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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Third Semester, B.E. -Electrical and Electronics Engineering

Semester End Examination; Dec. - 2014

Network Analysis - I

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each Unit.*
ii) Assume suitably missing data if any.

Unit - I

1. a. For the network shown in Fig. 1(a) Write the 3 mesh current equations in matrix form or in standard form and solve for the three mesh currents. Determine all the branch currents and the power delivered or absorbed by the sources. 5

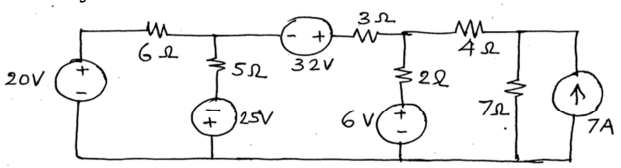


Fig 1(a)

b. Determine the resistance between the terminals AB of the network shown in Fig. 1(b) using suitable transformations. 7

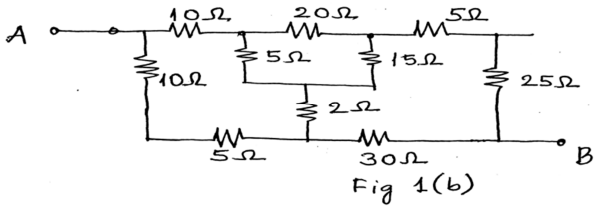


Fig 1(b)

c. For the coupled network shown in Fig. 1(c) find the voltage across the 5 Ω Resistor. Assume K = 0.8. 8

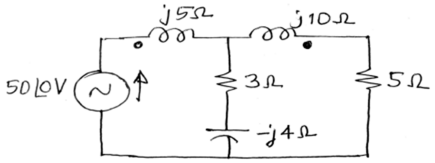


Fig 1(c)

2 a. Solve for the nodal voltages for the circuit shown in Fig 1(a). Using source conversion convert the circuit to a form appropriate for node voltage analysis and then write the node voltage equations. Arrange the equations in standard form and then solve for mode voltages. 6

b. Determine the resistance between points A and B in the network shown in Fig. 2(b). 6

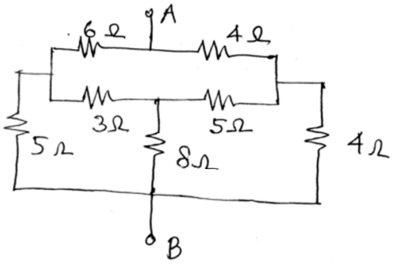


Fig 2(b)

c. Obtain the dotted equivalent of the coupled circuit shown in Fig. 2(c) and find the voltage across the –j10 Ω reactance using the equivalent circuit. 8

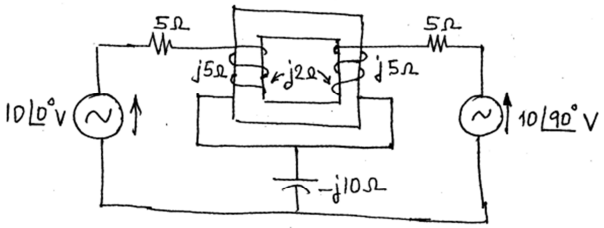


Fig 2(c).

Unit-II

3 a. Obtain the Thevenin's equivalent circuit and Norton's equivalent circuit and then determine Norton's equivalent circuit and then determine the current through a load (2+j2) Ω connected across AB. Are the currents in each approach the same? For the network shown in Fig. 3(a). 6

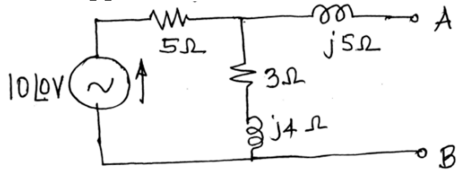


Fig 3(a)

b. Apply super position theorem to find the current through (3+j4) Ω impedance for the network shown in Fig. 3(b) 6

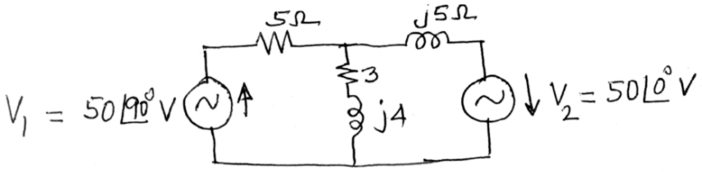


Fig 3(b)

c. Consider a series RLC circuit obtain the condition for resonance and frequency at resonance in terms of the elements of the network. Plot the variation of impedance (Z). Capacitive and inductive reactance and resistance of the circuit when the applied voltage is maintained constant with frequency varied from Zero to infinity. Also plot how the phase angle of the circuit varies with frequency and also variation of current. 8

4 a. Obtain the Thevenin's and Norton's equivalent circuit for the network shown in Fig. 4(a). What should be the load connected across AB so that maximum power is transferred from source to load. 10

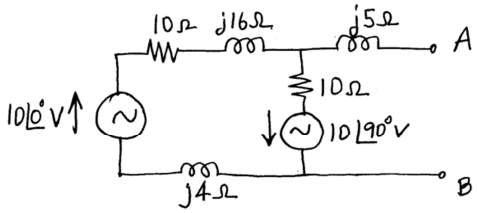


Fig 4(a)

b. Verify reciprocity theorem for the network shown in Fig 4(b) by finding the voltage V_X. 6

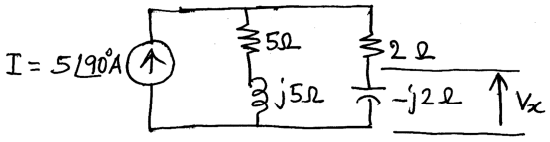


Fig 4(b)

c. Obtain the condition for resonance in the circuit shown in Fig. 4(c). When applied frequency is varied from zero to infinity. Find the expression for resonant frequency. 4

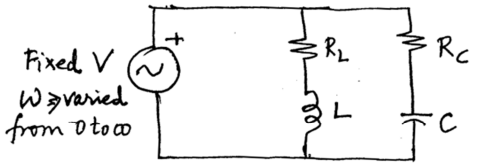


Fig 4(c)

Unit - III

5 a. A Three branch parallel circuit has the current locus as shown in Fig. 5(a). Determine all the circuit constants (element values) if ω = 5000 rad/sec. Draw the circuit diagram. 8

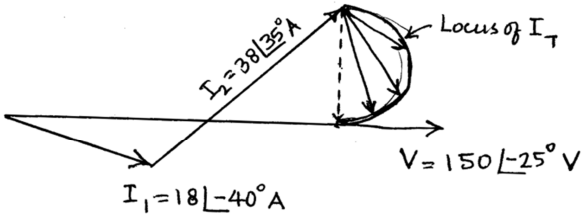


Fig 5(a)

b. For the network graph shown in Fig 5(b), draw the graph of the network. Plot to show the tree, twigs and links. Draw the incidence matrix considering suitable oriented graph. 6

Fig 5(b)

c. Write the steps for finding the dual of a network. Obtain the dual of the network shown in Fig. 5(c). 6

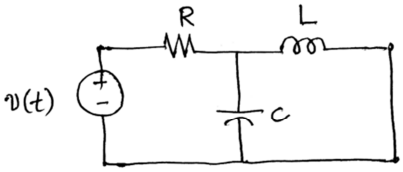


Fig 5(c)

6 a. For the circuit diagram shown in Fig. 6(a) draw the locus diagram to appropriate scale. 6

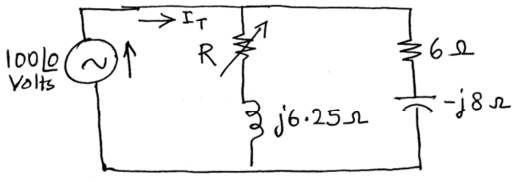
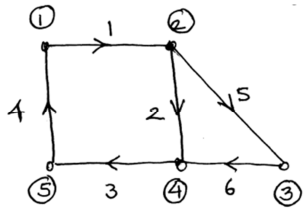


Fig 6(a)

b. Obtain the cut-set matrix for the graph shown in Fig. 6(b) starting from the fundamental steps. Assume the tree is formed by branches 1-2-3-6. 8

Fig 6(b)



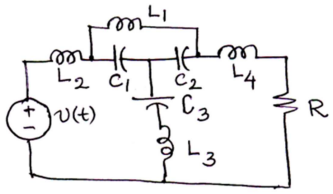


Fig 6(c)

Unit-IV

7 a. A 3 phase, 3 wire, 400volt RYB phase sequence system has a delta connected load with $Z_{RY} = 10\angle 0^0\Omega$, $Z_{YB} = 10\angle 30^0\Omega$, $Z_{BR} = 15\angle -30^0\Omega$. Obtain the three line currents and draw the phasor diagram showing the line voltages, line currents and phase currents approximately to scale if drawn to scale better. 10

b. A 3 phase 3 wire 400V, RYB system has a star connected load with $Z_R = 6\angle 0^0\Omega$, $Z_Y = 6\angle 30^0\Omega$ $Z_B = 5\angle 45^0\Omega$. Obtain the line currents and the phasor voltage across each impedance, and determine the displacement neutral voltage. 10

8 a. A 3 phase 3 wire RYB system supplies a balanced delta connected load of $20\angle 45^0\Omega$ in each phase. The supply voltage being 400 V. Determine the line currents and the power drawn in each phase and the total power drawn by the load. Draw the phasor diagram. Comment on the results. Use proper scale to draw. 10

b. A 3 phase, 4 wire system, 40 V wire system, 400 V of RYB system supplies a star connected load of $Z_R = 10\angle 0^0\Omega$, $Z_Y = 15\angle 30^0\Omega$ and $Z_B = 10\angle -30^0\Omega$. Find the line currents, the neutral currents and the total power supplied to the load. What is the Reactive power drawn by the load. 10

Unit - V

9 a. A rectifier is used to convert ac and dc. The designer has suggested to use a full wave rectifier output to be given to a load of consisting of three elements R = 5 Ω and this is in series with a parallel combination of L = 5 mH and C = 50μF. the input voltage to the rectifier unit is 300sinwt volts. 12

Obtain the trigonometric series upto first FOUR terms for the output wave of the converter. Assume ω = 2000 rad/sec. Find the current series for the three terms at least.

b. Find the trigonometrically form the Fourier series for the saw tooth waveform shown in Fig. 9(b) 8

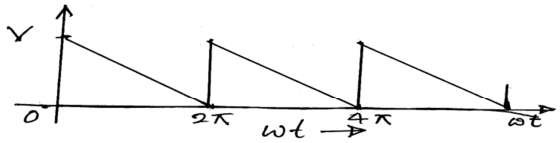


Fig 9(b)

10 a. Find the average power supplied to a network consisting of two elements in series if the applied voltage and the resulting current are given as 10

V(t) = 50+50sin 5000t+30 sin 10000t +20sin 200000t volts

i(t) = 11.2 sin (5000t+ 63.4º) + 10.6sin(10000t+45º) + 8.97sin (20000t+26.6º) Amps.

Find the elements of the network. Make any valid assumptions stating the reasons.

b. State the conditions to be satisfied to express a waveform as a trigonometric series. 2

c. Obtain the trignometric form of Fourier series stating the conditions that can be made use of in simplifying the computations for the waveforms given in Fig. 10(c). 8

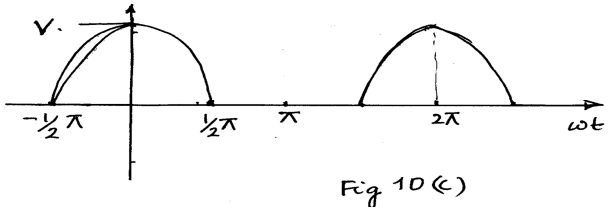


Fig 10(c)