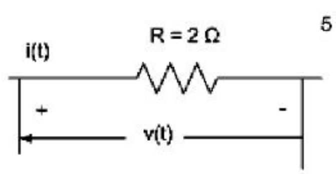


Figure (a)

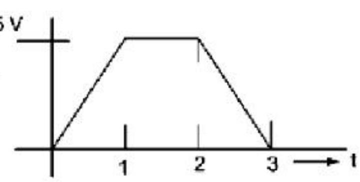
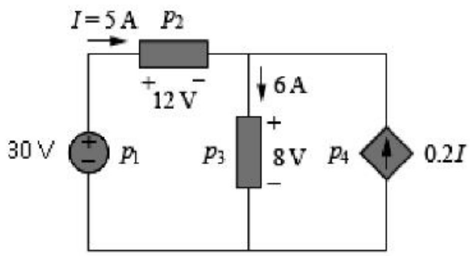
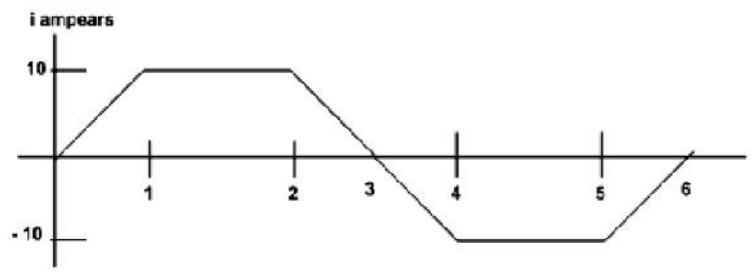


Figure (b)

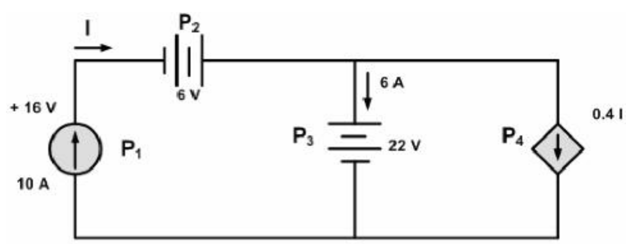
4. i. Calculate the power supplied or absorbed by each element as shown in below Figure. **(Dec 11)**



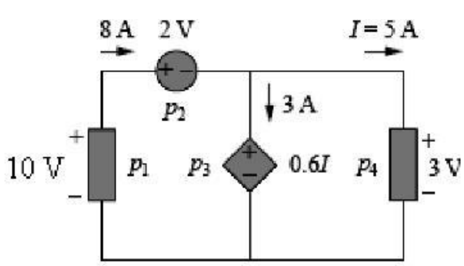
ii. A series RLC circuit with R= 4 ohms, L = 2mH and C = 500 micro-farads is carrying a current waveform shown in below Figure.2. Find the voltage across each element and sketch each voltage to same time scale.



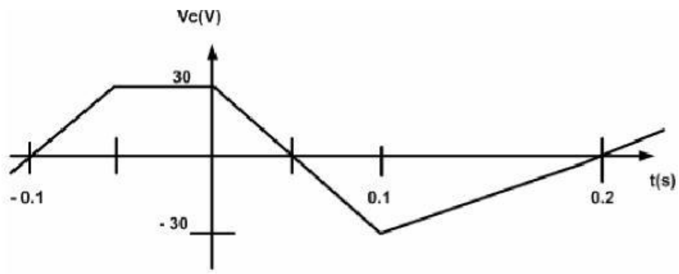
5. i. Calculate the power absorbed by each component in the circuit shown in below Figure. **(Dec 11)**



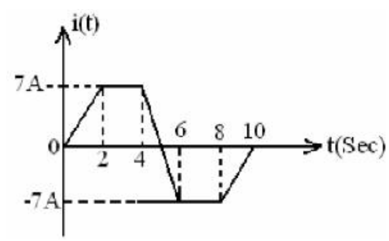
ii. A series circuit with R= 2 ohms, L = 2 mH, and C = 500 micro-farads has a current which increases linearly from zero to 10 A in the interval $0 \leq t \leq 1$ ms, remains at 10 A for 1 ms $\leq t \leq$ 2 ms, and decreases linearly from 10 A at t = 2 ms to zero at t = ms. Sketch VR, V_L, V_c.



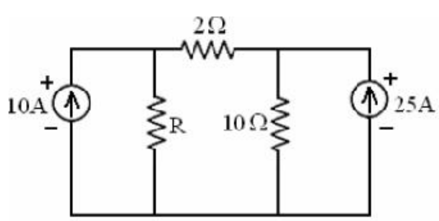
6. If the current waveform shown in below Figure. is applied to a 5 micro-farads capacitor, find the capacitor voltage vc(t) and prepare a sketch showing this waveform. Assume that the initial capacitor voltage is zero.



7. i. Write the volt-ampere relationship of R, L and C elements.
   ii. Explain the independent and dependent sources.



8. i. Distinguish between ideal and practical sources and draw their characteristics.
   ii. Calculate the value of 'R' in the circuit shown in below figure, if the power supplied by both the sources is equal.



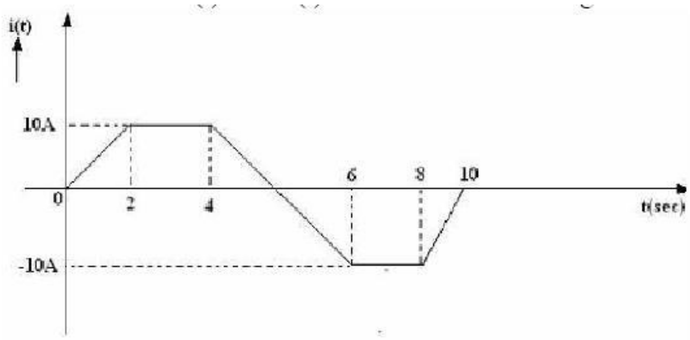
i. Compare active and passive elements and give examples for each.

ii. Explain the source transformation technique. **(May 11)**

9. i. Explain Active elements in detail.
   ii. A 25 ohms resistor is connected across a voltage source V (t) = 150 Sin ωt. Find the current I (t) and the instantaneous power P(t) and also the average power. Draw the relevant waveforms. **(Nov 10)**

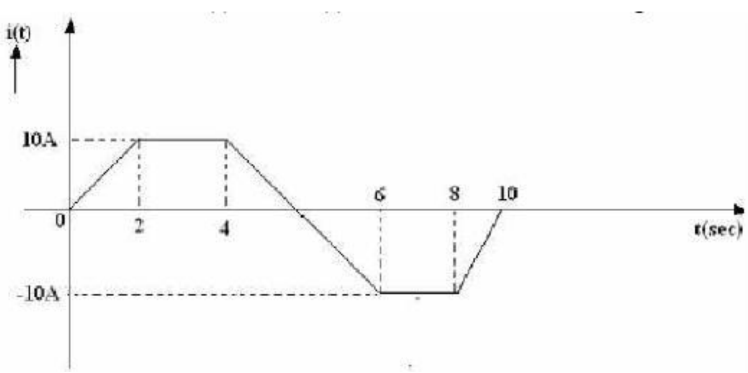
10. Explain Passive elements in detail. **(Nov 10)**

11. A pure inductance of 3 mH carries a current of the wave form shown in figure. Sketch the waveform of V(t) and P(t). Determine the average value of power.



(Nov 10, Sep 06)

12. i. Write short notes on source transformation.
    ii. A pure inductance of 5 mH carries a current of the wave form shown in figure. Sketch the waveform of V(t) and P(t). Determine the average value of power.



(Nov 10)

13. i. Explain voltage - current relationship for passive elements.
    ii. A 20 ohms resistor is connected across a voltage source V (t) = 200 Sin ω_t. Find the current I (t) and the instantaneous power P(t) and also the average power. Draw the relevant waveforms. **(Nov 10)**

14. What are passive and active elements? Explain the volt-current relationship of passive elements with examples. **(June 09)**

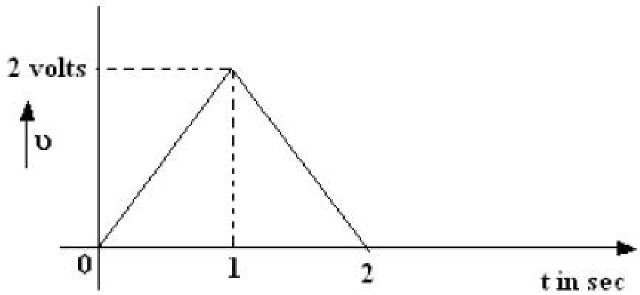
15. i. Define the following **(June 09)**

    a. Resistance

    b. Inductance

    c. Capacitance Also, Give the v - i relationship for the above elements.

    ii. A capacitor of 1F is supplied with a voltage wave form shown in figure Obtain the current and energy wave forms in the capacitor.



iii. A current $i = 10\,e^{-t}$ is applied to a 2H inductor. What is the respective voltage across inductor?

16. i. Explain **(June 09, May 06)**

a. KCL

b. KVL

c. Practical current source

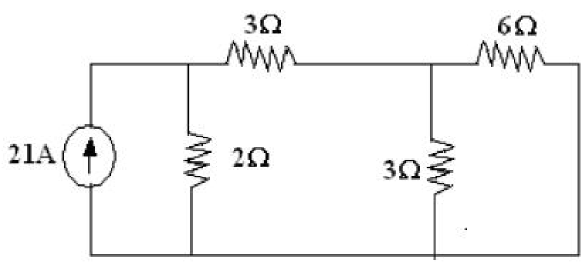
d. Practical voltage source.

ii. A 20V battery with an internal resistance of 5 ohms is connected to a resistor of x ohms. If an additional resistance of 6Ω is connected across the battery, find the value of x, so that the external power supplied by the battery remain the same.

17. i. What is the difference between an ideal source and a practical source? Draw the relevant characteristics of the above sources.

ii. Explain the difference between active elements and passive elements with suitable examples.

iii. Determine the current through 6Ω resistor and the power supplied by the current source for the circuit shown in figure.

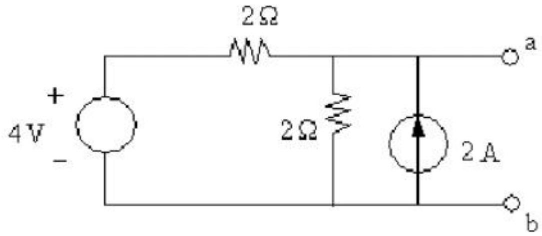


18. i. Distinguish between **(Feb 08)**

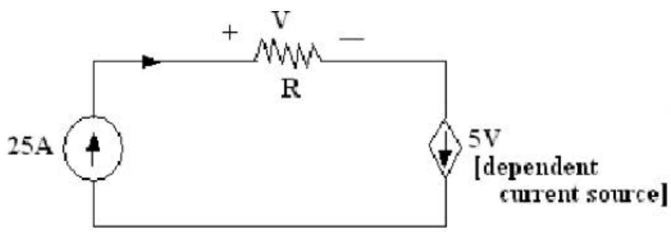
a. Independent and dependent sources.

b. Ideal and practical sources.

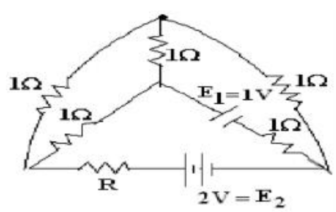
ii. Determine the value of R in figure. so that the current supplied by the battery E_1 would be zero.



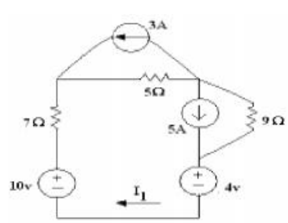
19. i. Explain Independent and dependent source in a detail. **(Feb 08)**
    ii. A circuit containing a 25 A independent current source and a 5-V dependent current source as shown in figure. Calculate V and R.
    ii. A voltage given by, $v = 6t$ volts is connected across a 25 ohms resistor. Determine the energy dissipated by the resistor during the internal $0 \le t \le 5$ sec.



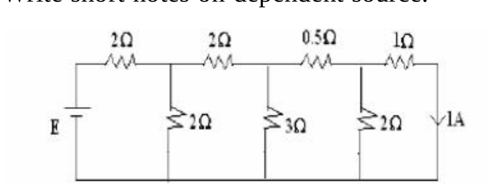
20. i. Distinguish between **(Feb 08)**
    a. Independent and dependent sources.
    b. Ideal and practical sources.
    ii. Determine the value of R in figure. so that the current supplied by the battery E_1 would be zero.



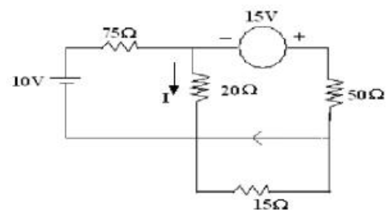
21. i. Find the value of current Ii in figure. **(May 07)**



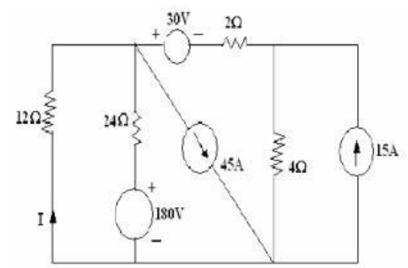
    ii. Find the value of E in the network shown in figure.
    iii. Write short notes on dependent source.



22. i. For the circuit shown below, find the current through 20ohms resistor? **(May 07, 06)**

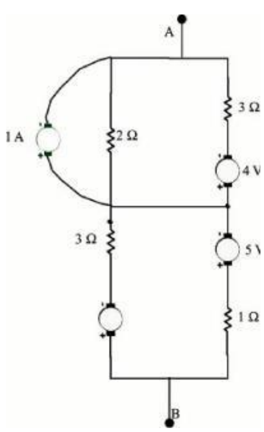


ii. Reduce the network shown below, to a single loop network by successive source transformation, to obtain the current in the 12 ohm• resistor.



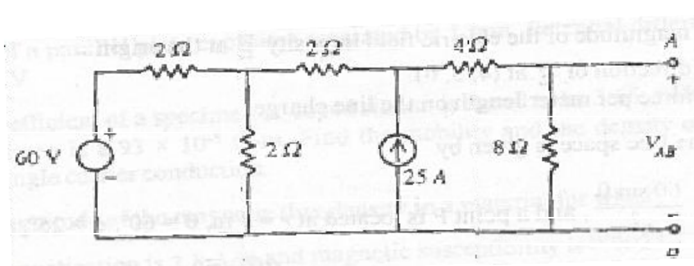
23. Explain volt-ampere relationship of R, L and c elements. **(Sep 06)**

24. Reduce the network of figure to a form with only one current source across terminals A and B



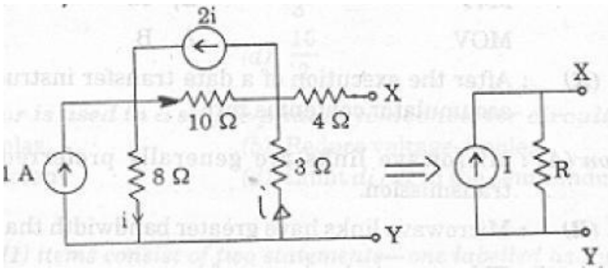
(Nov 03)

25. Find V_{AB} for the circuit shown above using source transformation.

. 

(IES 02)

26. Determine the values of I and R in the circuit shown in the figure.



27Define the following for alternating quantity

a) RMS value, b) Average value c) Form factor, iv) Peak factor.

ii For the circuit shown in Figuer. 4, determine the total impedance, total current and phase angle.

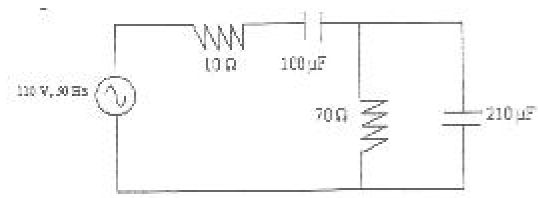
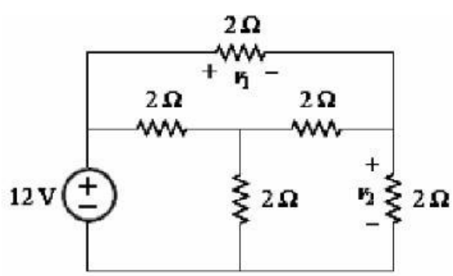


Figure.4

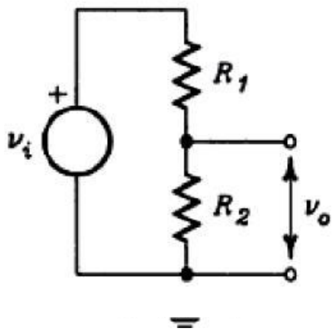
UNIT-II

1. i. Determine v_1 and v_2 in the circuit shown in below Figure. **(Dec 11)**

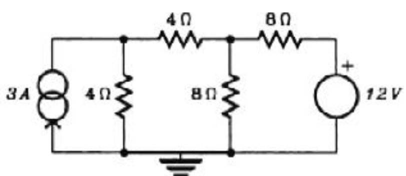


ii. Show by the application of Kirchhoff's law that, for the potential divider shown in below Figure.

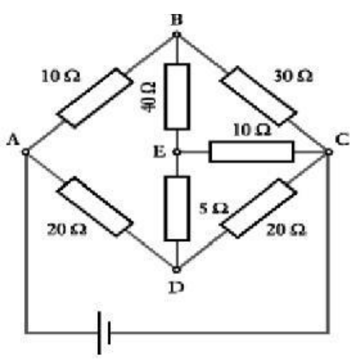
$$v_0 = \frac{R_2}{R_1 + R_2} v_i$$



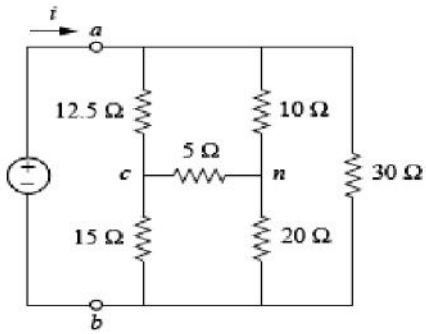
2. Perform both node and mesh analysis for the circuit shown in below Figure to determine all the branch voltages and currents. **(Dec 11)**



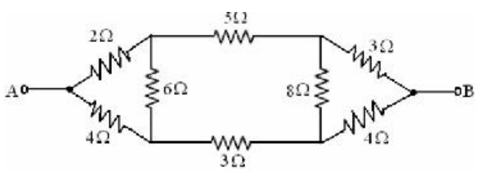
3. A network is arranged as shown in below Figure, and a battery having an e.m.f. of 10 V and negligible internal resistance is connected across the terminals AC. Determine the value and direction of the current in each branch of the circuit. **(Dec 11)**



4. Obtain the equivalent resistance Rab for the circuit shown in below Figure. Find the current *i* for the input voltage of 140 V and calculate the current in all the elements of the circuit. **(Dec 11)**



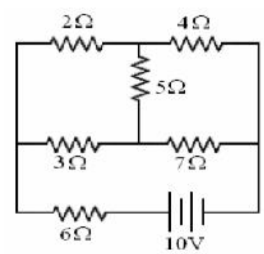
5. Find the voltage to be applied across 'A-B' in order to drive a current of 10 A into the circuit as shown in below figure using star-delta transformation.



(May 11)

6. i. Obtain the expressions for star-delta equivalence of resistive network.

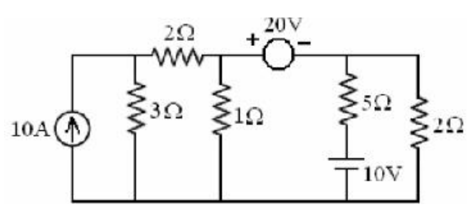
   ii. Calculate the current in the 5Ω resistor using kirchoff's laws for the network shown in below figure.



(May 11)

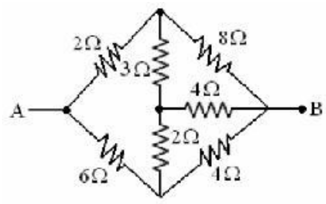
7. i. State and explain kirchoff's laws.

   ii. Determine the current in the 5Ω resistor for the circuit shown in below figure.



(May 11)

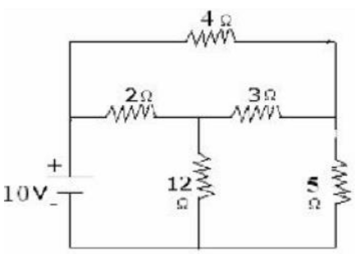
8. Determine the resistance between the terminals 'A-B' in the network shown in below figure.



(May 11)

9. i. State and explain Kirchoff's laws.

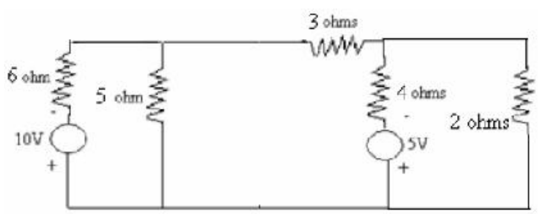
   ii. Find the current supplied by 10 V battery by using Star – Delta transformation for the following network.



(Nov 10)

10. i. Three resistances R_{ab}, R_{bc} and R_{ca} are connected in delta connection, Derive the expressions for equivalent star connection.

    ii. By using nodal analysis find the current flowing through 3 ohms resistor.



(Nov 10)

11. i. Write short notes on Star – Delta transformation.

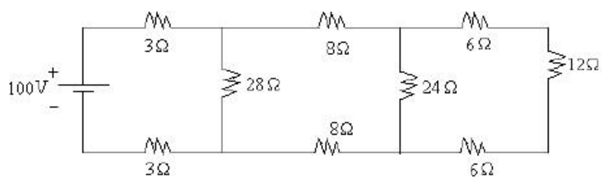
    ii. By taking any one example write down the procedure to obtain node voltages by using nodal analysis.**(Nov 10)**

12. i. State and explain Kirchoff's laws.

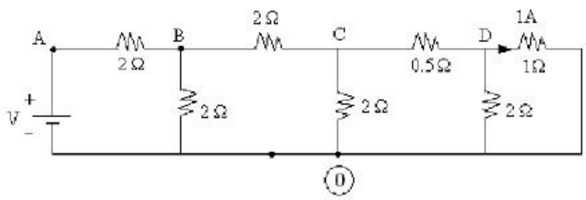
    ii. By using loop analysis find the current flowing through 5 ohms resistor.

(Nov 10)

13. i. Find the current delivered by the source for the network shown in figure using network reductions technique. **(June 09)**



ii. Find the value of applied d.c. voltage for the network, shown in figure.



14. i. A bridge network ABCD is arranged as follows: **(June 09)**

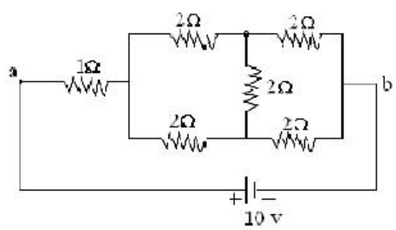
Resistance between terminals AB, BC, CD, DA and BD are 10 ohms, 30 ohms, 15 ohms, 20 ohms and 40 ohms respectively. A 4V battery is connected with negligible internal resistance is connected between terminals A and C. Determine the current through each element in the network using network reduction techniques.

ii. Three equal resistances are available. Find

a. Two ration of the equivalent resistances when they are connected in parallel.

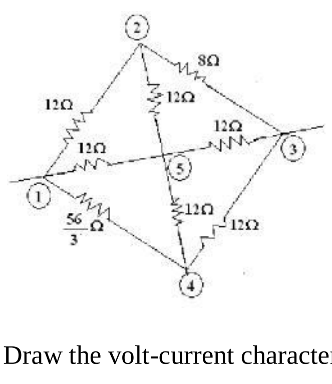
b. The ratio of the current through each elements when they are connected in parallel.

15. Find the power loss in 1 ohm resistance for the network as shown in figure. **(June 09)**



Three resistances are connected is parallel having the ration of 1:2:3 the total is 100 W when 10 V is applied to the combinations, find the values of the resitances.

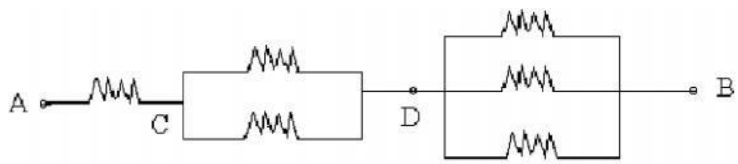
16. i. For the interconnected resistors as shown in figure, find the net resistance between the terminals 1 and 3.



ii. Draw the volt-current characteristic of practical voltage source? **(June 09)**

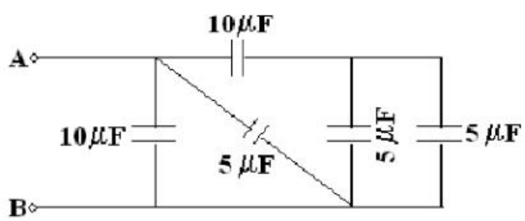
17. i. Two resistances when they are in series has an equivalent resistance of 9 ohms and when connected in parallel has an equivalent resistance of 2 ohms. Find the resistances and the ratio of the voltage and current sharing between these elements if supply voltage is 50V. **(May 08)**

ii. Find the equivalent resistance between the terminals AB in the network as shown in figure, if each has a resistance of R ohms and hence find the total current, current through each of the element if the total voltage is 45V.

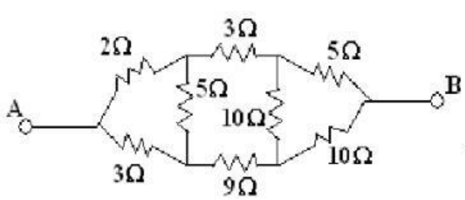


18. i. Voltage of 60V d.c. is applied across two capacitors of 100 μF. Find the voltage sharing between them if they are connected in series. What is the energy stored in each of the capacitors.

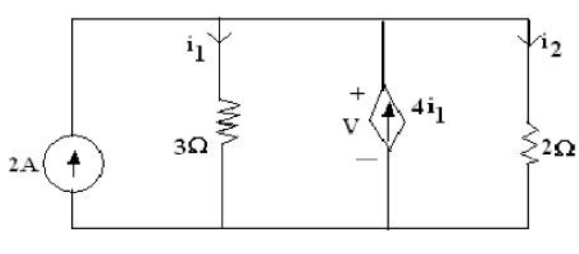
ii. Find the equivalent capacitance between the terminals A and B in the circuit shown in figure. **(May 08)**



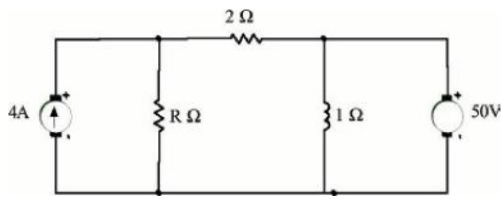
19. i. Find the voltage to be applied across AB in order to drive a current of 5A into the circuit by using star-delta transformation. Refer figure. **(Feb 08, May 06)**



ii. Using Kirchoff's current law, find the values of the currents i_1 and i_2 in the circuit shown in figure.

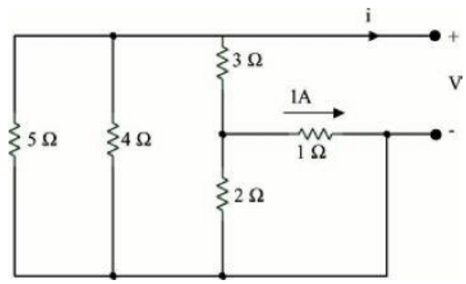


20. What is the value of R such that the power supply by both the sources are equal?



(May 04)

21. Determine the necessary values of V and I in the network shown in figure

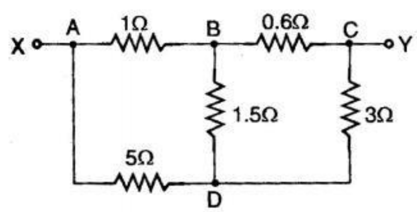


(Nov 03)

22. Determine the equivalent resistance between XY in the circuit shown

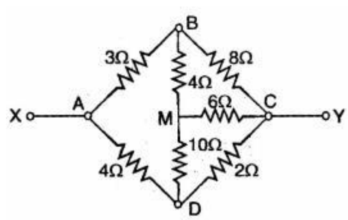
i. Using star-delta transformation

ii. Without using star-delta transformation.



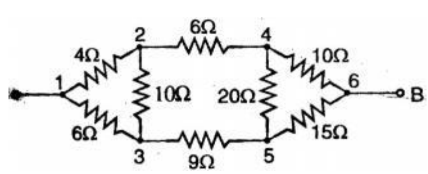
(BU Feb 97)

23. Determine the resistance between XY in the circuit shown in the Fig.



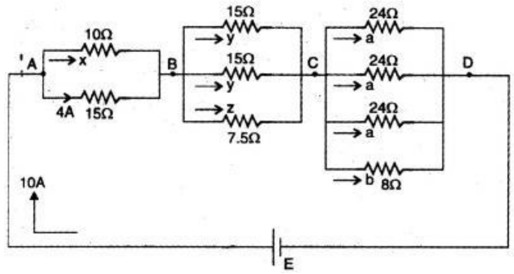
(BU Aug 96)

24. Find the voltage to be applied across AB in order to drive a current of 10A into the circuit. Use Star-Delta transformation.



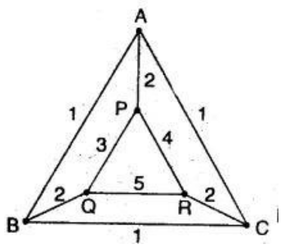
(BU Feb 96)

25. Find the current in all branches of the network shown.



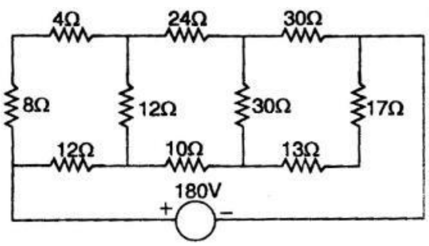
(BU Feb 96)

26. Find the equivalent resistance across terminal AB of the network shown in Fig. using Star-Delta transformation. All values are in ohms.



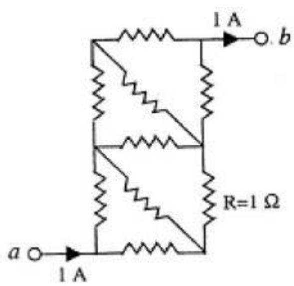
(BU Feb 95)

27. Determine the current in the 10 ohm resistor in the network shown in Fig. using star-delta conversion.



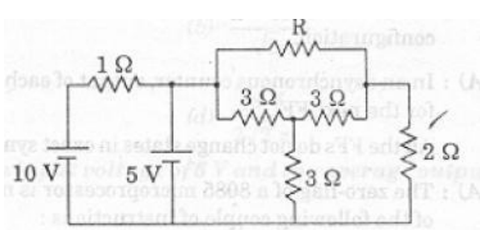
(BU Aug 94)

28. In the resistive network shown in figure all resistor values are 1 Ohm. A current of 1A passes from terminal a to terminal b. Calculate the voltage between terminals a and b, (Hint: You may exploit the symmetry of the circuit)



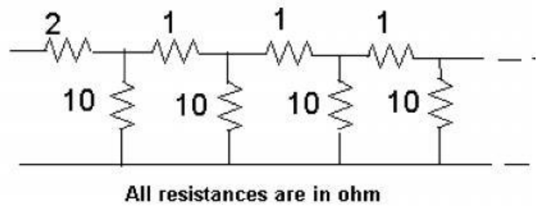
(GATE 02)

29. Determine a non negative value of R such that the power consumed by the 2 Ohm resistor in the figure shown is maximum.



(IES 02)

30. Find the input resistance of the infinite ladder n/w of Fig.

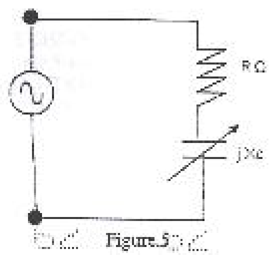


(IES 1999)

UNIT-III

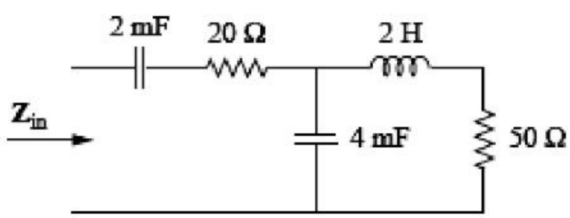
1. Define the band width and derive the expression for bandwidth of series resonating circuit and its relation with q- factor.

ii Write the applications of locus diagrams for the circuits shown in Figure.5 plot the locus of current.

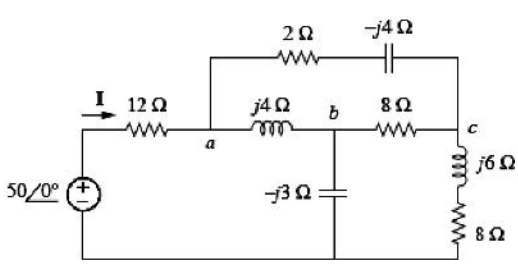


(MAY 12)

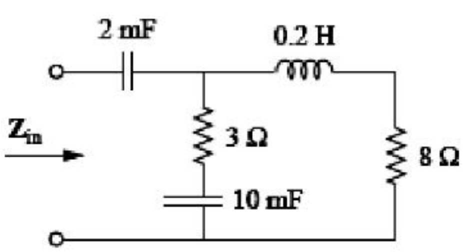
2. i. Determine the input impedance of the circuit shown in below Figure at $\omega = 10$ rad/s.**(Dec 11)**



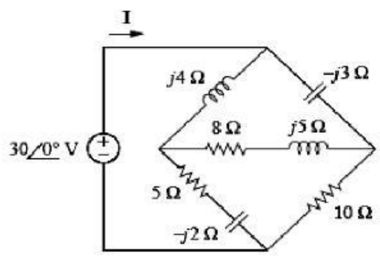
ii. Find current **I** in the circuit shown in below Figure.



3. i. Determine the input impedance of the circuit shown in below Figure at $\omega = 50$ rad/s.**(Dec 11)**



ii. Find **I** in the circuit shown in below Figure.



4. i. A resultant current wave is made up of two components : a 5A D.C component and a AC component of 50 Hz sinusoidal waveform which has a maximum value of 5A. **(Dec 11)**

a. Sketch the resultant wave

b. Write an analytical expression for the current wave and find a point where the AC component is zero value and also find where *di/dt* is positive.

c. What is the average value of the resultant current over a cycle?

d. What is the effective value of the resultant current?

ii. In a RC series circuit, which element doesnot consumes power? and prove it.

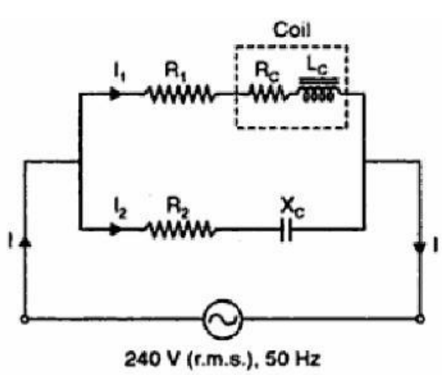
5. i. Prove that if a D.C current of I_{amps} is superposed in a conductor by an A.C current of maximum value I amps, the r.m.s value of the resultant is . **(Dec 11)**

ii. For the parallel circuit shown in below Figure has the parameter values as: R_1 = 100 ohms (non inductive) ; coil R_c = 40 ohms, L_c = 0.52 H, R_2 = 120 ohms; and X_c = 158 ohms (at 50 Hz).

a. Determine the branch currents and the total current

b. Draw the phasor diagram indicating the curerents and voltages across the coil and capacitor.

c. If the A.C source is replaced by an equivalent D.C source, what current wound be drawn by the circuit?



6. i. Define the following terms:

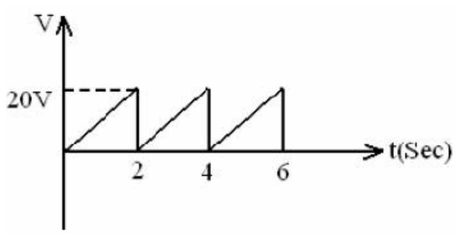
a. RMS value

b. Average value

c. Form factor

d. Peak factor

ii. Determine the average and effective values of saw-tooth waveform as shown in below figure.



(May 11)

7. Define the following terms: **(May 11, 09)**

i. Impedance

ii. Reactance

iii. Phase deference

iv. Power factor

8. A circuit consists of a resistance of 15Ω, a capacitance of 200 μF and inductor of 0.05H all in series. If supply of 230V, 50Hz is applied to the ends of circuit. Calculate

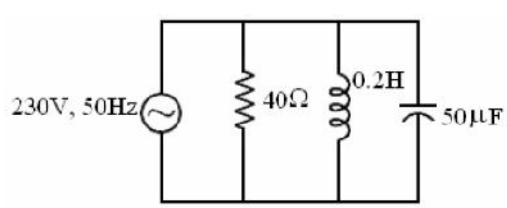
i. Current in the coil

ii. Potential difference across each coil

iii. Frequency at which current would have unity power factor. **(May 11)**

9. i. Define the RMS value and obtain an expression for the RMS value of sinusoidal current.

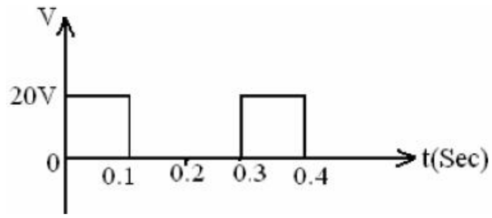
ii. Determine the circuit current and p.f for the following network shown in figure.



(May 11)

10. i. Explain the significance of j-operator. What are the different forms of expressing the sinusoidal quantity in complex form?

ii. Compute the RMS and average values of square wave form shown in below figure.



(May 11)

11. i. Derive the expression for RMS value of alternating current wave $I = I_m \sin \omega t$.

ii. A coil takes a current of 1 A at 0.6 lagging power factor from a 220 V, 60 Hz single phase source. If the coil is modeled by a series RL circuit find

a. The complex power in the coil and

b. The values of R and L. **(Nov 10)**

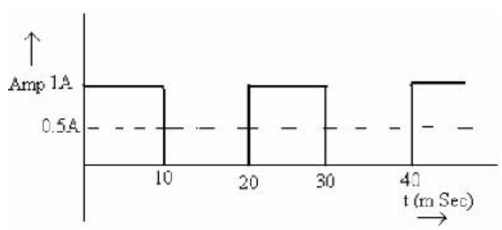
12. i. Show that power dissipated by a pure capacitor exited by a sinusoidal voltage source V = Vm Sin ωt is zero.

ii. A circuit consisting of three branches, Z_2 is in parallel with Z_3 the combination is in series with Z_1 having the values Z_1=10+j30, Z_2 = 5+j10and Z_3 = 4-j16 connected across single phase, 100 V, 50 Hz supply. Find

a. I_1, I_2 and I_3

b. V_1 and V_2 **(Nov 10)**

13. i. Find form factor of a non alternating periodic waveform shown in figure.



(Nov 10)

ii. A parallel circuit having two branches, first branch consisting of 3 ohms resistor is in series with 12.7 mH inductor, second branch consisting of 1 ohm resistor in series with 3.18 mH is connected across 200 V, single phase, 50 Hz supply. Calculate:

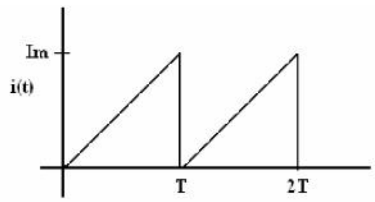
a. Conductance and susceptance of each branch

b. The resultant admittance

c. The current in each branch

d. Total current input **(Nov 10)**

14 Find form factor of triangular waveform shown in the figure.



A series circuit consisting of a 10 ohms resistor, a 100 μF capacitance and 10 mH inductance is driven by a 50 Hz AC voltage source of maximum value 100 V. Calculate the equivalent impedance, current in the circuit, the power factor and power dissipated in the circuit.

(Nov 10)

15. Two coils A and B have resistance of 12Ω and 6Ω and inductances of 0.02 and 0.03H respectively. These are connected in parallel and a voltage of 200V at 50Hz is applied to their combination. Find

i. Current in the each coil.

ii. The total current and the

iii. The power factor of the circuit.

iv. Power consumed by each coil and total power. **(June 09)**

16. A series -parallel circuit consists of three branches A, B and C in parallel and branch D in series with the parallel combination. The parameters of various branches are given below: **(June 09)**

Branch A : R=2Ω, L=0.0159H

Branch B : R=0.5Ω, C=0.00318F

Branch C : R=1Ω

Branch D : R=0.4 Ω, L=2.546mH

The entire circuit is connected across a voltage of 200V,50Hz. Calculate

i. The impedance of the circuit and

ii. The power consumed in each branch.

17. i. Deduce the relationship between the phase and line voltages in a star connected circuit. **(June 09)**

ii. Three similar inductive coils, each having a resistance of 20Ω and reactance of 12.57Ω are connected in star are fed from a 3-phase, 50Hz, 200V supply. Calculate the line current and the power absorbed.

18. i. Three identical impedances of (3+j4)Ω are connected in delta. Find an equivalent star network such that the line current is the same when connected to the same supply.

ii. Three impedances of (7+j4)Ω, (3+j2)Ω and (9+j2)Ω are connected between neutral and the R, Y and B phases. The line voltage is 440V, calculate.

a. The line currents and

b. The current in the neutral wire.

c. Find the power consumed in each phase and the total power drawn by the circuit. **(June 09)**

19. A 2 ohm resistance, 0.125 F capacitance and 3 H inductance are connected in series across a voltage of v (t) =12 sin (2t+30^0). Find **(June 09)**

i. Z, I, V_L, V_C, power factor and active power.

ii. Write time functions for i, v_L and v_C

iii. Draw the vector diagram.

20. i. An alternating voltage (80 + j60) v is applied to a circuit and current flowing is (-4 + j10) A. Find the

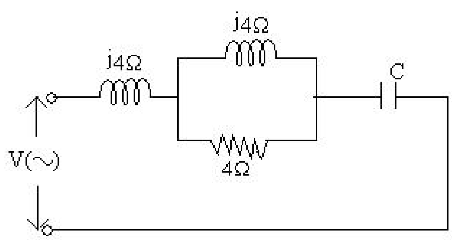
a. impedance of the circuit and b. the power factor.

ii. In a particular circuit a voltage of 10v at 25 Hz produces 100mA, while the same voltage at 75Hz produces 60mA. Draw the circuit diagram and insert the values of the constants. At what frequency will the value of impedance be twice that at 25Hz. **(June 09)**

21. A supply of 400V, 50Hz is applied to a series R C circuit. Find the value of C if the power absorbed by the resistor to be 500 w at 150v. What is the energy stored in a capacitor?

ii. Obtain the current expression in a R L series circuit when it is excited by v (t) =V_m sin wt. Also, draw the waveform for power

iii. What should be the value of C such that the input power factor is unity for any frequency ‘f’ of the source? Shown in figure.



22. Define form factor and peak factor of an alternating quantity. Calculate the average and rms value, the form factor and peak factor of a periodic current having the following values for equal time intervals, changing suddenly from one value to next: 0,40,60,80,100,80,60,40,0,-40,-60,-80 A. **(May 08)**

23. i. Derive an expression for the current, impedance, average power for a series RC circuit excited by a sinusoidally alternating voltage and also find the power factor of the circuit. Draw the phasor diagram.

ii. A series R-L series circuit having a resistance of 4 ohms and 3 ohms inductive reactance is fed by 100V, 50Hz, 1- ϕ supply. Find current, power drawn by the circuit and power factor. **(May 08)**

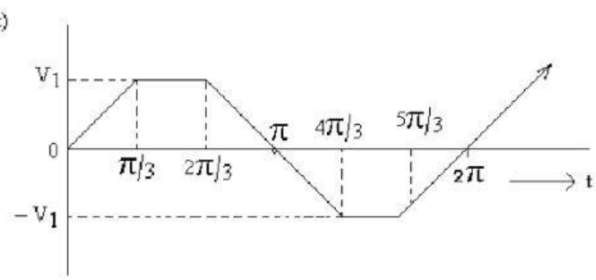
24. Why the rms values of an alternating quantity is more important than its average value. Find the rms value of the resultant current in a conductor which carries simultaneously sinusoidal alternating current with a maximum value of 15A and direct current of 15A, by deriving necessary expressions. **(May 08)**

25. i. The voltage of a circuit is $v = 200 \sin(wt + 30^0)$ and the current is $i = 50 \sin(wt + 60^0)$. Calculate

a. The average power, reactive volt-amperes and amparant power.

b. Find the circuit elements if $w = 100\pi$ rad /sec.

ii. Find the form factor of the following waveform shown in figure **(Feb 08, May 07)**



26. i. Define power factor? What is its importance in a.c circuits? **(Feb 08)**

ii. The impedances of a parallel circuit are $Z_1 = (6 + j8)$ohms and Z2 = (8 - j6) ohms. If the applied voltage is 120v, find.

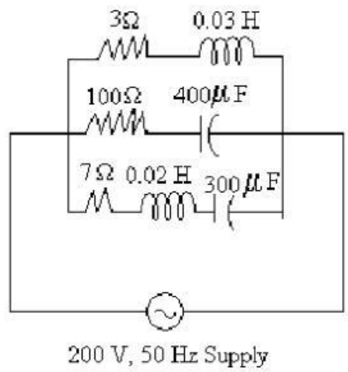
a. current and p.f of each branch

b. overall current and p.f of the combination

c. power consumed by each impedance. Draw a phasor diagram.

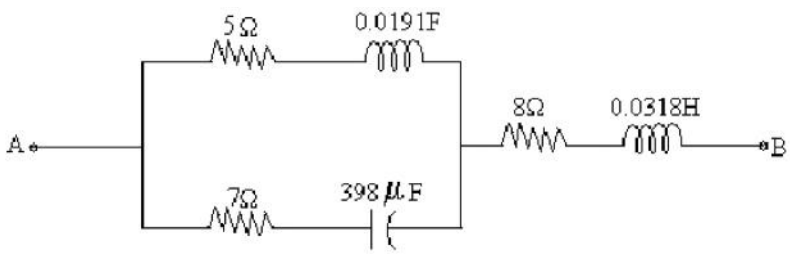
27. i. A 230v, 50Hz voltage is applied to a coil L = 5H and R = 2 ohms in series with a capacitance C. What value must c have in order that the p.d across the coil shall be 250v.

ii. A sinusoidal 50Hz voltage of 200v supplies the three parallel circuits as shown in figure. Find the current in each circuit and the total current. Draw the vector diagram. **(Feb 08)**



28. i. What is Form factor of an alternating quantity? Explain its significance?

    ii. In the circuit shown in figure. What 50Hz voltage is to be applied across A B terminals so that a current of 10Amps will flow in the capacitor.



(May 07)

29. i. Derive the expression for power in a1-ϕA.c circuits.

    ii. In the circuit shown in figure Calculate.

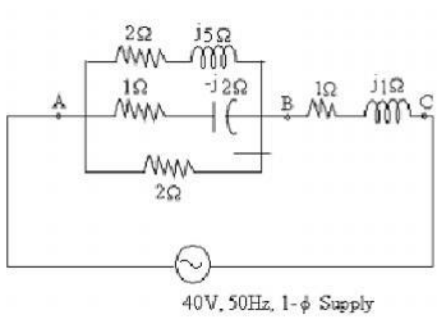
    a. The total impedance

    b. The total current

    c. Power factor

    d. The total S,P and Q

    e. The total admittance. Also, draw vector diagram



(Sep, May 06)

30. i. Explain the concept of

    a. Susceptance and

    b. Admittance

ii. An inductive coil takes 10A and dissipates 1000 watts when connected to a supply of 250V, 25Hz. Calculate.

a. the impedance

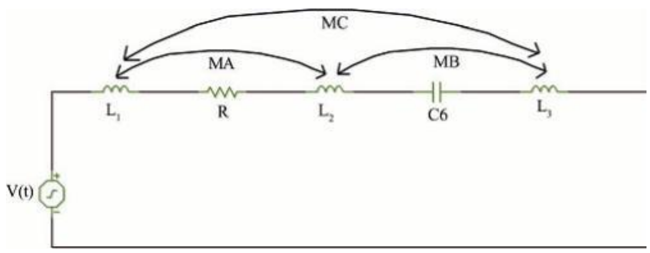
b. the effective resistance

c. reactance

d. the inductance

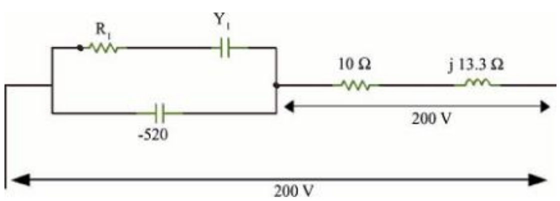
e. power factor. Also, Draw the vector diagram. **(May 06)**

31 Write the voltage equation for the following circuit in fig.



(May 04)

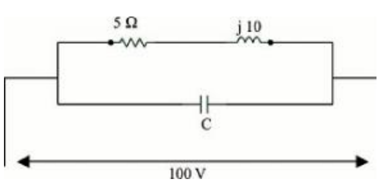
32. Find the value of R_1 and X_1 when a lagging current in the circuit gives a power of 2 KW



(Jun 04)

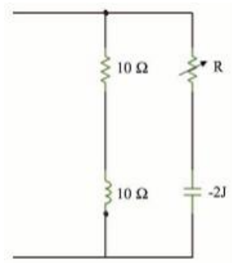
33. Determine the value of 'C' such that the power factor of the circuit is unity

(Nov 03)



34. In steady state analysis determine the circuit consists of a two element series circuit if the applied voltage $V=150 \text{ Sin } (5000t+45^0)$ volts results in a current $i=3 \text{ Sin } (500t-15^0)$ amps. **(Nov 03)**

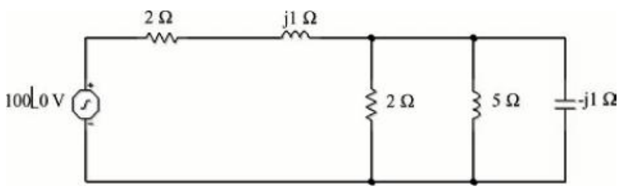
35 For a parallel N/W shown in fig determine the value of R at resonance.



(May 02)

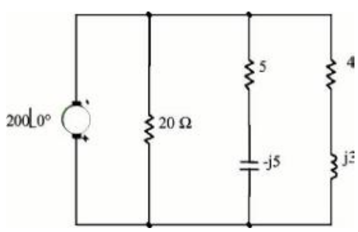
36. A periodic current waveform starts abruptly at 10 amps and decrease linearly to zero and then repeats the cycle. Find the R.M.S. value of the wave form. **(May 02)**

37. Find the reactive power drawn by the circuit shown in fig.



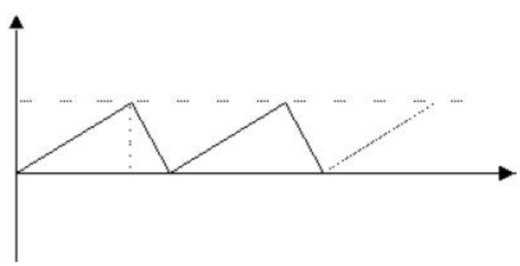
(Jan 02)

38 Find branch currents, total current and power supplied by the source. Draw the Phasor Diagram.



(Jan 02)

39. Determine the r.m.s. value of the saw tooth wave form shown below:



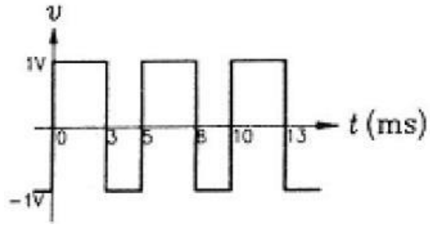
(May 01)

40. Consider the voltage waveform v, shown in figure find.

i. the dc component of v,

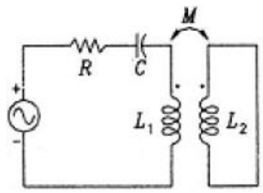
ii. The amplitude of the fundamental component of v, and

iii. The rms value of the AC part of v.



(GATE 01)

41. Determine the resonance frequency and the Q factor of the circuit shown below. R = 10 Ohms, C = 3 μF, L_1 = 40 mH, L_2 = 10 mH, and M = 10 mH

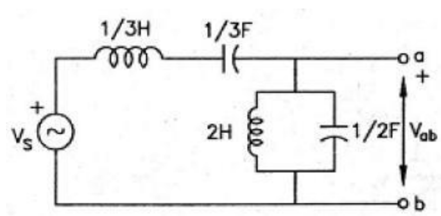


(GATE 01)

42. A circuit consisting of a single resistor R and an inductor L in series is driven by a 25 V rms, 50 Hz sinusoidal voltage source. A capacitor is to be placed in parallel with the source to improve the power factor. Given that the average power dissipated in the R is 100 W and that the reactive power delivered to the L is 75 VAR, what value of C will yield a 0.9 p.f. lagging as seen by the source? **(GATE 98)**

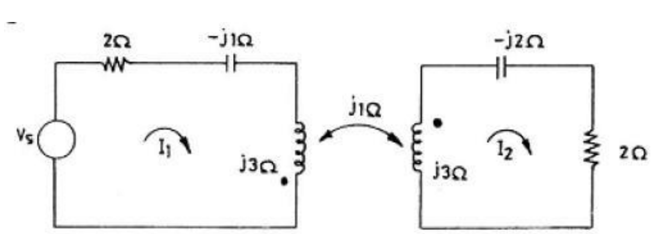
43. A 159.23 μF capacitor is in parallel with a resistance R draws a current of 25 A from 300 V, 50 Hz mains. Using phasor diagram, find the frequency f at which this combination draws the same current from a 360 V mains. **(GATE 94)**

44. Find the rms value of the voltage $v_{ab}(t)$ in the circuit of Figure if $v_s = (240\sqrt{2}\sin t + 70\sqrt{2}\cos 3t)$ volts



(GATE 94)

45. Determine the impedance seen by the source $V_s = 24\angle 0°$ in the network shown
(GATE 93)



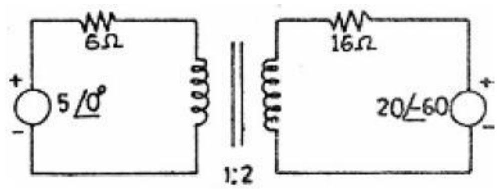
46. For what value of R can one replace the circuit of Figure by a pure resistance at all frequencies? **(GATE 92)**

47. In figure below calculate

i. The power delivered by each source

ii. The power dissipated in each resistor

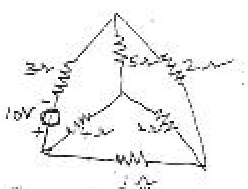
(GATE 91)



UNIT-IV

1. i Define and illustrate the following with an example:
   a) Branch b) Tree c) Cut-set d) Tie-set.

   ii Figure 6 shown below represents resistive circuits. Determine the number of branches, number of nodes, and number of links. Write down the incidence matrix for the given network. Also develop the network equiliobrium equations. (Dec-2012)



2. In the circuit shown in below Figure R = 2 ohns, L = 1 mH, and C = 0.4 μF. **(Dec 11)**

   i. Find the resonant frequency and the half-power frequencies.

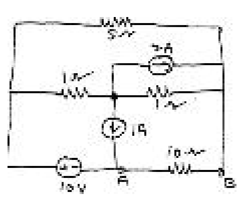
   ii. Calculate the quality factor and bandwidth.

   ii. Determine the amplitude of the currents at resonant and half-power frequencies ω_0, ω_1, and ω_2.

3. i Is Norton theorem duel of thevenin's therem? Justify your answer.

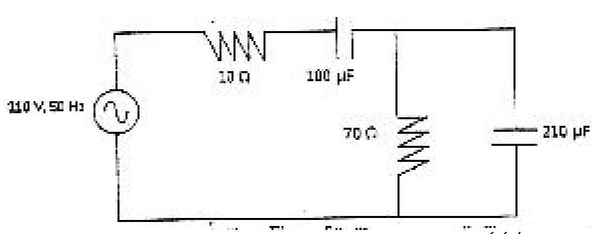
   ii Find the current in the 10Ω resistor as shown in below figure 7 using superposition theorem.

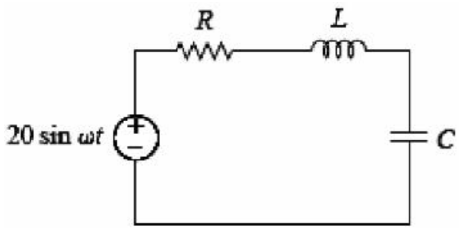
(Dec-2012)



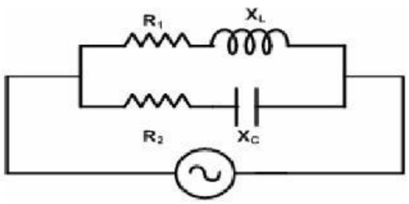
4. i State and explain the compensation theorem

   ii Apply Thevenin's therem and obtain the current passign thrugh 210 μF capacitor of Figure8. (Dec-12)

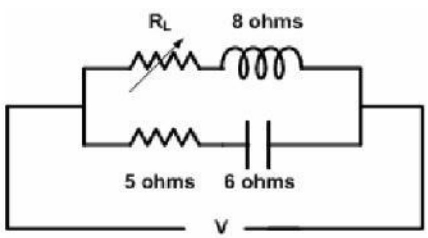




5. Derive an expression for the resonant frequency for a parallel circuit shown in below Figure.**(Dec 11)**



Draw the locus diagram and obtain the value of RL in the circuit shown in below Figure which results in resonance for the circuit.



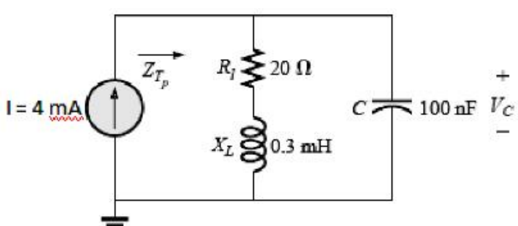
6. i. For the parallel resonant circuit shown in below Figure with $R_s = \infty\ \Omega$. **(Dec 11)**

a. Determine resonant frequency (*fs*), half power points.

b. Calculate the maximum impedance and the magnitude of the voltage VC at fm.

c. Determine the quality factor *Qp*.

d. Calculate the bandwidth.



ii. A non inductive resistance R, variable between 0 and 12 ohms, is connected in series with a coil of resistance of 4 ohms and reactance of 5 ohms the circuit supplied from a 230 V a,c supply. By means of a locus diagram, determine the current supplied to the circuit when R is 0, 6 and 12 ohms.

7. A series-connected RLC circuit has R = 4 and L = 25 mH. **(Dec 11)**

i. Calculate the value of C that will produce a quality factor of 50.

ii. Find ω_1, ω_2, and B.

iii. Determine the average power dissipated at $\omega = \omega_0, \omega_1, \omega_2$. Take $V_m = 100$ V.

8 i. Explain the procedure to draw the locus diagram of R-L series circuit when L is varying.

ii. A series RLC circuit has to be designed so that it has a band width of 320 Hz and inductance of the coil is 0.2H. It is has to resonate at 350Hz, determine the resistance of coil and capacitance of condenser. If the applied voltage is 150V, determine the voltage across capacitor and coil.

(May 11)

9. i. Derive the expression for band width of RLC series circuit.

ii. A series circuit consisting of R = 500Ω, L = 0.5 H and C = 15 μF is connected to a variable frequency supply of 120V. If the frequency is varied through 40 to 80 Hz, draw the locus diagram of current. Determine the current and p.f at 40 and 80 Hz frequency.

(May 11)

10. i. Explain the procedure to draw the locus diagram of R-C series circuit when 'C' is varying.

ii. An impedance coil having R = 20Ω and a 50Hz inductive reactance of 22Ω is connected to 110V, 60Hz source. A series circuit consisting of resistor, R = 10Ω and variable capacitor is then connected in parallel with coil

a. For what value of 'C' will the circuit be in resonance?

b. Calculate two line currents at resonance **(May 11)**

11. i. Explain the procedure to draw the lows diagram of R-L-C series circuit when varying X_L and X_C.

ii. A series resonant circuit has the following parameters:

Resonance frequency = 3×10^6 Hz,

Band width = 10^5Hz and R = 4Ω.

Calculate L and C of the network, half power frequency and power quality **(May 11)**

12. i. Show that the resonant frequency ω_0 of an RLC series circuit is the geometric mean of ω_1 and ω_2, the lower and upper half power frequencies respectively.

ii. A voltage $V = 50\angle 0^0$ V is applied to a series circuit consisting of fixed inductive reactance X_L = 5 ohms and a variable resistance R. Sketch the admittance and current locus diagrams.

(Nov 10)

13. i. Obtain the current locus of a series circuit having a fixed resistance and a variable inductance.

ii. Given a series RLC circuit with R = 100 ohms, L = 0.5 H and C = 40 μF, Calculate the resonant, lower and upper half – power frequencies. **(Nov 10)**

14. i. Show that $Q_0 = \omega_0 L/R = f_0/BW$ for a series RLC circuit.

ii. A voltage of $V = 50\angle 0^0$ V is applied to a series circuit of fixed resistance R = 5. ohms and a variable capacitance C. Sketch the admittance and current locus diagrams. **(Nov 10)**

15. i. Obtain the current locus of a fixed resistance and a variable capacitance.

ii. Given a series RLC circuit with R = 10 ohms, L = 1 mH and C = 1 μF is connected across a sinusoidal source of 20 V with variable frequency. Find

a. The resonant frequency

b. Q factor of the circuit at resonant frequency

c. Half power frequencies. **(Nov 10)**

16. Draw the current, impedance and admittance loci for an R L series circuit having fixed resistance but variable reactance. **(June 09, May 06)**

17. i. Compare series and parallel resonant circuits.

ii. A series RLC circuit consists of resistor of 100 Ω, an inductor of 0.318H and a capacitor of unknown value. When this circuit is energised by a 230V, 50Hz ac supply, the current was found to be 23A. Find the value of capacitor and the total power consumed. **(June 09)**

18. Obtain the rms value, average value, form factor and peak factor for a voltage of symmetrical square shape whose amplitude is 10V and time period is 40secs. **(May 08)**

19. i. Explain the phenomenon of “Acceptor resonance” in electrical circuits.

ii. Proceeding analytically, sketch the resonance curves for a series resonant circuit with variable frequency and constant R, L and C.

iii. A series circuit comprising R, L and C is supplied at 220v, 50Hz. At resonance, the voltage across the capacitor is 550v. The current at resonance is 1A. Determine the circuit parameters R, L and C. **(May 07)**

20. i. Bring out the differences between series and parallel resonance?

ii. A series RLC circuit consists of resistance R = 20 ohm, inductance, L=0.01H and capacitance, C = 0.04uF. Calculate the frequency at resonance. If a 10 Volts of frequency equal to the frequency of resonance is applied to this circuit, calculate the values of V_C and V_L across C and L respectively. Find the frequencies at which these voltages V_C and V_L are maximum? **(May 06)**

21. Figure shows below a series parallel circuit. Find

a. admittance of each branch

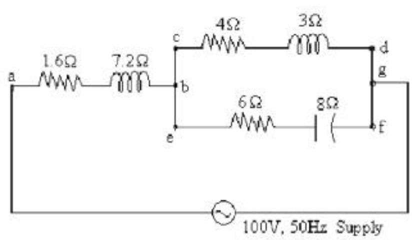
b. admittance between points b and g.

c. impedance between points b and g.

d. total circuit impedance

e. total current and power factor

f. currents in each branch. **(May 06)**



22. A series RLC circuit with Q=250 is resonant at 1.5Hz, find the frequency at half power points and also band width. **(92)**

23. An impedance coil having resistance 28.8 Ohm and inductance 0.024H is connected in series with a 0.008 micro farad capacitance. Calculate :

i. Q of the circuit

ii. Bandwidth

iii. Resonant frequency

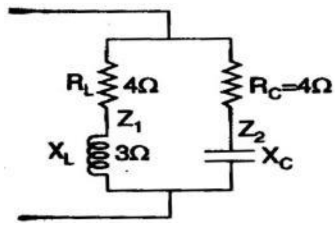
iv. Half power frequencies **(BU Mar 98)**

24. A series RLC circuit with an input voltage of 5 $\angle 0^0$V resonates at a frequency of 8400 Hz. The peak value of current is 500 mA at resonance and the band-width is 120 Hz. Determine the values of R, L, C and cut-off frequencies. **(BU Oct 98)**

25 An R-L-C series circuit of 8 Ohms resistance should be designed to have a bandwidth of 50Hz. Determine the values of L and C, so that the system resonates at 250 Hz. Also determine the half-power frequencies.

(BU Aug 1997)

26. For the network shown in the figure, determine the value of X_C at which it resonates when f = 100 Hz.



(BU Aug 97)

27 An impedance coil having a resistance of 30 Ohms and a 50 Hz inductive reactance of 33.3 Ohm is connected to a 125V, 60 Hz source. A series circuit consisting of a 20 Ohm resistor and a variable capacitor is then connected in parallel with the coil.

i. For what value of capacitance will the circuit be in resonance ?

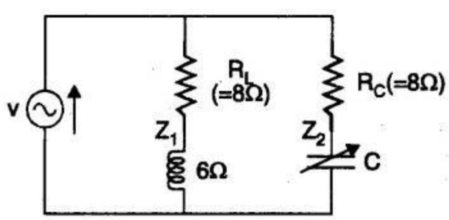
ii. Calculate the two values of the line current for the condition of resonance. **(BU Feb 97)**

28. A series resonant circuit has a resistance of 5 Ohms and quality factor 2π. If the resonant frequency is 100 Hz, Calculate

i. Other two elements

ii. Pass band and half power frequencies. Find the value of reactive element to be connected across this circuit so that unity p.f. current of 1.2A flows, when the combination is connected to a 50 Hz source. Calculate the source voltage. **(BU Aug 96)**

29. For the network shown in the figure, determine the value of C at which it resonates when f = 100 Hz.



(BU Feb 96)

30. An inductance coil having a resistance of 20 Ohms and inductance of 0.02 H is connected in series with 0.02 μF capacitor. Calculate

i. Q of the coil

ii. Resonant frequency and

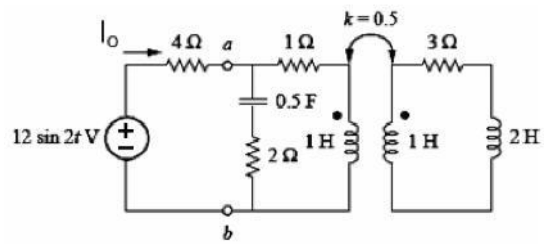
iii. The half-power frequencies. **(BU Jul 89, Feb 96)**

31. For a series resonant circuit with constant voltage and variable frequency, obtain the frequency at which voltage across the inductor is maximum. Calculate this maximum voltage when R = 50 Ohm, L = 0.05 H, C = 20μF and V = 100 Volts. **(BU Aug 95)**

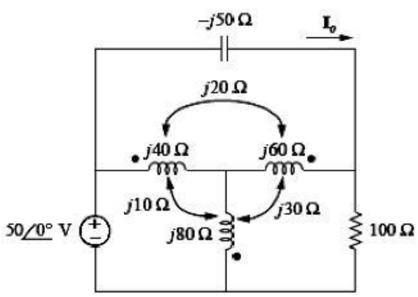
32. A coil with R = 10 ohm and L = 0.2H is in series with a capacitor of 20μF. Determine resonant frequency, Q factor and bandwidth.

33. An R-L-C series circuit of 8 ohms resistance should be designed to have a band-width of 50 Hz. Determine the values of L and C, so that the system resonates at 500 Hz. **(BU Apr 91)**

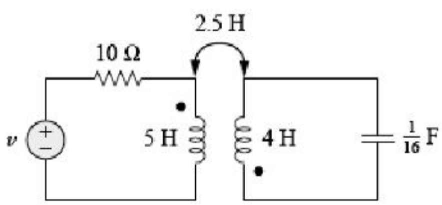
34. For the network shown in below Figure, find **Z**ab and **I**o. **(Dec 11)**



35. Find current **I**o in the circuit shown in below Figure. **(Dec 11)**

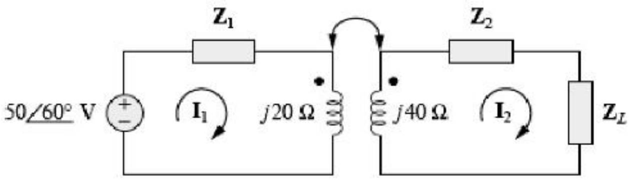


36. i. Consider the circuit shown in below Figure. Determine the coupling coefficient. Calculate the energy stored in the coupled inductors at time t = 1s if v = 60 cos(4t+30°)V.

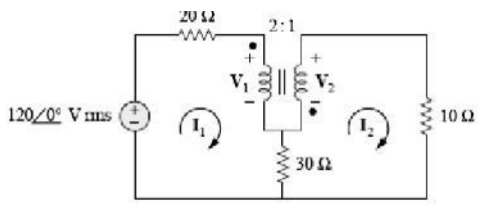


ii. For the circuit shown in below Figure, calculate the input impedance and current $\mathbf{I}_1$.

Consider Z_1=60 - j100Ω, Z_2=30+j40Ω, and Z_L = 80+j60Ω.



37. Define the coefficient of coupling and Calculate the power supplied to the 10 ohms resistor in the ideal transformer circuit shown in the below Figure. **(Dec 11)**



38. i. Compare and contrast electric and magnetic circuit.

ii. Two coils having 500 and 1000 turns, respectively, are wound side by side on a closed iron circuit of area of cross-section 100 cm^2 and mean length 800 cm. Calculate the coefficients of self induction of the two coils and the mutual induction between the two. Neglect leakage. Take μ_r as 2000. If a current steadily grows from 0 to 1 A in 0.1 sec, in the first coil, find emf induced in the other coil.

(May 11)

39. i. State and explain Faraday's laws of electromagnetic induction.

ii. Self-inductance of two coupled coils are $L_1 = 10\times10^{-3}$ H and $L_2 = 20\times10^{-3}$H. The coefficient of coupling (K) being 0.75 in the air, find voltage in the second coil, and the flux of first coil, provided the second coil has 500 turns and the circuit current is $I_1 = 2 \sin 314t$ A. **(May 11)**

40. i. Explain the importance of dot convention in coupled circuits.

ii. A mild steel ring has a mean circumference of 1000 mm and a uniform area of cross-section of 600 mm^2. Calculate the MMF required producing a flux of 500 nWb, assuming permeability of mild steel as 1200. An air gap of 2 mm in length is now cut in the ring. Determine the flux produced, if the MMF remains constant. **(May 11)**

41. i. Derive the relation between self inductance, mutual inductance and coefficient of coupling.

ii. A mild steel ring has a mean circumference of 600mm and a uniform cross-sectional area of 350 mm^2. Calculate the MMF required producing a flux of 600μWb when an air gap of 1mm length is now cut in ring. Also determine the flux produced if MMF remains constant. Given relative permeability of mild steel is 1200. **(May 11)**

42. i. Obtain the expression for co - efficient of coupling.

ii. A cast steel electromagnet has an air gap length of 3 mm and an iron path of length 40 cm. Find the number of amphere turns necessary to produce a flux density of 0.7 Wb/m^2 in the gap. Neglect the leakage and fringing. **(Nov 10)**

43. i. Define and explain self – inductance and mutual – inductance.

ii. Two coupled coils of L_1 = 0.8 H and L_2 = 0.2 H have a coupling coefficient k = 0.9. Find the mutual inductance M.

iii. State and explain Faraday's laws of electro magnetic induction. **(Nov 10)**

44. i. What is an electric circuit? What is a magnetic circuit? Make a comparison between electric circuit and magnetic circuit.

ii. Coil 1 of a pair of coupled coils has a continuous current of 5 A, and the corresponding fluxes φ_{11} and φ_{12} are 0.2 and 0.4 mWb respectively. If the turns are N_1=500 and N_2=1500, find L_1,L_2, M and k.

(Nov 10)

45. i. State and explain Faraday's laws of electro magnetic induction.

ii. An iron ring of mean circumference of 1 m is uniformly wound with 400 turns of wire. When a current of 1.2 A is passed through the coil, a flux density of 1.15 Wb/m2 is produced in the iron. Find the relative permeability of the iron under these circumstances. **(Nov 10)**

46. An iron ring of cross sectional area 800 mm^2 and of mean radius 170mm has two windings connected in series, one of 500 turns and the other of 700 turns. If the relative permeability of iron is 1200 find,

i. The self inductance of each coil.

ii. The mutual inductance, assume that there is no leakage. Derive the formulae used. **(June 09)**

47. i. Derive an expression for the energy stored in an inductor and a capacitor. **(June 09, May 08)**

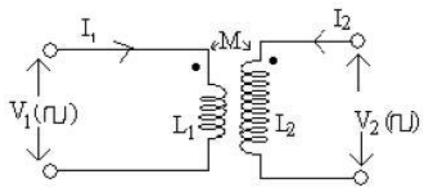
ii. Obtain an expression for Co-efficient of coupling.

48. Two long single layer solenoids have the same length and the same number of turns but are placed co-axially one with in the other. The diameter of the inner coil is 8cm and that of the outer coil is 10cm. Calculate the co-efficient of coupling. **(June 09)**

49. A non-magnetic ring having a mean diameter of 30cm and a cross-sectional area of 4cm^2 is uniformly wound with two coils A and B one over the other. A has 100 turns and B has 250 turns. Calculate the mutual inductance between the coils. Also, calculate the emf induced in B when a current of 6A in A is reversed in 0.02secs. Derive the formulae used. **(June 09, May 08)**

50. i. Write short notes on dot convention used in magnetically coupled coils. **(June 09, May 06)**

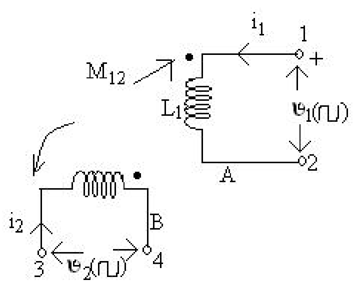
ii. In the network shown in figure, L_1=1H, L_2=2H, M=1.2H. Assuming the inductance coils to be ideal, find the amount of energy stored after 0.1 see of the circuit connected to a d.c.source of 10V.



51. i. Derive the expression of equivalent inductance of two series connected coupled coils. **(June 09, Sep 06)**

ii. Two coupled coils have self-inductances L_1=10mH and L_2= 20mH. The coefficient of coupling is 0.75. Find the voltage in the second coil and the flux of first coil provided the second coil has 500 turns and the circuit current is given by i_1 = 2 sin 314t Amperes.

iii. Write the voltage equation for the following figure showing coupled coil equivalent circuit.



52. i. Distinguish between statically induced e.m.f and dynamically induced e.m.f? **(June 09)**

ii. Derive the expressions for self inductance and mutual inductance interms of number of turns, flux and current in a coupled circuit.

iii. A coil of 150 turns is linked with a flux of 0.01 wb when carrying a current of 10A, calculate the inductance of the coil. If this current is uniformly reversed in 0.01 sec, calculate the induced e.m.f.

53. i. Explain the Faraday's Law of electromagnetic induction?

ii. A cast steel ring has a circular cross section 3cm in diameter and a mean circumference of 80cm. The ring is uniformly wound with 600 turns.

a. Estimate the current required to produce a flux of 0.5 mcob in the ring.

b. If a saw cut 2mm wide is made in the ring, find approximately the flux produced by the current found in(i).

c. Find the current value which will give the same flux as in (i). Assume the gap density to be the same as in the iron and neglect fringing. **(June 09, May 07)**

54. The mean diameter of a steel ring is 40cm and flux density of 0.9 wb/m^2 is produced by 3500 ampere turns per metre. If the cross-section of the ring be 15 cm^2 and the number of turns 440, calculate

i. The exciting current,

ii. The self inductance

iii. The exciting current and the inductance when an air gap of 2cm is cut in the ring, the flux density being the same. Ignore leakage and fringing. **(May 08)**

55. The number of turns in a coil is 250. When a current of 2A flows in the coil, the flux in the coil is 0.3mwb. When the current is reduced to zero in 2ms, the voltage induced in a coil lying in the vicinity of the coil is 63.75V. If the co-efficient of coupling between the coils is 0.75, find.

i. The self inductance of two coils.

ii. Mutual inductance.

iii. Number of turns in the second coil.

Derive the formulae used. **(May 08)**

56. i. Explain the following terms:- **(Feb 08, May 06)**

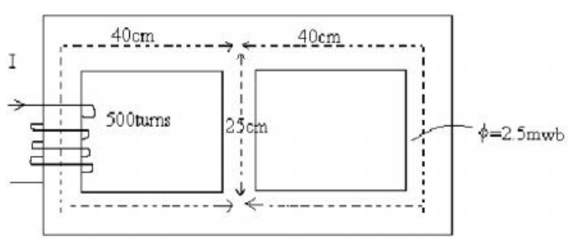
a. Magnetic circuit

b. Permeability

c. Magneto motive force

d. Reluctance.

ii. A cast steel structure is made of a rod of square section 2.5cm × 2.5cm as shown in figure. What is the current that should be passed in a 500 turn coil on the left limb, so that a flux of 2.5mwb is made to pass in the right limb. Assume permeability as 750 and neglect leakage.



57. i. Compare magnetic circuit with electric circuit in any six aspects. **(Feb 08)**

ii. Define

a. Magnetising force and

b. Flux density

iii. For the circuit shown in figure, find the input impedance. Assume load impedance to be Z_L.

58. i. Explain the terms magnetic field strength, magnetic circuit, magnetic flux and magnetic flux density.

ii. What is coefficient of coupling? What is the range of variation of this quantity? In which type of circuits is it minimum and in which type of circuits is it maximum?

iii. The combined inductance of two coils connected in series are 0.6H and 0.1H in series aiding and series opposing connections. If the self inductance of each coil is 0.2H, find the coefficient of coupling?

(Feb 08)

59. i. What is magnetic coupling? What is its effect? How can you arrange two coils so that they donot have magnetic coupling?

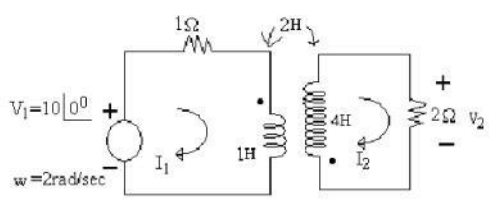
ii. Two coils having 30 and 600 turns are wound side by side on a closed iron circuit of 100 cm2 cross section and mean length 150cm. Calculate

a. The self inductance of the two coils and mutual inductance if relative permeability of iron is 2000. Assume no magnetic leakage.

b. Calculate from 0 to 10A steadily in 0.01sec.

iii. Define reluctance? Give its units. **(May 07)**

60. i. Solve for the currents I_1 and I_2 in the circuit shown in figure. Also, find the ratio of V_2/V_1.



(May 07, Sep 06)

ii. What is magnetic circuit? Compare magnetic circuit with electric circuit in any four aspects.

61. i. Define the following:

a. Self inductance

b. Mutual Inductance

c. Static Induced e.m.f

d.. Dynamically induced e.m.f.

ii. Derive the relationship between the self, mutual inductances and coefficient of coupling.

iii. Two similar coils connected in series gave a total inductance of 600 mH and when one of the coil is reversed, the total inductance is 300mH. Determine the mutual inductance between the coils and coefficient of coupling? **(May 07, 06)**

62. i. Bring out an analogy between magnetic circuits and electric circuits.

ii. Define:

a. Permeability and

b. Magnetic flux.

iii. A ring shaped electromagnet has an air gap of 6mm and 20 cm^2 in area, the mean length of the core being 50cm and its cross section is 10 cm^2. Calculate the ampere-turns required to produce a flux density of 0.5 Wb/m^2 in the gap. Assume the permeability of iron is 1800. **(Sep 06)**

63. i. Explain

a. Self inductance

b. Mutual Inductance.

ii. Two identical 1000 turns coils X and Y lie in parallel planes such that 60% of the magnetic flux produced by one coil links the other. A current of 5A in X produces in it a flux of 0.05mwb. If the current in X changes from +6A to –6A in 0.01sec what will be the magnitude of the e.m.f induced in Y? Also, Calculate the self inductance of each coil and the mutual inductance?

iii. Define leakage factor and its effect in a magnetic circuit. **(Sep 06)**

64. i. Explain

a. Statically induced e.m.f and

b. Dynamically induced e.m.f

ii. Explain the terms

a. MMF

b. Reluctance. **(May 06)**

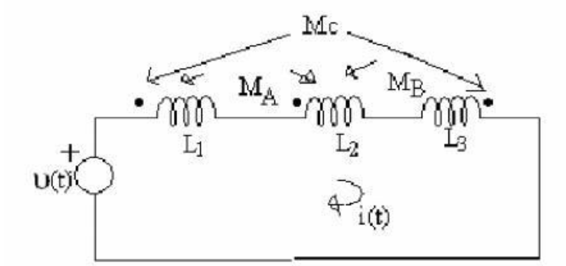
65. Two identical coils connected in series gave an inductance of 800mH,and when one of the coils is reversed gave an inductance of 400mH.Determine self- inductance mutual inductance between the coils and the coefficient of coupling. **(May 06)**

66. i. Explain the Dot Convention for mutually coupled coils.

ii. Derive the Expression for coefficient coupling between pair of magnetically coupled coils. **(May 06)**

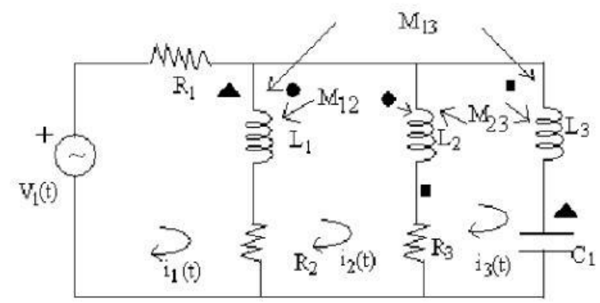
67. i. Define magneto motive force, Magnetic flux, and Reluctance of a magnetic circuit. Specify the unit for the above quantities, state the Relationship between the above quantities.

ii. Write down the Voltage equation for the following circuit, and determine the effective inductance.

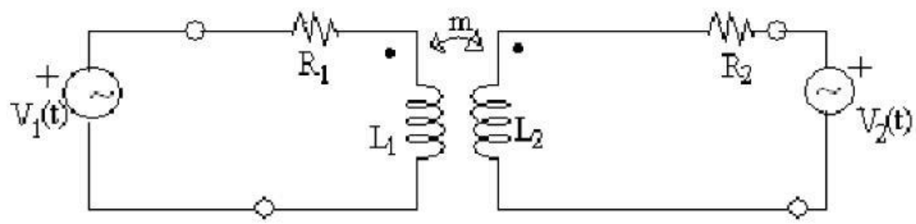


(May 06)

68. Write the Loop Equations for the Coupled circuit shown in Figure. **(May 06)**



69. i. Obtain the Equivalent 'T' for magnetically Coupled circuit shown in Figure.



ii. A coil of 500 turns is wound uniformly over a wooden ring having a mean circumference of 50cms and a cross sectional area of 500mm2. If the current through the coil is 3Amps, Calculate

a. The magnetic strength
b. The flux density and
c. The total flux. **(May 06)**

70. i. State the principle of constant flux linkages.

ii. Why is that current through an inductance does not change suddenly?

iii. Enumerate the features and uses of inductances. **(May 06)**

71. A current of 5A is reduced to 2A in 0.05 Sec in a coil of inductance 1.0 H calculate the mean value of the EMF induced in the coil. **(May 06)**

72. i. Explain how to obtain the B-H curve of a magnetic material. What does that curve indicate?

ii. A steel magnetic circuit has an uniform cross sectional area of 6 cm^2 and length 60cm. A coil of 300 turns is wound uniformly over the magnetic circuit. When the current in the coil is 1A, the total flux is .01 mwb and when the current is 5 amp, the flux is 0.6 mwb. Calculate the magnetic field strength and relative permeability in each case. **(May 06)**

73. i. Define the terms

a. Magnetic flux

b. Magnetic flux density

c. Magneto motive force

d. Reluctance.

ii. The air gap in a magnetic circuits is 1.5 mm long and 2500 mm2 in cross sectional area. Calculate
a. the reluctance of the air gap

b. the m.m.f required to set up a flux of 800×10^{-6} wb in the air gap. **(May 06)**

74. i. What do you understand by the terms "Hysteresis loss" and derive an expression for the same in a magnetic material.

ii. Calculate the value of hysteresis loss in watts occurring a magnetic material, when the flux density is 1.2 tesla, and the frequency of variations is 40 and the volume of the material is 400 cm^3. Take steinmetz. Coefficient as 1.6. **(May 06)**

75. i. Derive an expression for the energy stored in a magnetic field

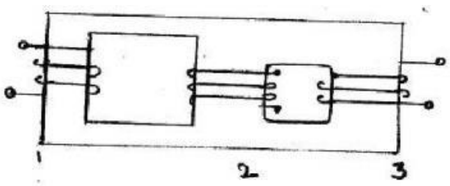
ii. Two coils with self inductance L_1 and L_2 Henrys are connected in series aiding, and the net inductance is found to be 6 henrys and in series opposition (differential) the net inductance is found to be 2 henrys. If the coefficient of coupling between the two coils is 0.5, Calculate the self and mutual inductances.

(May 06)

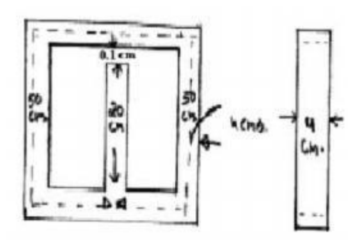
76. i. An iron ring of mean diameter 20cm and a cross sectional area of 10sqcm is wound uniformly with 1000 turns of wire. If a current of 0.5A is passed through the coil, calculate the flux density in the ring assuming permeability of iron to be 800.

ii. Explain the need for dot convention in coupled coils. With a neat diagram explain how dots are placed on coils on the same magnetic material. **(May 06)**

77. i. Explain Dot convention for magnetically coupled coils. Determine the dotted ends for the magnetically coupled coils as shown in the Figure.

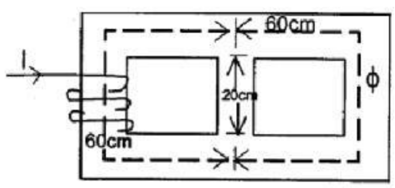


ii. The magnetic circuit shown in Figure4 is designed to carry a flux of 1 milliweber in the air gap. Find the current in the coil of 600 turns wound on the central limb. Assume no leakage. Dimensions are given in cms. Describe permealibity of the material is 350.



(May 06)

78. i. A cast steal iron core has a square cross section of side 3cm. Assuming the permeability of steel to be 800, Find the m.m.f required to produce a flux 0.2 mwb in the right limb as shown in the Figure.



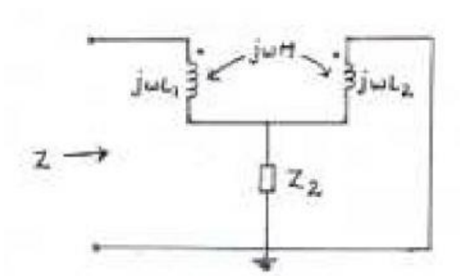
(May 06)

ii. Define self and mutual inductances. Establish the polarity of two mutually coupled coils on a single magnetic core.

iii. Find the equivalent inductance of the following circuit.

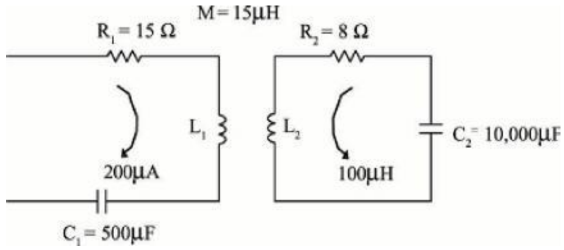
79. i. Explain the concept of self and mutual inductances

ii. Find the input impedance Z of the network as shown in the Figure.



80. Explain about Dot convection. **(May 04)**

81. A voltage of 100V at a frequency of $10^6/2\pi$ Hz is applied to the primary of the coupled circuit shown below. Calculate the total resistance and reactance referred to the primary. Determine the secondary and primary currents



(May 04)

82. A magnetic circuit comprises three parts in series each of uniform cross section area they are

part (a) : a length of 100mm and C.S.A $50mm^2$

part (b): a length of 80mm and C .S.A $100mm^2$

part (c) : an air group length of 0.4mm and C.S.A $150mm^2$

a coil of 200 turns is woonded on part (b) and the flux density in the air gap is 0.2 tesla. Assuming that all the flux passes through the given circuit, and that the relative permeability of the magnet material is 1200, find the coil current to produce such a flux density? **(May 03)**

83. A torroid is made of steel rod of 2cm diameter. The mean radius of torroid is 20cm relative permeability of steel is 2000. compute the current required to produce l mwb of flux and 1000 turns in the torroid. **(Jan 03)**

84. Two coupled coils with respective self inductances L_1 = 0.8H and L2= 0.2H have a coupling coefficient of 0.6 coil has 500 turns. If the current is coil is $I_1(t)$ = 10sin 100t, determine the voltage at coils and the maximum flux setup by the coil. **(May 02)**

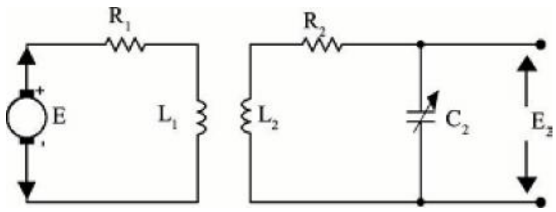
85. A rectangular cone has a cross sectional area of 20 cm^2. It is made from two materials can steel 50 cm long and sheet steel 30 cm long. It is defined to encate a flux of 2mwb in the cone. The relative permeability for cast steel is 1000 and that of sheet steel is 4000. The coil has 200 tunes. Find mmf and current in the coil.
(May 02)

86. An iron ring of mean length 50cm has an air gap of 1mm and a coil winding of 200 turns. If the permeability of iron 400 when a current of 1.25A flows through the coil. Find the flux density? **(95)**

87. State Faraday’s law of induction. **(GATE 94)**

88. For mutually coupled circuit shown in figure below show that the secondary current and voltage E2 will have its largest value if the following relationship looks true.

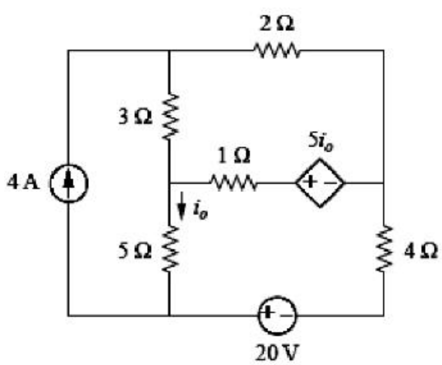
$1/WC_2 = W((R_2/R_1) L_1 + L_2) = WL_2$



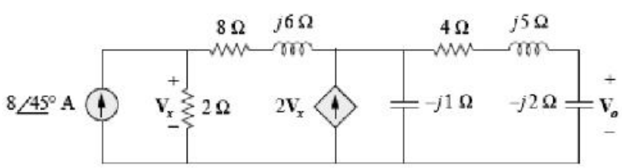
(IES 99)

UNIT-IV

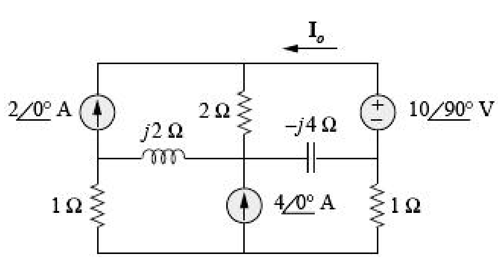
1. Draw a suitable tree and dual network. Use general loop analysis to find i_0 in the circuit shown in below Figure. **(Dec 11)**



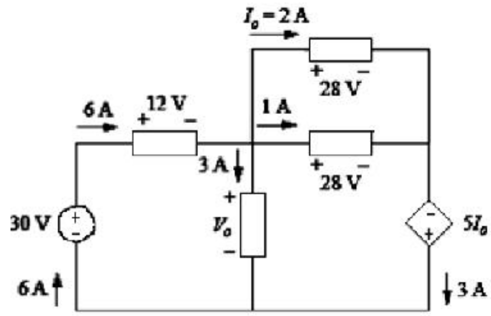
2. With the help of suitable example explain about the concept of super-node. For the circuit shown in below Figure. Find V_o in the circuit using node analysis. **(Dec 11)**



3. With the help of suitable example explain about the concept of super-mesh. Solve for Io in the circuit as shown in below Figure using mesh analysis. **(Dec 11)**



4. Draw a suitable tree and dual network for the Figure.8 shown below. Find V_0 in the circuit shown below. **(Dec 11)**



5. i. Explain the following terms with respect to graph theory

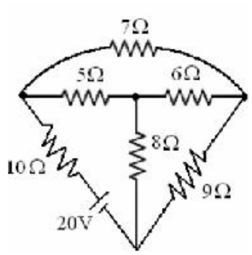
a. Node

b. tree

c. link

d. sub-graph

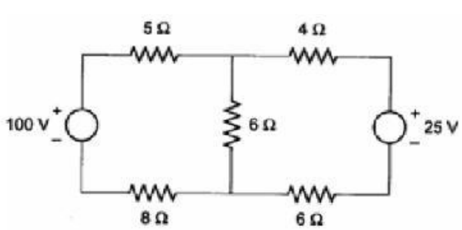
ii. Find the branch currents as shown in following figure by using the concept of tie-set matrix.



(May 11)

6. i. Illustrate the super mode analysis with an example.

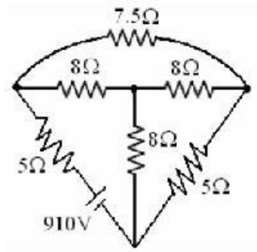
ii. For the network shown in figure determine all branch currents and the voltage across the 6-Ω resistor by loop current analysis.



(May 11)

7. i. Explain the super mesh Analysis with an example.

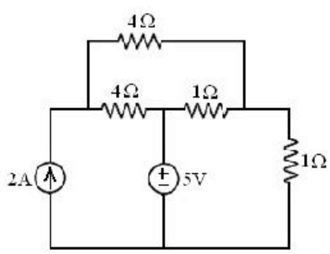
ii. For the resistive network as shown in below figure, write a cut set schedule and equilibrium equations on voltage basis. Hence obtain value of branch voltage and branch currents.



(May 11)

8. i. Describe the procedure to construct the dual of a network with an example.

   ii. Find the current and voltages across the registers of the network shown in below figure.



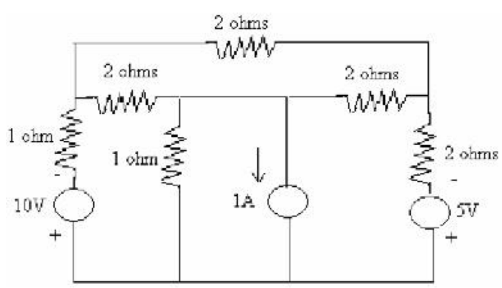
(May 11)

9. For the below network, draw

   i. Graph

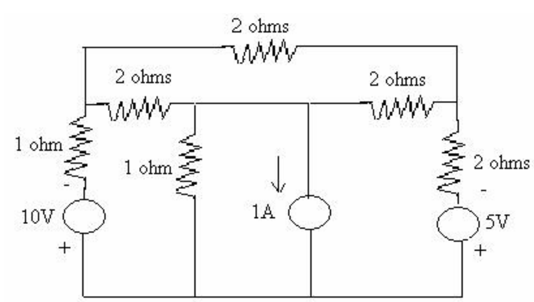
   ii. Tree

   iii. Dual network



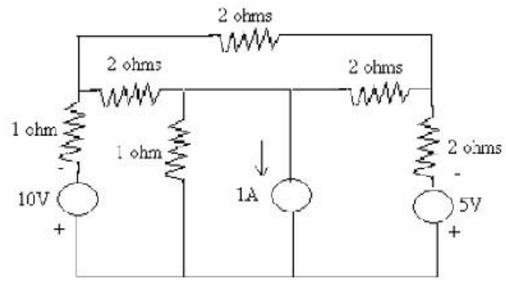
(Nov 10)

10. Obtain the node voltages for the following network shown in figure.



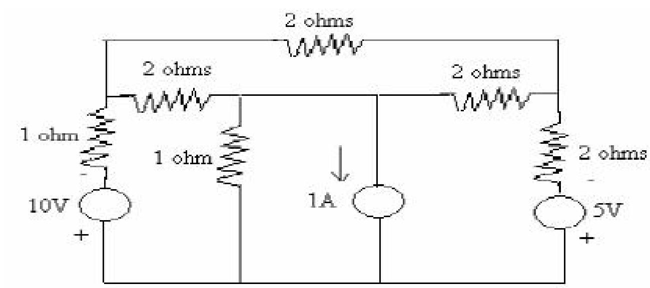
(Nov 10)

11. For the below network draw the graph and write down the procedure to obtain cut set matrix.



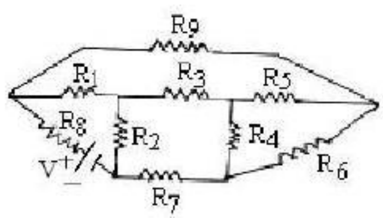
(Nov 10)

12. For the above network draw the graph, Select a tree and write tie set schedule for selected tree, solve circuit.

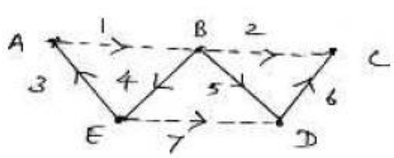


(Nov 10)

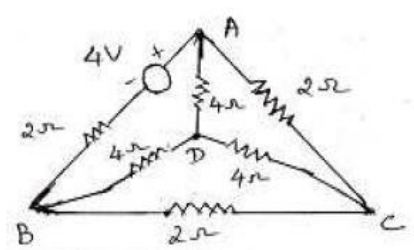
13. i. For the n/w shown in figure, draw the oriented graph, select a tree and obtain a tie-set matrix. Write down the KVL equations from the tie-set matrix. **(June 09)**



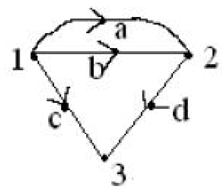
ii. For the graph shown in figure, find the tie-set and cut-set matrices.



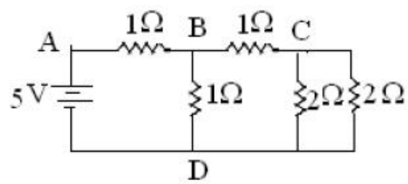
14. i. Write the matrix loop equation for the given network and determine the loop currents, as shown in figure and find the current through each element in the network. **(June 09)**



ii. For the given graph shown in figure write the tie-set schedule and obtain the relation between branch currents and link currents.



15. For the given network find the tie-set matrix loop currents as shown in Figure. Hence find the current through each element in the network. **(June 09)**



16. i. What is complete incidence matrix? How is reduced incident matrix obtained from it? Explain with suitable example.

ii. Explain network analysis using network topology based on KVL and KCL. **(June 09)**

17. i. Define the following and explain by taking an example. **(June 09)**

a. Branch

b. Node

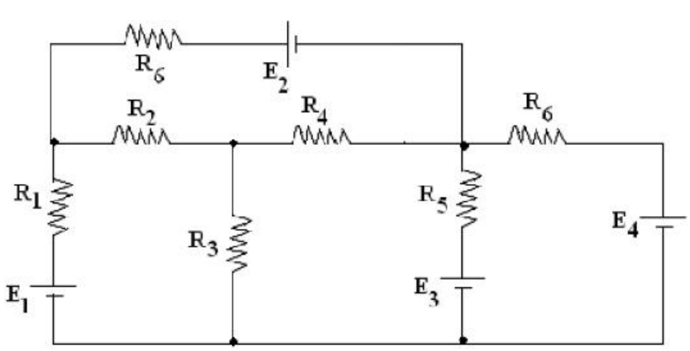
c. Path

d. Sub graph

e. Tree

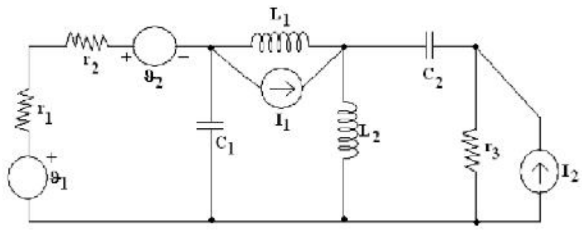
f. Degree of a node.

ii. Draw the oriented graph of the network shown in figure and write the cutset matrix.



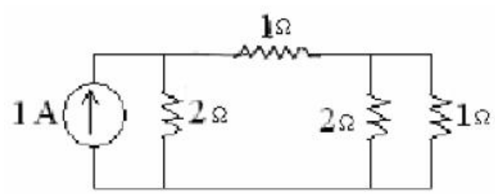
18. i. Explain the procedure for obtaining fundamental tie-set matrix of a given network.

ii. Draw the oriented graph of the network shown in figure and write the incidense matrix.

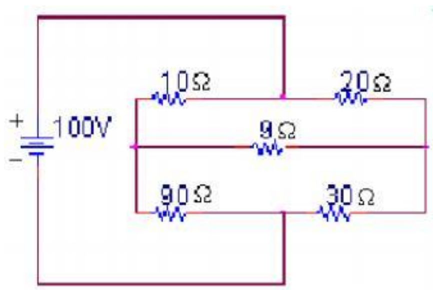


(June 09, Feb 08, May 07, Sep 06)

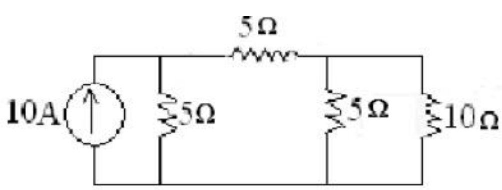
19. i. Obtain the cut - set matrix for the network, as shown in figure. **(May 08)**



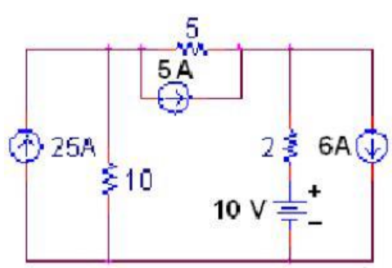
ii. For the network shown in figure. Determine the power dissipated in 9ohms resistor using Mesh analysis



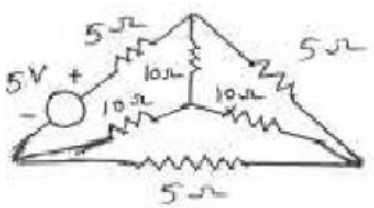
20. i. For the network shown in figure draw the oriented graph and frame the cut-set matrix. **(May 08)**



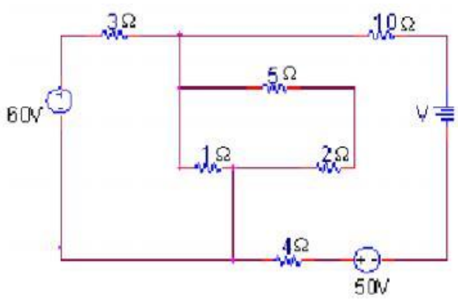
ii. Compute node voltages for the circuit as shown in figure.



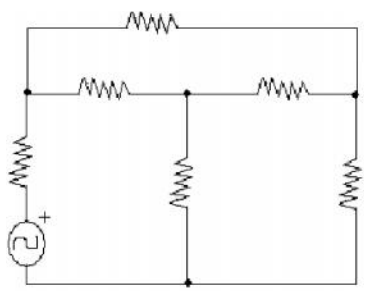
21. i. Write the tie - set schedule for the network shown in figure **(May 08)**



ii. Using mesh analysis, determine the voltage V which gives a voltage of 50V across 10 ohms resistor shown in figure

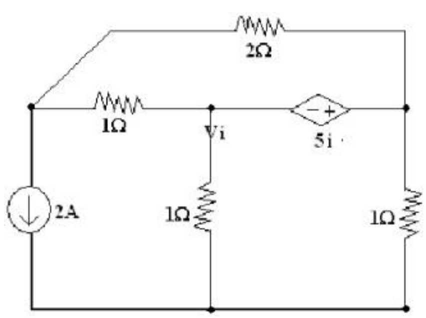


22. i. For the circuit shown in figure, draw the graph and tree.

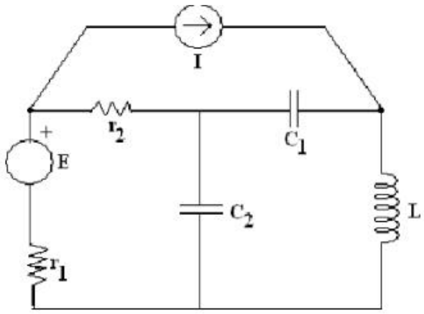


(Feb 08)

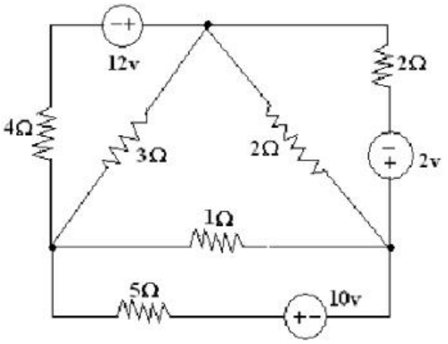
ii. Using the mash analysis, find the magnitude of the current dependent source and the current through the 2 ohms resistor. As shown in figure.



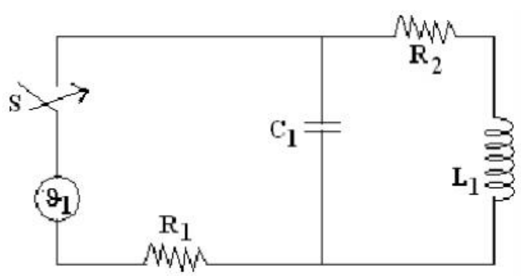
23. i. Draw the graph of the network shown in figure. **(Feb 08, Aug 06)**



ii. In the figure shown in figure, find the current trough 5 ohms resistor using mesh analysis.

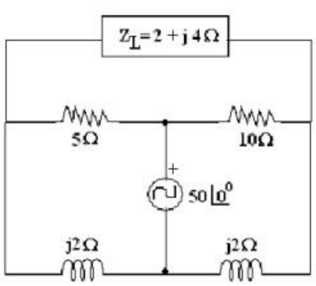


24. i. Draw the Dual of the network shown in figure

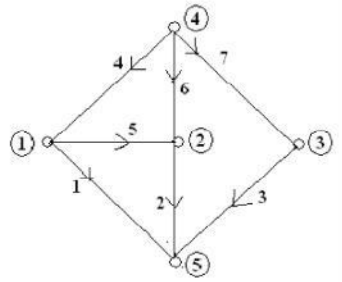


(Feb 08, May 07)

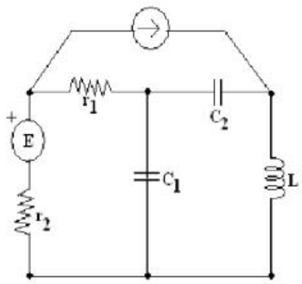
ii. Find the current through Z2 in the network shown in figure using mesh analysis.



25. i. Draw the oriented graph of the network shown in figure

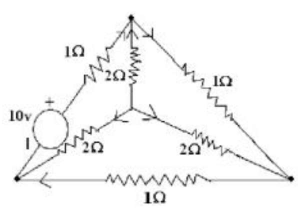


ii. Obtain the fundamental loop and fundamental cut-set matrices for the graph shown in figure

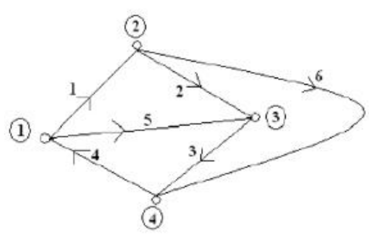


(May 07)

26. i. For the circuit shown in figure, draw the graph and write down the tie set matrix.



ii. Draw the incidense matrix of the following graph. as shown figure



(Sep 06)

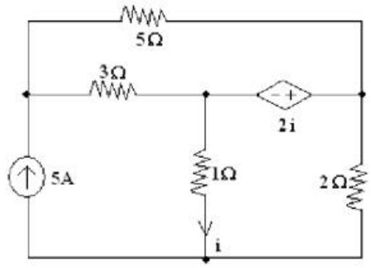
27. i. For the circuit shown in figure, draw the graph and indicate tree.

a. Branch

b. Node

c. Degree of a node

d. Links.



ii. Using Nodal method, find the current through 5W resistor, in the following circuit. **(Sep, May 06)**

28. i Define the following and explain by taking an example.

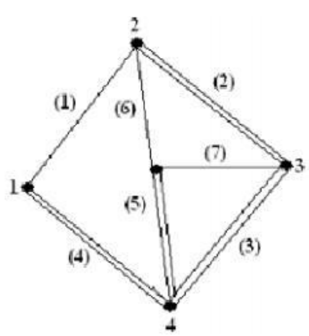
a. Node, Branch, Path b. Tree

c. Sub graph d. Loop

e. Links f. Directed graph.

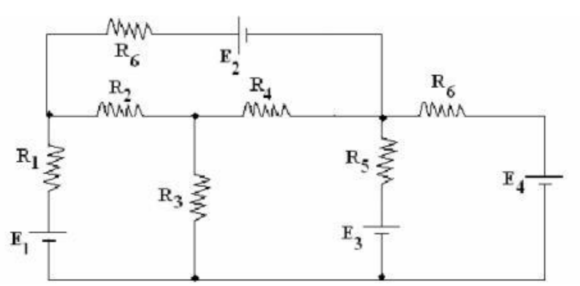
g. Degree of a node.

ii Find the fundamental tie-set and cut-set matrix for the graph and for the tree shown below

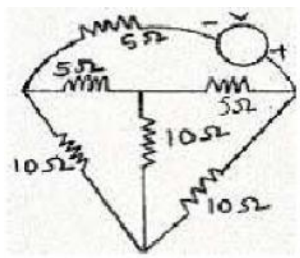


(May 06)

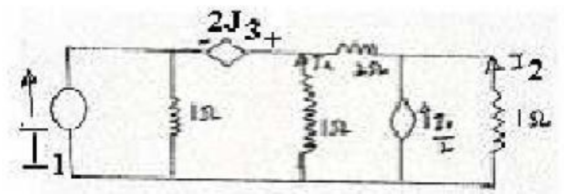
29. Draw the oriented graph of the network shown and write the cut set matrix. **(May 06)**



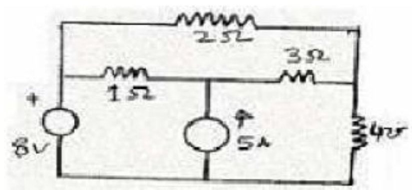
30. i. Explain clearly what you understand by a cutest, and a Tieset. Write down the basicTieset schedule for the network shown in figure by taking 10Ω resistor branches as Tree branches.



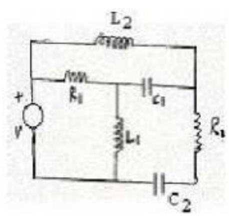
ii. For the network shown the figure, determine the ratio of I_2 / I_1. **(Jun 05)**



31. i. For the circuit shown below the figure, find the currents & voltages in all the branches of the circuit. Use Node Voltage method. **(Jun 05)**



ii. Draw the dual of the network shown below the figure. Explain the procedure employed. **(Jun 05)**

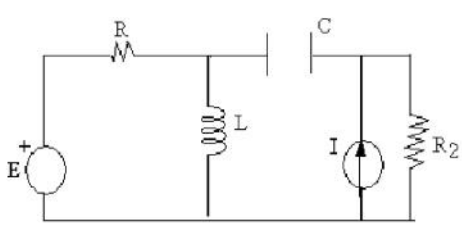


iii. Obtain the expression for characteristic impedance of a symmetrical T- network. **(Jun 05)**

32. i. Define basic cutset, Basic loop, spanning tree with suitable examples.

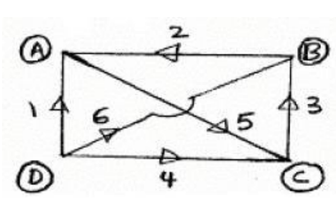
ii. Explain what are the dual elements with suitable examples.

iii. Draw the dual of the following network shown fig.

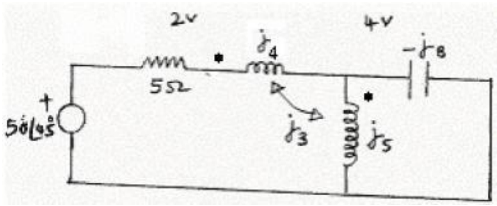


(Jun 05)

33. i. For the given network graph shown below, write down the basic Tieset matrix, taking the tree consisting of edges 2,4 and 5. Write down the KVL network equations from the matrix. **(Jun 04)**

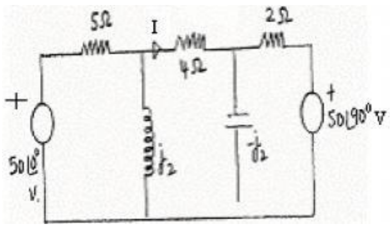


ii. Find the voltage across the 5Ω resistance for the coupled network shown in figure.



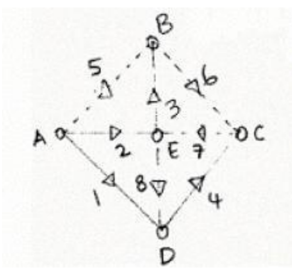
(Jun 04)

34. i. In the network shown below find current I using nodal analysis.

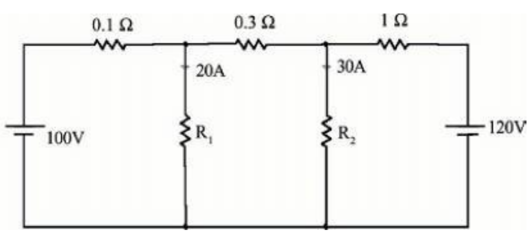


ii. Obtain the basic Cutset matrix for the given oriented graph, taking. 1,2,3,4 as tree branches. **(Jun 04)**

Write down KCL network equations from the above matrix.

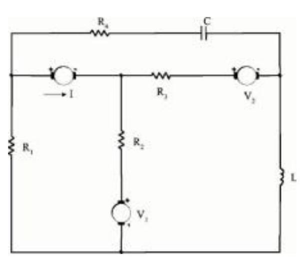


35. Find R_1 & R_2 using loop method

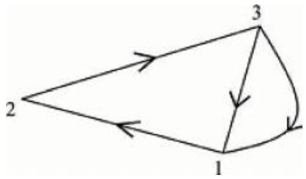


(Nov 03, 04)

36. i. What is duality? How to obtain dual of following network ?

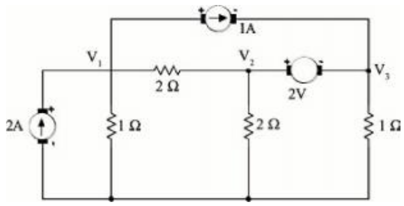


ii. Construct incidence matrix for the graph shown below



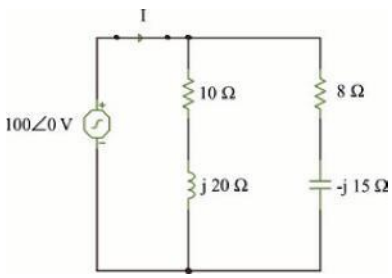
(03)

37. Consider the Network shown in fig find the power delivered by 2V source by applying the method of nodal analysis



(03)

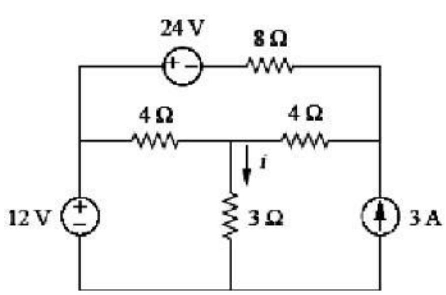
38. Find V_1 & V_2 using nodal analysis



(02)

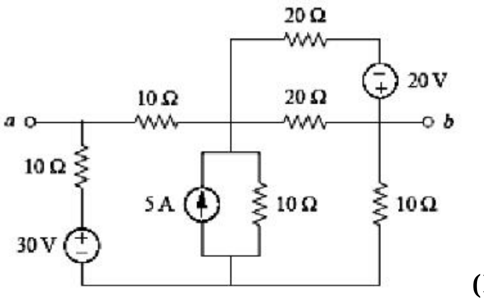
UNIT-V

1. With suitable example explain Millman's and Compensation theorems for DC exitations. For the circuit in below Figure, use the superposition theorem to find *i* and power in all resistances.



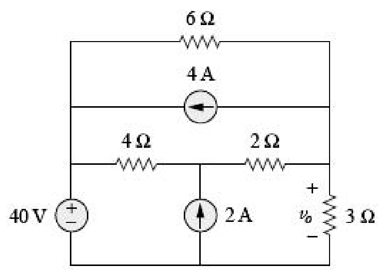
(Dec 11)

2 With suitable example explain Tellegen's theorem for DC networks. For the circuit shown in below Figure, find the Norton's equivalent circuit between terminals a and b.

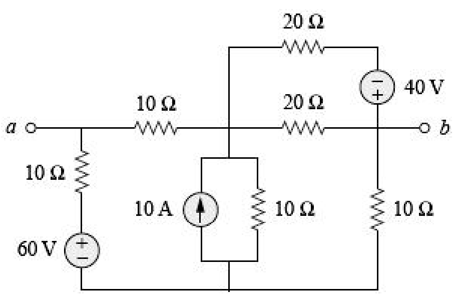


(Dec 11)

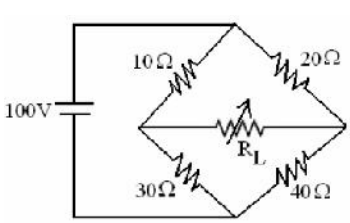
3. State Millman's and Compensation theorems for d.c excitations. Apply the superposition principle to find v_o in the circuit shown in below Figure. **(Dec 11)**



4. State Tellegen's, Reciprocity theorems. For the circuit below Figure, find the Thevenin's equivalent between terminals a and b. **(Dec 11)**



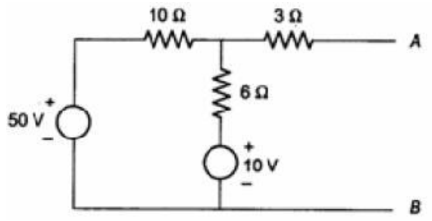
5. Determine the load resistance to receive maximum power from the source, also find the maximum power delivered to the load in the circuit shown in below figure.



(May 11)

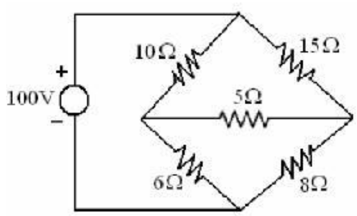
6. i. State and explain superposition theorem.

   ii. Find thevenin's equivalent circuit for the circuit shown in below Figure.



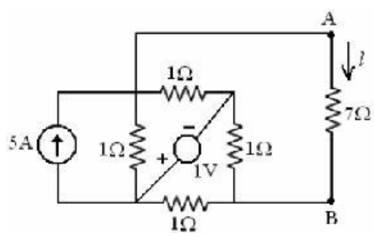
(May 11)

7. Use Thevenin's theorem to find the current through the 5-Ω resistor in figure.



(May 11)

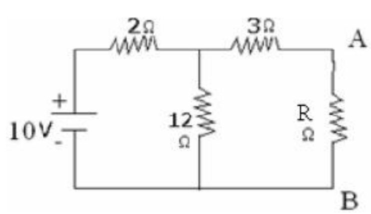
8. Find the current in the 7-Ω resistor across AB of the network shown in figure using superposition theorem.



(May 11)

9. i. State and explain Tellegens theorem.

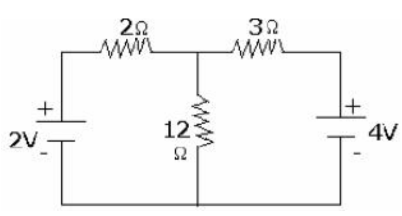
ii. When the load impedance R draws the maximum power? Find the maximum power delivered to the load by using maximum power transfer theorem for the given network.



(Nov 10)

10. i. State and explain reciprocity theorem.

ii. Using superposition theorem determine the current through 12Ω resistor (All resistances are in Ω) as shown in figure.



(Nov 10)

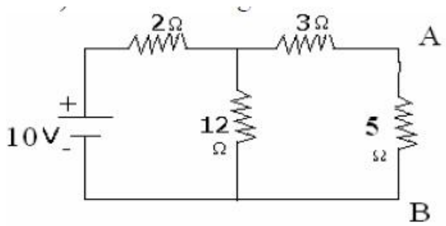
11. i. State and explain Millman's theorem.

ii. By using Thevenin's theorem determine the current through 5 Ω resistor (All resistances are in Ω) as shown in figure.

(Nov 10)

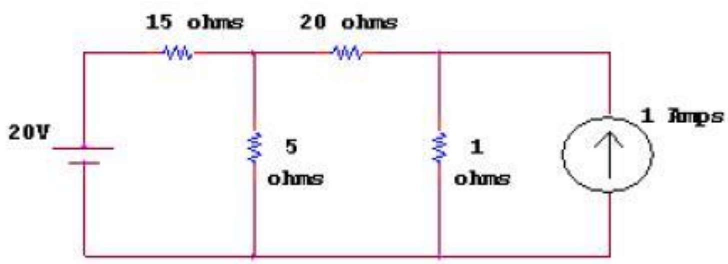
12. i. State and explain Compensation theorem.

ii. By using Norton's theorem determine the current through 5Ω resistor (All resistances are in Ω) as shown in figure.



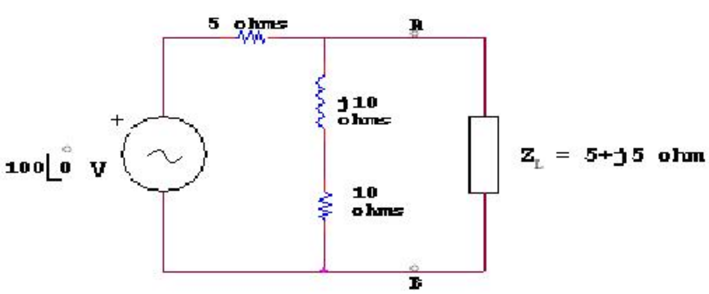
(Nov 10)

13. i. Solve for current in 5 ohms resistor by principle of super position theorem shown in figure. **(June 09)**



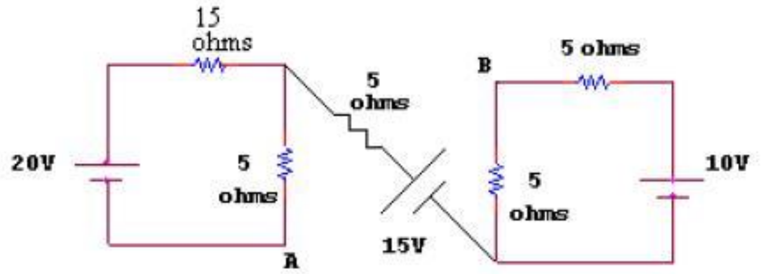
ii. State and explain Millmann's theorem.

14. i. Using Norton's theorem, find the current through the load impedance Z_L as shown in figure. **(June 09)**



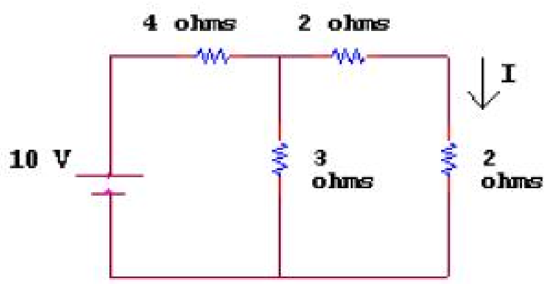
ii. State and explain reciprocity theorem.

15. i. Determine the Thevenin's equivalent across the terminals A and B as shown in figure.



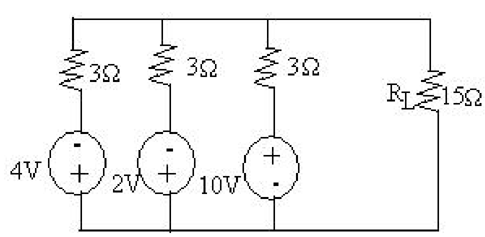
(June 09)

ii. Verify reciprocity theorem for the voltage V and Current I in the network shown in figure.



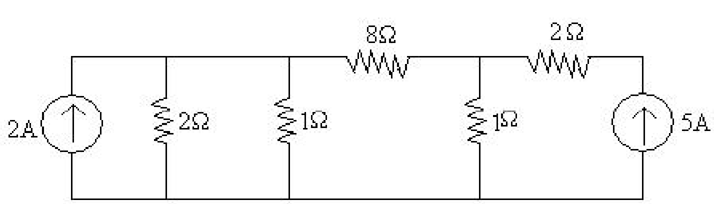
16. i. State and Explain Norton's theorem. **(June 09)**

ii. Find the current through load resistance RL and also find the voltage drop across load using Millman's theorem. as shown in figure



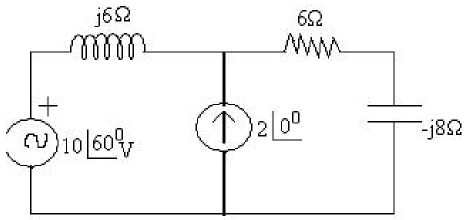
17. i. State and explain Thevenin's theorem. **(June 09)**

ii. Estimate the power loss in the 8Ω resistor using Thevenin's theorem. as shown in figure

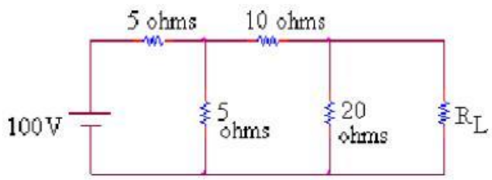


18. i. State and explain the Millmann's theorem.

ii. Find the current in the 6Ω resistor using Superposition theorem. as shown in figure

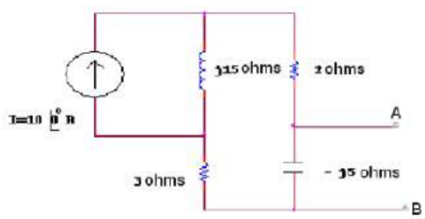


19. i. Find the value of RL so that maximum power is delivered to the load resistance RL as shown in figure, and find the maximum power.



ii. State and explain Thevenin's theorem. **(May 08)**

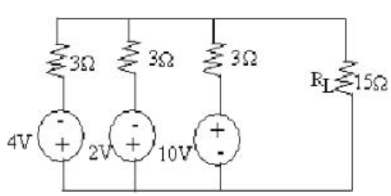
20. i. Obtain Norton's equivalent across terminals A and B for network shown in figure.



ii. State and explain Maximum power transfer theorem. **(May 08)**

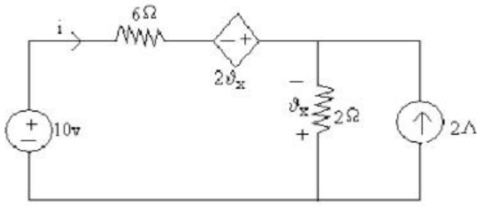
21. i. State and Explain Norton's theorem.

ii. Find the current through load resistance R_L and also find the voltage drop across load using Millman's theorem. as shown in figure. **(Feb 08)**



22. i. State and explain Reciprocity theorem.

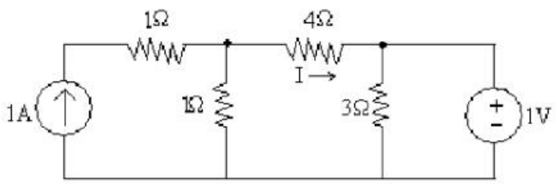
ii. Find the current i in the circuit shown in figure using superposition theorem.



(May 07)

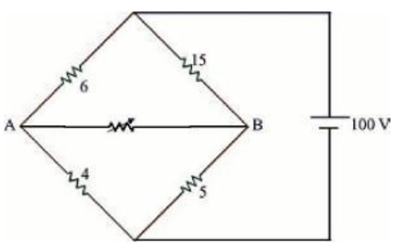
23. i. Explain the steps for solving a network problem using Thevenin's theorem.

ii. Find the current I in the circuit shown in figure below,



(May 06)

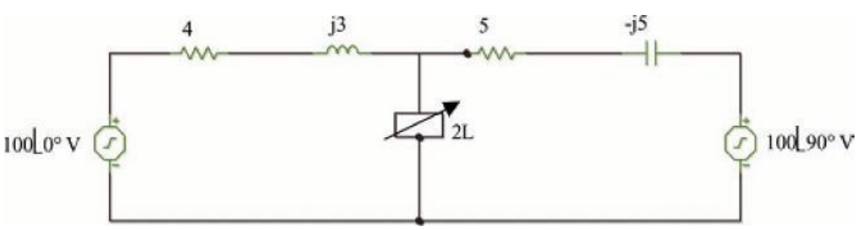
24. Determine value of R for maximum power transfer?



(May 02)

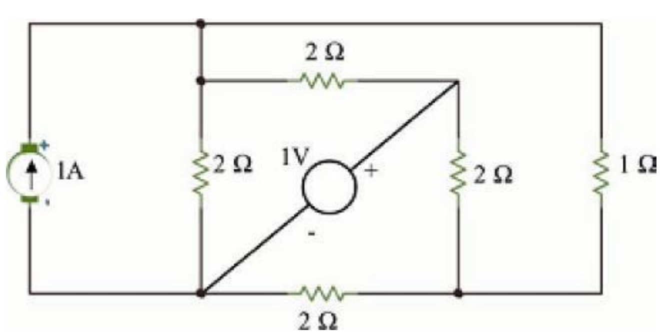
25. i. State and explain maximum power transfer Theorem?

ii. Find maximum power received by 2L



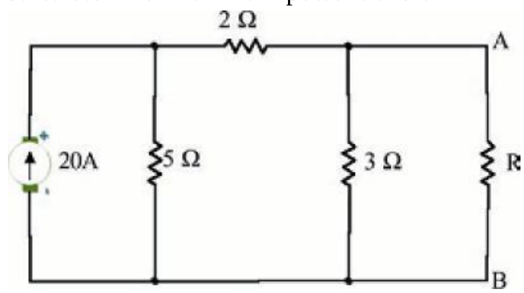
(Sep 02)

26. Determine in current in 1Ω by superposition theorem ?



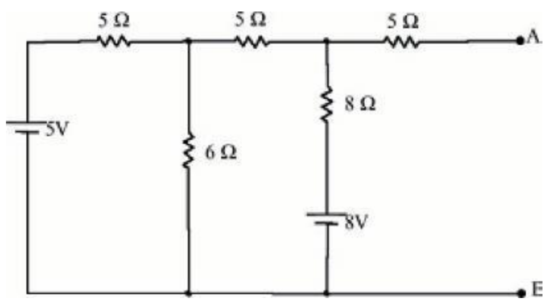
(Sep 02)

27. Calculate R for maximum power transfer



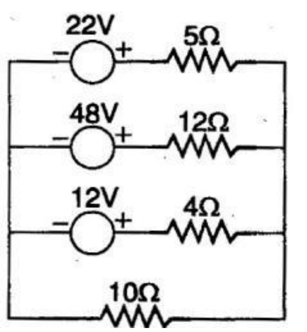
(98)

28. Find Thevenin's equivalent circuit for the circuit



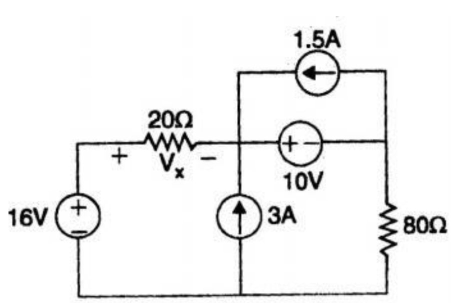
(97)

29. Use Millman's theorem to find the current through the load and the current supplied by each source.



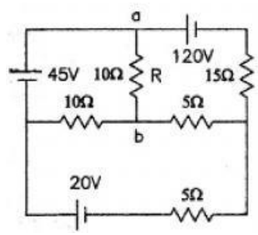
(BU Apr 98)

30. Find the components of V_X caused by each source acting alone in the circuit shown. What is V_x when all the sources are active ?



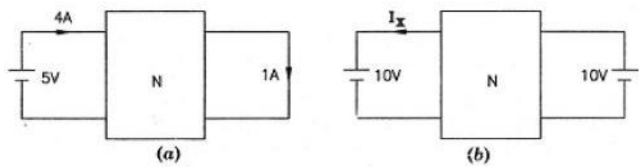
(BU Apr 98)

31. For the circuit shown below find the current through the resistance. It connected between points a and b by Thevenin's theorem.



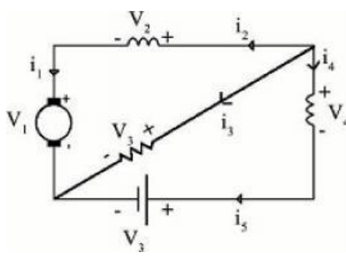
(GATE 95)

32. The network N, in Figures (a) and (b) is passive and contains only linear resistors. The branch currents in figure (a) are as marked. Using these values and the principle of superposition and reciprocity, find I_x in Figure (b)

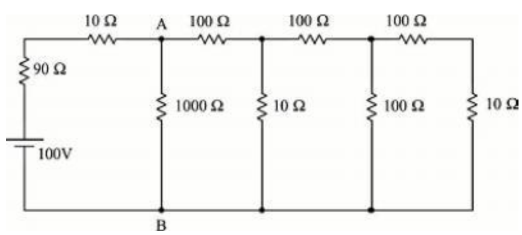


(GATE 94)

33. Prove that the load impedance which absorbs the maximum power from the source is the conjugate of the impedance of the source. A loud speaker is connected across terminals A and B of the network shown in figure what should be its impedance to obtain maximum dissipation in it. **(IES 96)**



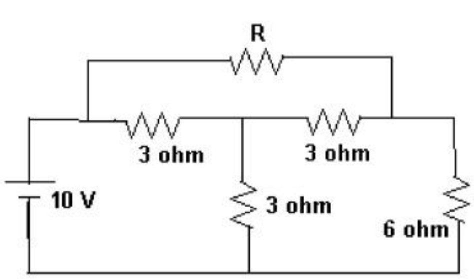
34. By the iterated use of Thevenin's Theorem, reduce the circuit shown below to a single emf acting in series with a single resistor. Hence calculate the current in10Ω resistor XY.



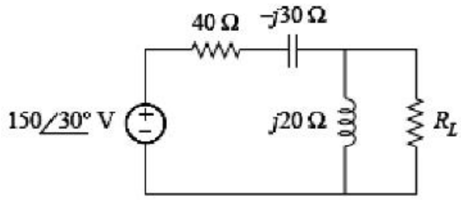
(IES 95)

35. Determine the value of R shown in the Fig. such that the 6 ohm resistor consumes the maximum power.

(IES 02)



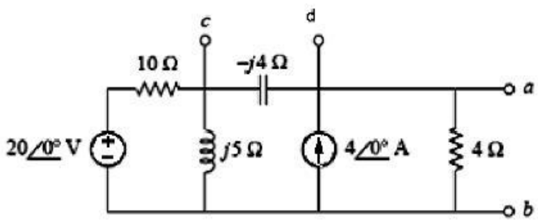
36. With suitable examples explain Tellegen's, Superposition theorems for AC circuits. Find the value of R_L that will absorb the maximum average power (shown in Figure). Calculate that power. **(Dec 11)**



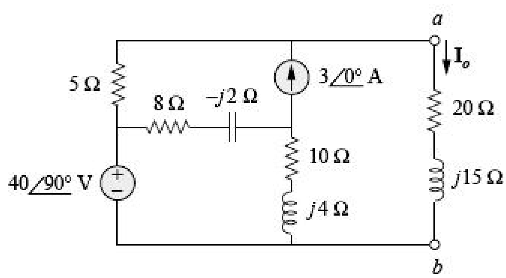
37. With suitable example explain Reciprocity theorem for AC circuits. Find the Thevenin's equivalent circuit of the circuit shown in below Figure as seen from

i. terminals a-b

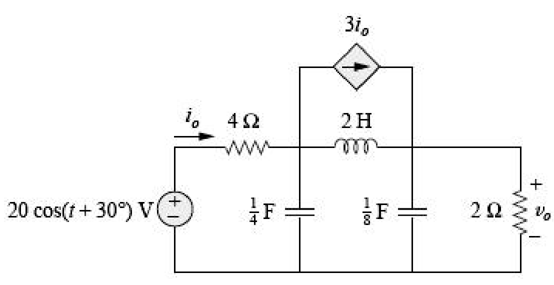
ii. terminals c-d



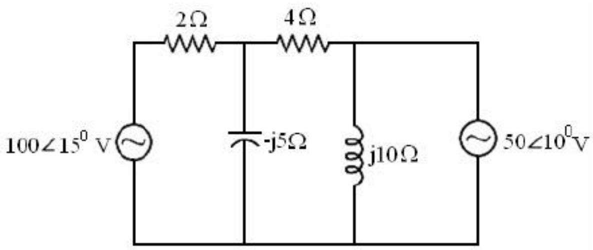
38. Obtain current $\mathbf{I}_o$ inFigure shown below using Norton's theorem. **(Dec 11)**



39. Using Thevenin's theorem, find v_o in the circuit shown in below Figure. **(Dec 11)**



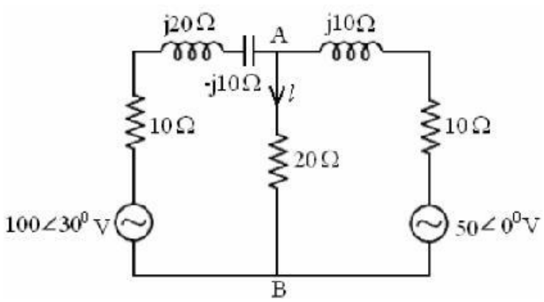
40. Find the current through the capacitor and voltage across 4-Ω resistance of the AC network shown in figure by using superposition theorem.



(May 11)

41. i. State and explain the maximum power transfer theorem.

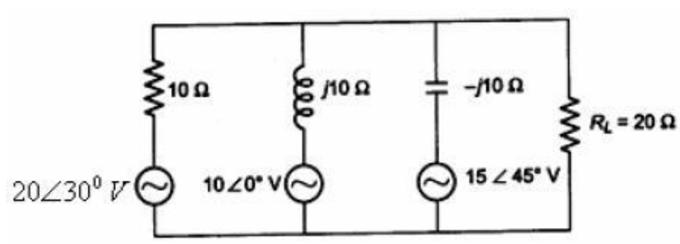
ii. Determine the current I in the branch AB of circuit shown in figure by using Norton's theorem.



(May 11)

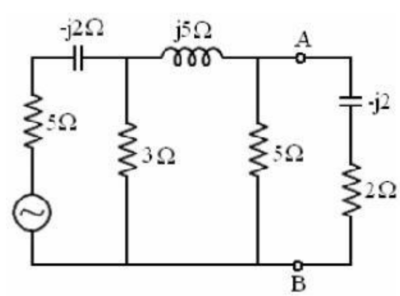
42 i. State and explain compensation theorem.

ii. Using Millman's theorem find the current through RL in the circuit shown in figure.



(May 11)

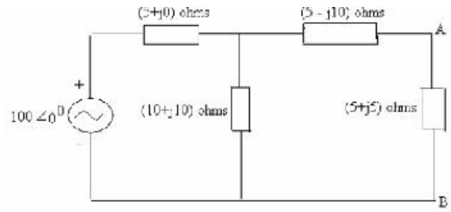
43. For the network shown in figure, replace the circuit to the left of terminals 'AB' with a Thevenin equivalent. The determine current in the (2 – j2) Ω impedance connected to the equivalent circuit.



(May 11)

44. i. State and explain Milleman's theorem for AC network by taking any one example.

ii. By using Norton's theorem find the current flowing through (5+j5) ohms impedance

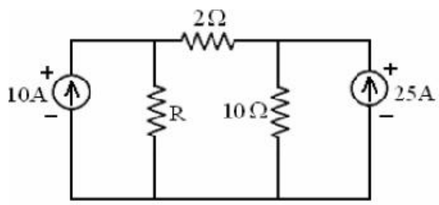


(Nov 10)

ASSIGNMENT QUESTIONS:

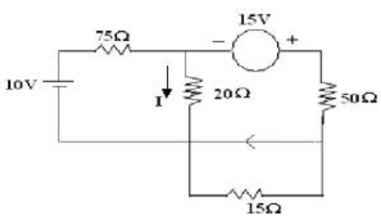
UNIT-I

1. i. Distinguish between ideal and practical sources and draw their characteristics.
   ii. Calculate the value of 'R' in the circuit shown in below figure, if the power supplied by both the sources is equal.

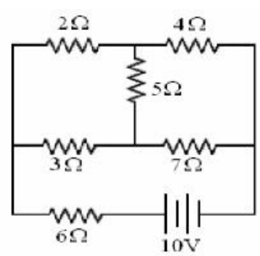


2. i. Explain Active elements in detail.
   ii. A 25 ohms resistor is connected across a voltage source V (t) = 150 Sin ωt. Find the current I (t) and the instantaneous power P(t) and also the average power. Draw the relevant waveforms. **(Nov 10)**

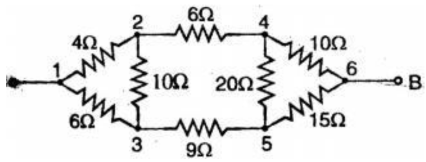
3. i. For the circuit shown below, find the current through 20ohms resistor? **(May 07, 06)**



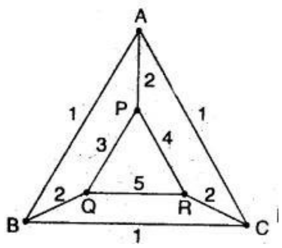
ii. Obtain the expressions for star-delta equivalence of resistive network.
iii. Calculate the current in the 5Ω resistor using kirchoff's laws for the network shown in below figure.



4. Find the voltage to be applied across AB in order to drive a current of 10A into the circuit. Use Star-Delta transformation.

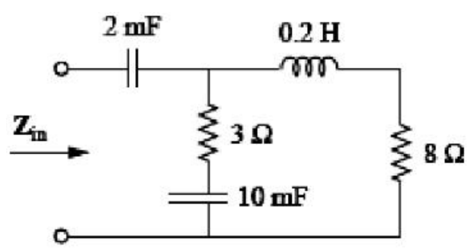


5. Find the equivalent resistance across terminal AB of the network shown in Fig. using Star-Delta transformation. All values are in ohms.

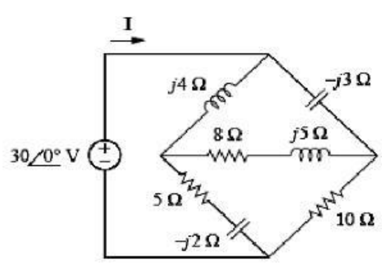


UNIT-II

1. i. Determine the input impedance of the circuit shown in below Figure at $\omega = 50$ rad/s. **(Dec 11)**

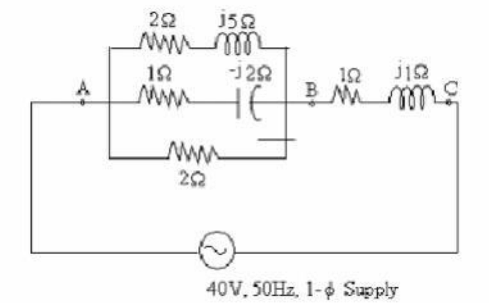


ii. Find **I** in the circuit shown in below Figure.



2. i. Derive the expression for power in a1-ϕA.c circuits. ii.
In the circuit shown in figure Calculate.
a. The total impedance
b. The total current
c. Power factor
d. The total S,P and Q

e. The total admittance. Also, draw vector diagram



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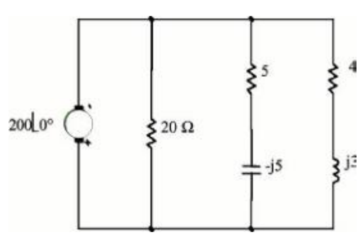
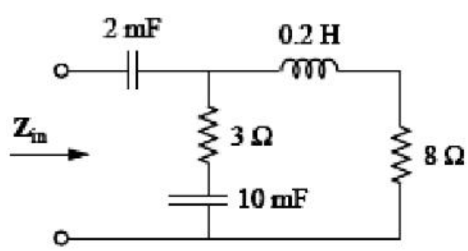
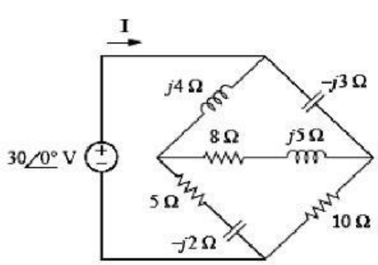
3. Find branch currents, total current and power supplied by the source. Draw the Phasor Diagram.



4. i. Determine the input impedance of the circuit shown in below Figure at $\omega = 50$ rad/s.



ii. Find **I** in the circuit shown in below Figure.



UNIT-III

1. i. Explain the procedure to draw the locus diagram of R-L series circuit when L is varying.
   ii. A series RLC circuit has to be designed so that it has a band width of 320 Hz and inductance of the coil is 0.2H. It is has to resonate at 350Hz, determine the resistance of coil and capacitance of condenser. If the applied voltage is 150V, determine the voltage across capacitor and coil.

2. i. Explain the procedure to draw the locus diagram of R-C series circuit when ‘C’ is varying.
   ii. An impedance coil having R = 20Ω and a 50Hz inductive reactance of 22Ω is connected to 110V, 60Hz source. A series circuit consisting of resistor, R = 10Ω and variable capacitor is then connected in parallel with coil
   a. For what value of ‘C’ will the circuit be in resonance?
   b. Calculate two line currents at resonance

3 i. Compare series and parallel resonant circuits.
   ii. A series RLC circuit consists of resistor of 100 Ω, an inductor of 0.318H and a capacitor of unknown value. When this circuit is energised by a 230V, 50Hz ac supply, the current was found to be 23A. Find the value of capacitor and the total power consumed

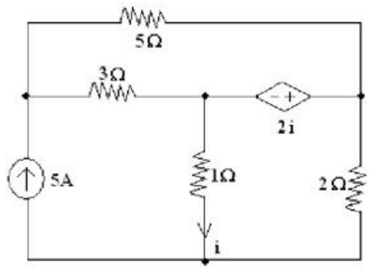
4 A series RLC circuit with Q=250 is resonant at 1.5Hz, find the frequency at half power points and also band width

5. An impedance coil having resistance 28.8 Ohm and inductance 0.024H is connected in series with 0.008 micro farad capacitance. Calculate :
   i. Q of the circuit
   ii. Bandwidth
   iii. Resonant frequency
   iv. Half power frequencies

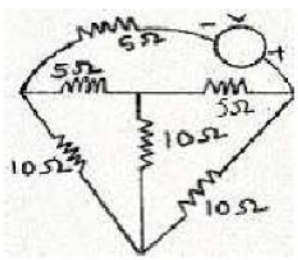
UNIT-IV

1. Explain the following terms with respect to graph theory
   a. Node b. tree c. link d. sub-graph

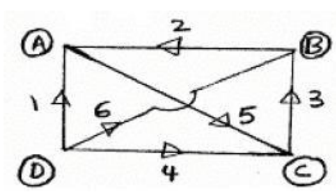
2. For the circuit shown in figure, draw the graph and indicate tree. a. Branch
    b. Node
    c. Degree of a node d. Links.



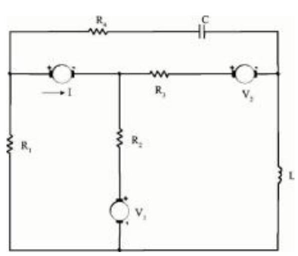
3. Explain clearly what you understand by a cutest, and a Tieset. Write down the basicTieset schedule for the network shown in figure by taking 10Ω resistor branches as Tree branches.



4 For the given network graph shown below, write down the basic Tieset matrix, taking the tree consisting of edges 2,4 and 5. Write down the KVL network equations from the matrix.

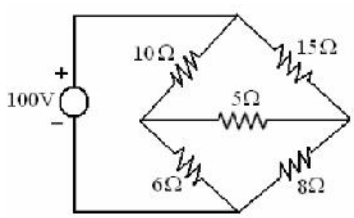


5 What is duality? How to obtain dual of following network ?

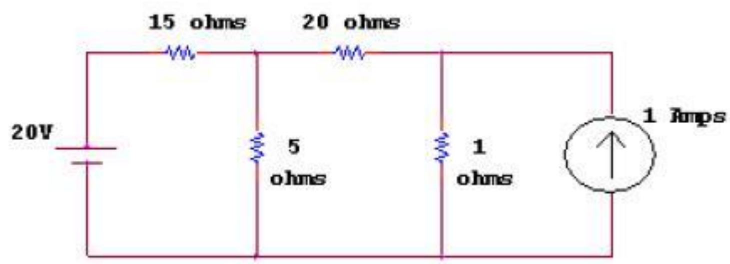


UNIT-V

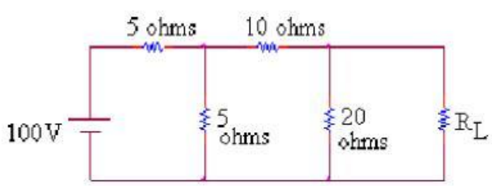
. 1. Use Thevenin's theorem to find the current through the 5-Ω resistor in figure



2. Solve for current in 5 ohms resistor by principle of super position theorem shown

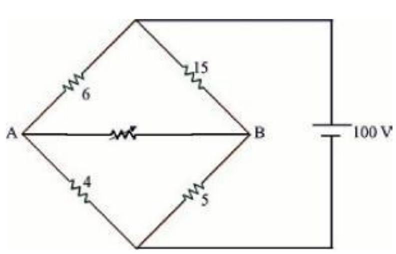


3. i. Find the value of RL so that maximum power is delivered to the load resistance RL as shown in figure, and find the maximum power.

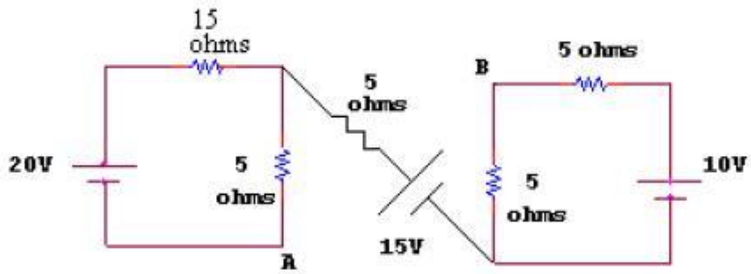


ii. State and explain Thevenin's theorem

4. Determine value of R for maximum power transfer?



5. i. Determine the Thevenin's equivalent across the terminals A and B as shown in figure.



ii. Verify reciprocity theorem for the voltage V and Current I in the network shown in figure.