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

(An Autonomous Institution affiliated to VTU, Belagavi)

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

Semester End Examination; Dec - 2017 / Jan - 2018

Network Analysis and Synthesis

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. Using Mesh analysis, find the steady state sinusoidal current i_1 for the circuit shown in Fig. 1a. When $Vs = 10\sqrt{2}\cos\left[100t + 45^\circ\right]$ Volt. 10

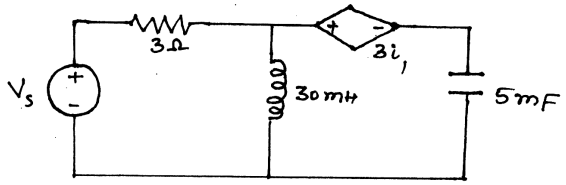


Figure - 1a

b. Using Nodal analysis, find the power delivered by the source in the circuit shown in Fig. 1b. 10

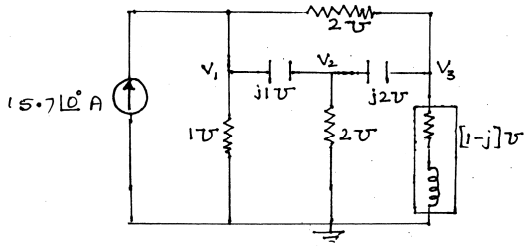


Figure - 1b

2 a. State and prove maximum power transfer theorem for AC circuits. 7

b. For the Network shown in Fig. 2b, obtain the Thevinin's equivalent as seen from terminals *p* and *q*. 7

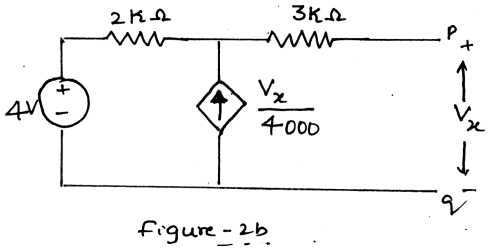


Figure - 2b

c. The network shown in Fig. 2c consists of two star connected circuits in parallel. Obtain the single delta connected equivalent. 6

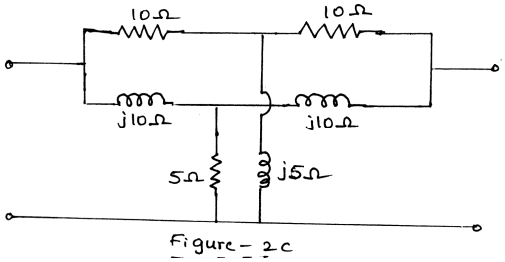


Figure - 2c

Contd….2

UNIT - II

3 a. Derive the expression for the resonant frequency of the circuit where R_L = resistance in the inductor branch and R_c = resistance in the capacitor branch. Also show that the circuit will resonate at all frequencies if $R_L = R_C = \sqrt{\frac{L}{C}}$. 10

b. A 220 V, 100 Hz AC source supplies a series RLC circuit with a capacitor and a coil. If the coil has 50 mΩ resistance and 5 mH inductance, find at a resonance frequency of 100 Hz, what is the value of capacitor? Also calculate 'Q' factor and Half power frequencies. 10

4 a. In a circuit as shown in Fig. 4a, the switch *K* is changed from position 1 to 2 at $t = 0$. The steady state having been reached before switching. Find values of $i(t,)$ $\frac{di(t)}{dt}$ and $\frac{d^2i(t)}{dt^2}$ at $t = 0^+$. 10

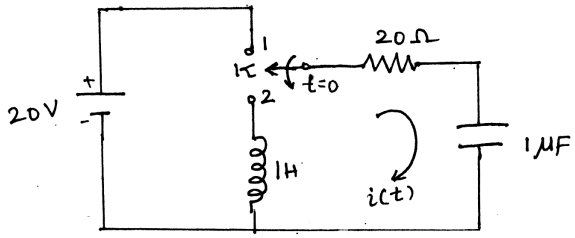


Figure-4a

b. In the network shown in Fig. 4b, a steady state is reached with the switch *K* open. At $t = 0$ the switch is closed for the element values given, determine the values of $V_a(0^-)$ and $V_a(0^+)$. 10

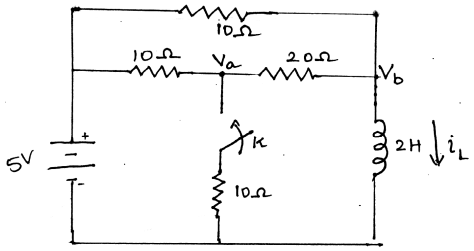


Figure-4b

UNIT - III

5 a. State and prove;

i) Initial value theorem 10

ii) Final value theorem as applied to Laplace-Transform.

b. Find the Laplace transform of the following : 10

i) $\sin^2(t)$ ii) $\cos^2(t)$ iii) $5 + 4e^{-2t}$.

6 a. Using the convolution theorem, find the inverse Laplace transform of the following functions: 10

$i)\ F(s) = \frac{1}{s(s+1)}$ $ii) F(s) = \frac{1}{(s-a)^2}$.

Contd….3

b. The switch in the network of Fig. 6b opens at $t = 0$. Use Laplace transformation analysis to determine the voltage across the capacitor for $t \geq 0$. 10

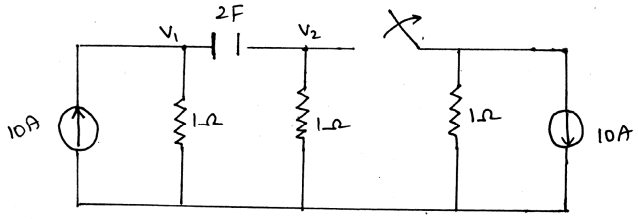


Figure - 6b

UNIT - IV

7 a. Obtain Z- Parameters of the circuit shown in Fig.7a. 10

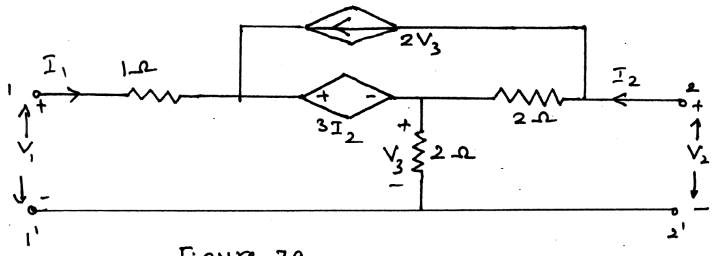


Figure-7a

b. Determine *Y* parameters of the two-port network shown below in Fig. 7b. 10

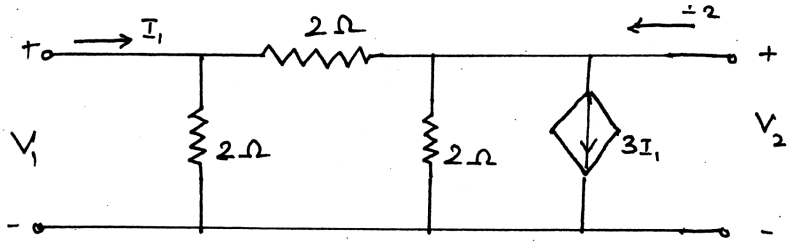
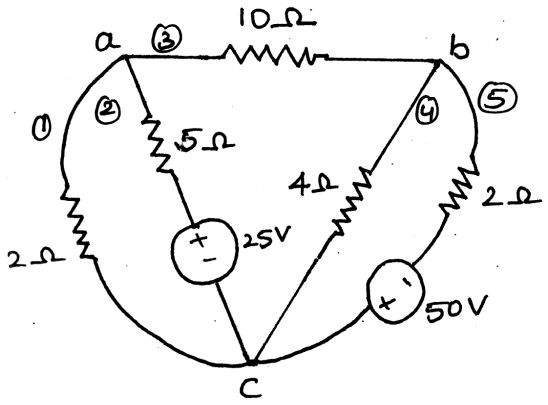


Figure-7b

8 a. For the network shown in Fig. 9a, draw the graph. Select a tree with branches 2 and 4. Draw the cut-set matrix. Write down the equilibrium equations with node-pair voltages as variables. Solve these equations and find the various branch voltages and currents. The integers indicate branch numbers. 12



Contd….4

b. Draw the dual of the network shown in Fig. 8b. Show that the loop equations of the network are the duals of the nodal equations of the dual network. 8

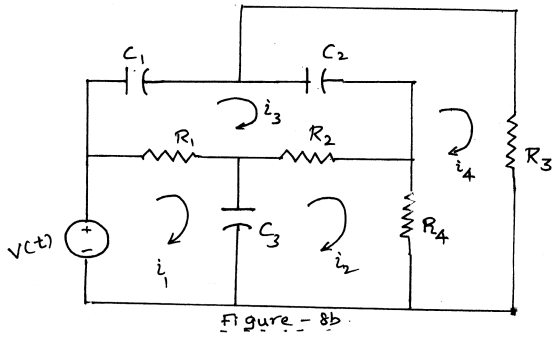


Figure - 8b

UNIT - V

9 a. Test whether the following polynomial is Hurwitz: 7

$G(s) = s^3 + 2s^2 + 3s + 6.$

b. Test whether the function given is a positive real function : 7

$$F(s) = \frac{s^2 + 2s + 25}{s^2 + 5s + 16}.$$

c. List the properties of LC immitance function. 6

10 a. Synthesize the following functions in Foster Form : 8

$$Z(s) = \frac{(s+1)(s+4)}{(s+2)(s+3)}.$$

b. Synthesize the following functions in Caver form : 8

$$Z_{LC}(s) = \frac{(s^2+1)(s^2+4)}{s(s^2+2)}.$$

c. List the properties of R-L impedances and R-C admittances. 4

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