U.S.N

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. - 2015

Electric Circuit Theory

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each **unit**.*
ii) Justify any Assumptions made.

UNIT - I

1 a. Define the following :

i) Branch of a network ii) Potential Source 5

iii) Current Source iv) Network and circuit.

b. Explain with figures the four types of dependent sources. 8

c. For the network shown in Fig .Q1(c), use nodal analysis to determine the node voltages. 7

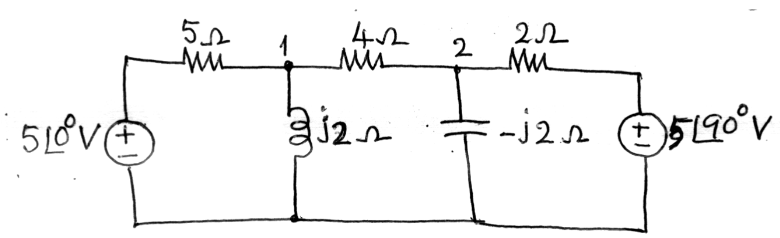

Fig. Q 1(c)

2 a. For a network, develop the generalized mesh equation in the matrix form $[Z][I]=[V]$ where [Z] = impedance matrix, [I] = mesh current matrix and [V] = source voltage matrix. 7

b. Using mesh analysis, find the current I_0 and the power dissipated in the 5 Ω resistor in the current of Fig. Q 2(b). 7

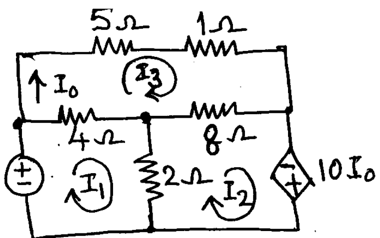

Fig Q 2(b)

c. Calculate the current through 2 Ω resistor in the circuit of Fig. Q2(c) using source information. 6

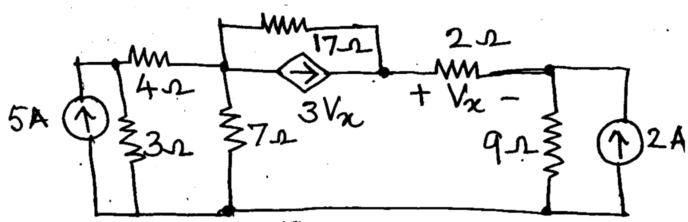

Fig Q 2(c)

Contd…..2

UNIT - II

3 a. Define the following with an example each :

(i) Oriented graph (ii) Tree (iii) Incidence matrix (iv) Fundamental cut-set (v) fundamental tie-set 10

b. For the network shown in Fig. Q 3(b) draw its dual. Write in the integrodifferential form,

(i) Mesh equations for the given network ii) Node equations for the dual. 10

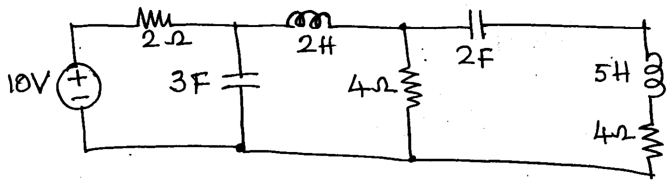

Fig Q 3(b)

4 a. Distinguish between the following terms as applied to network topology. Give suitable examples: (i) Planar graph and non-planar graph (ii) Links and twigs. 5

b. The reduced incidence matrix of a network is given below. Draw the oriented graph corresponding to it. 5

$$\begin{bmatrix} -1 & +1 & 0 & 0 & 0 & -1 \\ 0 & -1 & -1 & +1 & 0 & 0 \\ 0 & 0 & +1 & 0 & -1 & +1 \end{bmatrix}$$

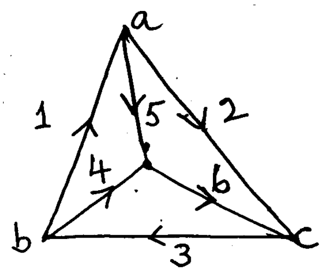

Fig Q 4(c)

c. For the oriented graph shown in Fig. Q4 (c) write the complete incidence matrix. Also write the cut-set and tieset matrices considering branches 4, 5 and 6 as twigs. 10

UNIT - III

5 a. State and explain Reciprocity theorem. 6

b. Use superposition theorem to find V_o in the circuit of Fig. Q 5(b). 7

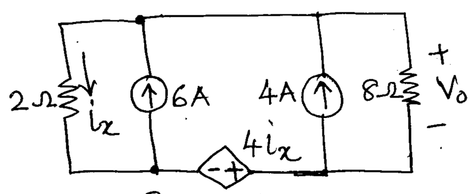

Fig Q 5(b)

c. Find the Thevenin equivalent circuit at terminals a-b in the circuit shown in Fig. Q5(c). What is the impedance Z_L to be connected across a-b so that maximum power is delivered to Z_L? What is that maximum power? 7

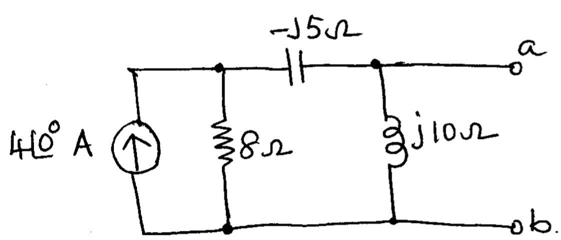

Fig. Q 5(C)

6. a. For a series resonant circuit show that $\omega_0 = \sqrt{\omega_1 \omega_2}$ where ω_0 = resonant frequency and ω_1, ω_2 = half power frequencies. 6

b. A coil under test is connected in series with a variable capacitor C and a sine wave generator giving a 10 V rms output at a frequency of 1k rad/s. By adjusting C, the current is found to be maximum when C = 10 μF. Further the current falls down to 0.707 times the maximum value when C = 12.5 μF; 7

i) Find the inductance and resistance of the coil ii) Find the Q of the coil at resonance

iii) What is the maximum current in the circuit?

c. In the network shown in Fig. Q6(c), find the values of C for which the circuit resonates at w = 5000 rads/s. 7

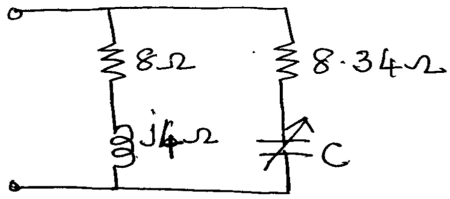

fig Q 6(c)

UNIT - IV

7 a. Write the equivalent form of the elements in terms of, 8

(i) The initial conditions of the elements (ii) the final conditions of the elements.

b. In the network shown in Fig. 7(b) the switch is closed at t = 0 with the capacitor uncharged find the values of i and di/dt at $t = 0+$. 4

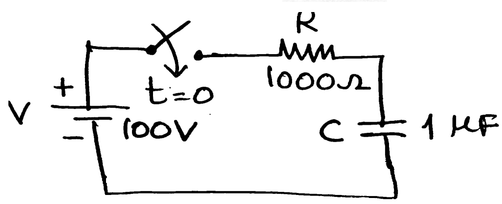

fig Q 7(b)

c. State convolution theorem as applied to Laplace transforms. Use convolution theorem to find the Laplace inverse of the function, 8

$$F(s) = \frac{s}{(s+1)(s+2)}$$

8 a. Determine v, $\frac{dv}{dt}$ and $\frac{d^2v}{dt^2}$ at $t = 0^+$ when the switch k is opened at $t = 0$ in the circuit of Fig. Q 8(a). 7

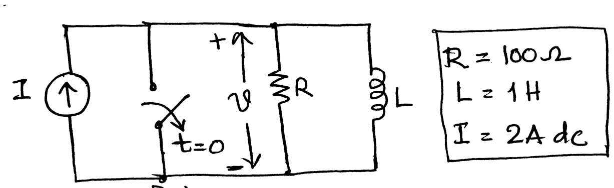

fig Q 8(a)

b. What are the advantages of Laplace transform method over classical method for solving differential equation. 3

c. Show that $L\left\{\frac{df(t)}{dt}\right\} = sf(s) - f(0-)$ where $F(s) = L\{f(t)\}$ *and* $f(0-) = \lim_{t\to 0} f(t)$. 3

d. A pulse of 10 V magnitude and 5 μs duration is applied to the RC circuit as shown in Fig. Q 8(d). Find the current $i(t)$ using Laplace transform method. 7

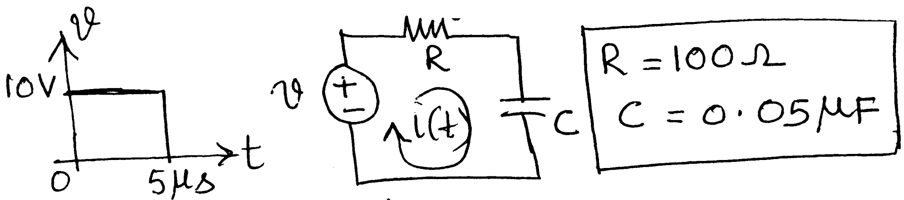

Fig Q 8(d)

UNIT - V

9 a. What are poles and zeros of a network functions? List the restrictions on pole and zero locations for transfer functions. 10

b. Determine the y-parameters for the two-port network shown in Fig. Q 9(b) and draw the y-parameter equivalent circuit. 10

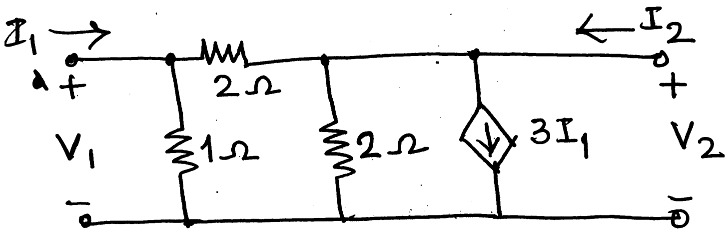

Fig Q 9(b)

10a. For the network shown in Fig. 10(a) compute $\alpha_{12}(s) = \frac{I_2(s)}{I_1(s)}$ and $Z_{12}(s) = \frac{V_2(s)}{I_1(s)}$. Also locate the poles and zeroes of $\alpha_{12}(s)$ *and* $Z_{12}(s)$ on the s-plane Assume R = 1 Ω, C_1 = 1 F and C_2 = 2 F. 10

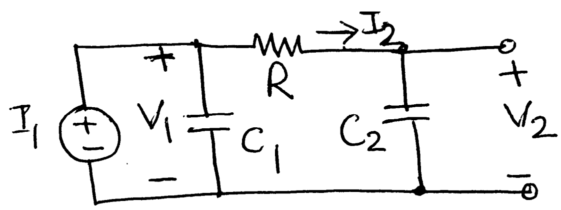

Fig Q 10(a)

b. Explain the symmetry and reciprocity properties of two port networks. 4

c. Show that the overall transmission parameter matrix for the cascaded connection of two two-port networks is the matrix product of the transmission parameter matrices of the individual two-port networks in the cascade. 6

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