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

(An Autonomous Institution affiliated to VTU, Belgaum)

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

Semester End Examination; Dec - 2016/Jan - 2017

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. Determine the value of the voltage labeled V_1 shown in Figure-1a. 6

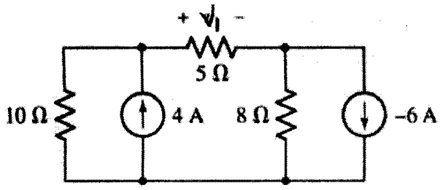

Figure-1a

b. For the circuit of Figure-1b, use nodal analysis to determine V_1 and V_2. 7

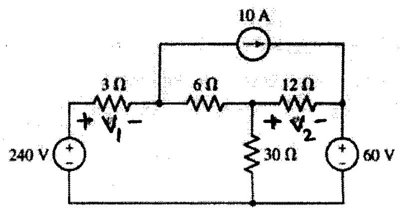

Figure-1b

c. Employ mesh analysis to determine the current flowing in the circuit of Figure-1c through the 2 Ω resistor. 7

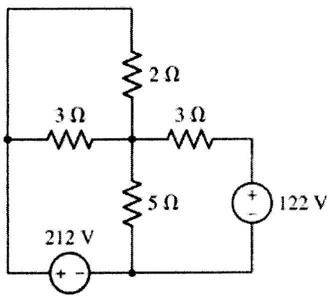

Figure-1c

2 a. Using source transformation, determine the power dissipated by the 5.8 kΩ resistor in Figure-2a. 6

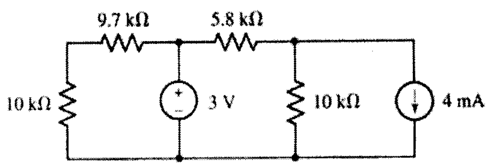

Figure-2a

b. Find the frequency domain Thevenin equivalent of the network shown in Figure-2b. Show the result as V_{th} in series with Z_{th}. 7

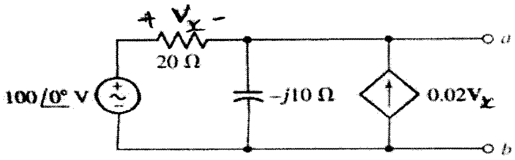

Figure-2b

c. Find the average power absorbed by the 10 Ω resistor shown in Figure-2c. 7

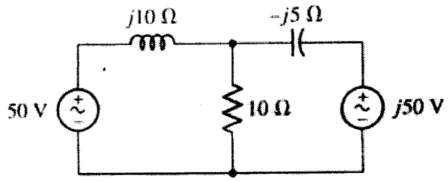

Figure-2c

UNIT - II

3 a. Define quality factor and prove that for a parallel RLC circuit quality factor $Q_0 = \omega_0 RC$. 6

b. A parallel resonant circuit has $\omega_0 = 1000\ rad/s,\ Q_0 = 80,$ and $C = 0.2\ \mu F$. Find R and L. 7

c. A series resonant network consists of a 50 Ω resistor, a 4 mH inductor, and a 0.1 μF capacitor. Calculate values for, (i) ω_0 (ii) f_0 (iii) Q_0 and (iv) Bandwidth B. 7

4 a. In the network shown in Figure-4a, the switch is changed from the position 1 to the position 2 at $t = 0$. Steady state condition having reached before switching. Find the values of i, di/dt and d^2i/dt^2 at $t = 0^+$. 10

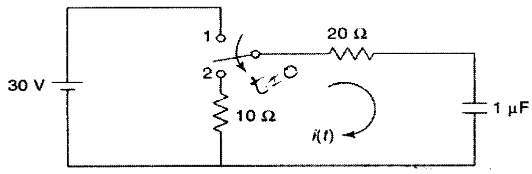

Figure-4a

b. For the network shown in Figure-4b, the switch is open for a long time and closes at $t = 0$. Determine $V_C(t)$. 10

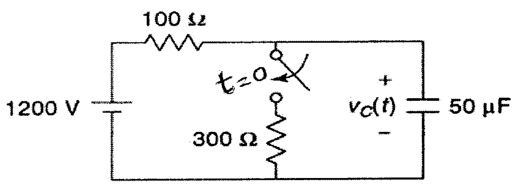

Figure-4b

UNIT – III

5 a. State and prove :

(i) Initial value theorem (ii) Final value theorem as applied to Laplace transform. 6

b. Find the Laplace transform of the following :

i) $3u(t - 3) - 3$ ii) $3u(3 - t)$. 6

Contd......3

c. Referring to the RL circuit of Figure-5c, (i) Write a differential equation for the inductor current $i_L(t)$, (ii) Find $I_L(s)$ the Laplace transform $i_L(t)$, (iii) Solve for $i_L(t)$ by taking the inverse Laplace transform of $I_L(s)$. 8

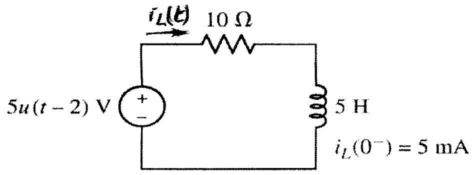

Figure-5c

6 a. Find the Thevenin equivalent impedance seen looking into the terminals of the circuit depicted in Figure-6a. Do the analysis in S-domain only. 7

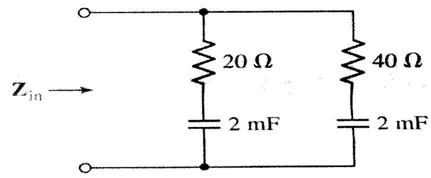

Figure-6a

b. Prove that the inverse Laplace transform of the product of two Laplace transforms is the convolution of the individual Laplace transforms. 7

c. State all poles and zeros of each of the following s-domain functions : 6

i) $\dfrac{3s^2}{s(s^2+4)(s-1)}$ ii) $\dfrac{s^2+2s-1}{s^2(4s^2+2s+1)(s^2-1)}$.

UNIT - IV

7 a. Find y_{11} and y_{12} for the two-port shown in Figure-7a. 6

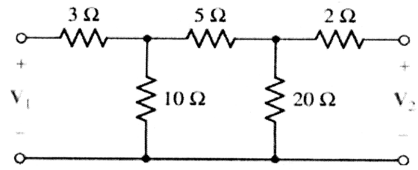

Figure-7a

b. Convert the Δ network of Figure-7b to a Y connected network. 7

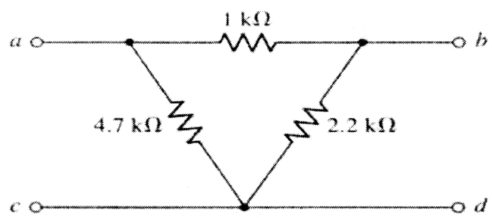

Figure-7b

c. Find t_A for the single 2 Ω resistor of Figure-7c. Show that t for a single 10 Ω resistor can be obtained by $(t_A)^5$. 7

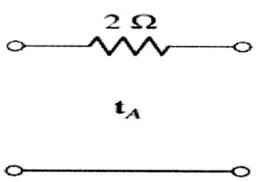

Figure-7c

8 a. Compare the following terms as applied to network topology with suitable examples : 6

(i) Planar graph and non planar graph (ii) Links and twigs.

b. For the circuit shown in Figure-8b,

(i) Draw its graph (ii) Draw its tree (iii) Write the fundamental cutset matrix. 7

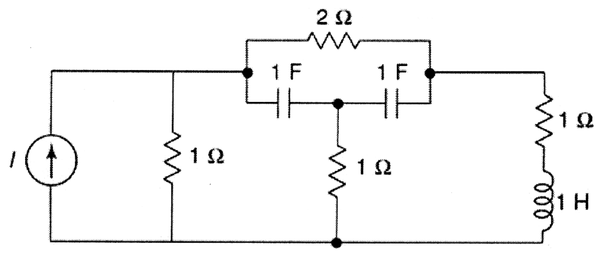

Figure-8b

c. The reduced incidence matrix of a graph is given in Figure-8C. Express branch voltages in terms of node voltages. 7

$$Q = \begin{bmatrix} -1 & 1 & 0 & 0 & -1 \\ 0 & 0 & 1 & 0 & -1 \\ 1 & 0 & 0 & 1 & 0 \end{bmatrix}$$

Figure-8c

UNIT - V

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

$P(s) = s^4 + s^3 + 5s^2 + 3s + 4.$

b. Test whether the function given is a positive real function $f_{(s)} = \dfrac{s^2 + 6s + 5}{s^2 + 9s + 14}$. 7

c. Justify which of the function is RL or RC impedance functions : 6

i) $z_{(S)} = \dfrac{4(s+1)(s+3)}{s(s+2)}$ ii) $z_{(S)} = \dfrac{s(s+4)(s+8)}{(s+1)(s+6)}$.

10 a. Realize Cauer-II form of the function : 7

$$z_{LC(S)} = \frac{s\left(s^4 + 3s^2 + 1\right)}{3s^4 + 4s^2 + 1}.$$

b. Realize Foster-I form of the function : 7

$$z_{(S)} = \frac{(s+1)(s+3)}{s(s+2)}.$$

c. List any five properties of LC driving point immittance function. 6

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