CBCS SCHEME

USN 18EE32

Third Semester B.E. Degree Examination, Feb./Mar. 2022
Electric Circuit Analysis

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Use Source transformation and Source shift methods to convert the circuit shown in Fig. Q1(a) to a single current source in parallel with a single resistor. **(06 Marks)**

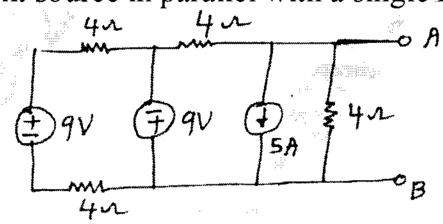


Fig. Q1(a)

b. Compute the resistance across the terminals XY of network, shown in Fig. Q1(b). **(06 Marks)**

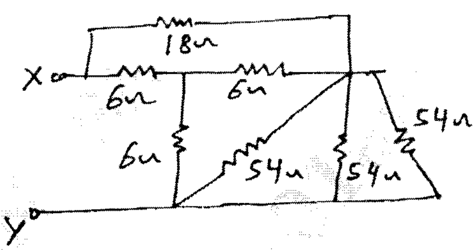


Fig. Q1(b)

c. For the network shown in Fig. Q1(c), write the mesh equations for the meshes indicated in time domain. Draw the dual network and write its nodal equations. **(08 Marks)**

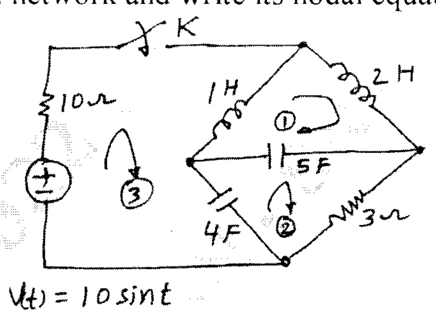


Fig. Q1(c)

OR

2 a. Use Node equations to determine what value of E will cause V_x to be zero for the circuit shown in Fig.Q2(a). **(08 Marks)**

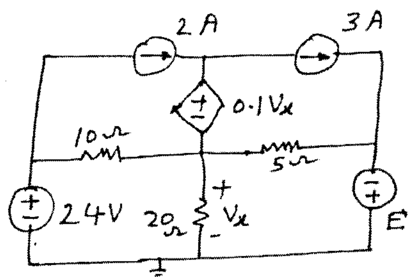


Fig. Q2(a)

b. Using Mesh analysis, find the current through 10Ω resistor in the circuit shown in Fig. Q2(b). **(06 Marks)**

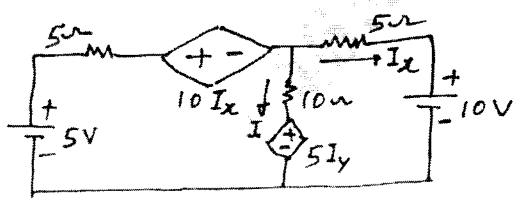


Fig. Q2(b)

c. In the circuit shown in Fig. Q2(c), determine V_2 which results in zero current through 4Ω resistor. Use Mesh current analysis. **(06 Marks)**

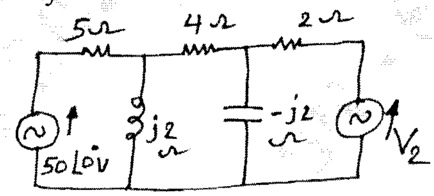


Fig. Q2(c)

Module-2

3 a. Use Superposition principle to find the current in 2Ω resistor in the network shown in Fig. Q3(a). **(06 Marks)**

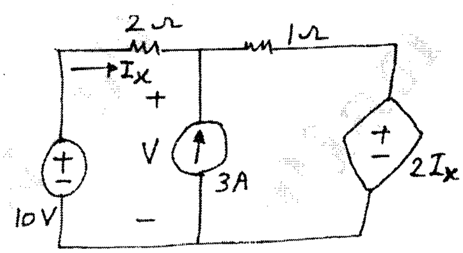


Fig. Q3(a)

b. Find the Thevenin and Norton equivalent circuit at terminals AB for the circuit shown in Fig. Q3(b). **(10 Marks)**

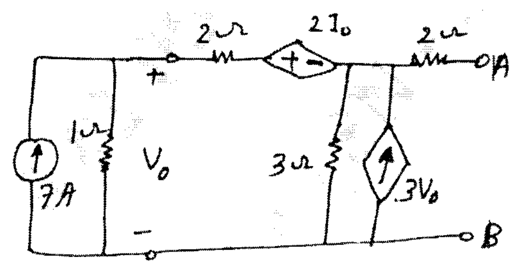


Fig. Q3(b)

c. State and prove maximum Power Transfer theorem as applied to DC network. **(04 Marks)**

OR

4 a. Use Millman's theorem to determine the voltage 'Vs' of the network shown in Fig. Q4(a). Given that $E_R = 230\angle 0^0$ V ; $E_Y = 230\angle -120^0$ V ; $E_B = 230\angle 120^0$ V. **(06 Marks)**

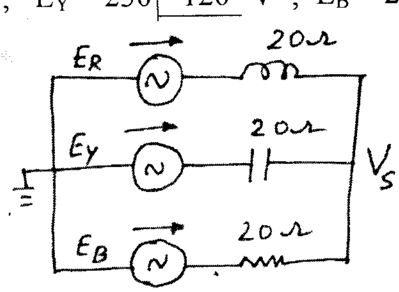
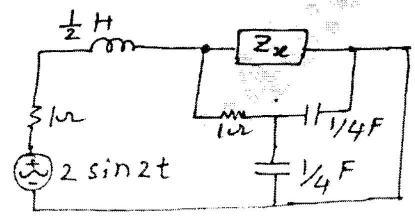


Fig. Q4(a)

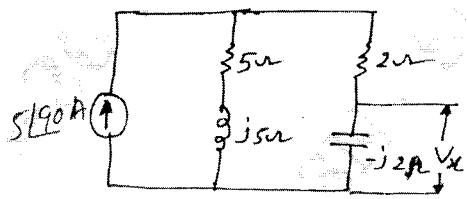
b. For the circuit shown in Fig. Q4(b), determine the impedance Z_X such that maximum power is transferred from the source to the load of impedance Z_X. **(08 Marks)**

Fig. Q4(b)



c. Verify Reciprocity theorem for the circuit shown in Fig. Q4(c). **(06 Marks)**

Fig. Q4(c)

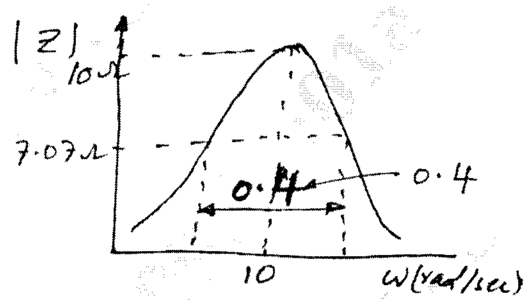


Module-3

5 a. Define Q of the circuit and show that the resonant frequency is the geometric mean of half power frequencies. **(07 Marks)**

b. Determine the RLC parallel circuit parameters whose impedance response curve is shown in Fig. Q5(b). What are the new values of W_r and bandwidth if 'C' is increased 4 times? **(07 Marks)**

Fig. Q5(b)



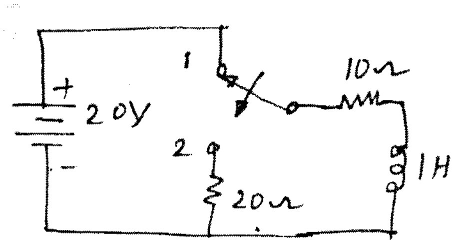
c. A parallel R – L circuit is energized by a current source of 1A. The switch across the source is opened at $t = 0^+$. Solve for V, DV and D^2V at $t = 0^+$, if R = 100Ω and L = 1H. **(06 Marks)**

OR

6 a. A two branch anti resonant circuit contains L = 0.4H and C = 40μF. Resonance is to be achieved by variation of R_L and R_C. Calculate the resonance frequency for the following cases : i) $R_L = 120\Omega$; $R_C = 80\Omega$ ii) $R_L = 80\Omega$; $R_C = 0$ iii) $R_L = R_C = 100\Omega$. **(08 Marks)**

b. Determine i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$, when the switch K is moved from position 1 to 2 at t = 0 in the network shown in Fig. Q6(b). Steady state having been reached before switching. **(06 Marks)**

Fig. Q6(b)

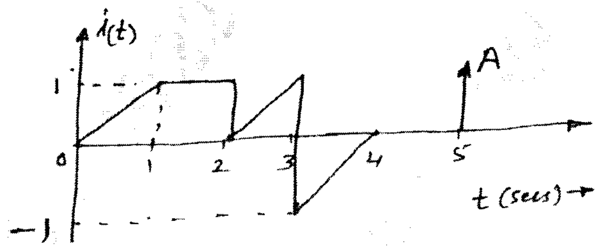


c. Why do we need to study initial conditions? Write the equivalent form of the elements in terms of the initial and final conditions of the element. **(06 Marks)**

Module-4

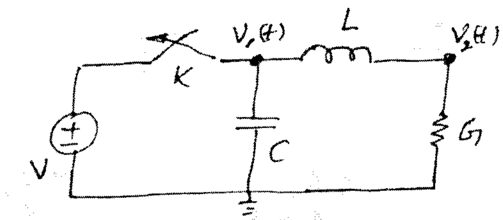
7 a. The current function i(t) shown in Fig. Q7(a) is impressed on a capacitor 'C'. What should be the strength 'A' of the impulse so that the voltage across the 'C' becomes zero for $t > 5$ sec. **(10 Marks)**

Fig. Q7(a)



b. In the circuit shown in Fig. Q7(b), the switch is opened at t = 0, with V = 1V , C = 1F , $L = \frac{1}{2}$H and G = 1℧. Find the node voltages $V_1(t)$ and $V_2(t)$ by Laplace transform method. **(10 Marks)**

Fig. Q7(b)



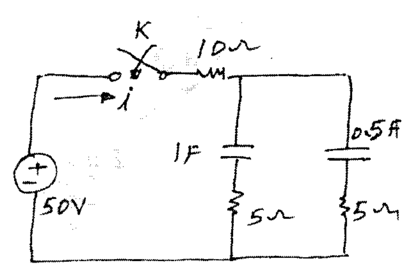
OR

8 a. State and prove Initial and Final value theorems. **(08 Marks)**

b. If f(t) = 2t, sketch the following i) f(t – 2) u(t) ii) f(t) u(t – 2) iii) f(t – 2) u (t – 2) iv) f(t) δ(t) v) f(t) δ (t – 2). **(06 Marks)**

c. In the circuit shown in Fig.Q8(c), the switch is closed at t = 0 and there is no initial charge on either of the capacitors. Find the resulting current 'i'. Using Laplace transformation. **(06 Marks)**

Fig. Q8(c)



Module-5

9 a. A three phase, 4 – wire 150V, CBA system has a star connected load with $Z_A = 6\angle 0^0\ \Omega$ $Z_B = 6\angle 30^0\ \Omega$ and $Z_C = 5\angle 45^0\ \Omega$. Obtain all the i) Line currents ii) Currents in the neutral iii) Hence draw the Phasor diagram. **(08 Marks)**

b. Define [Z] and [Y] of a two port network and derive for [Z] in terms of [Y]. **(08 Marks)**

c. Determine [Z] for the network shown in Fig. Q9(c). **(04 Marks)**

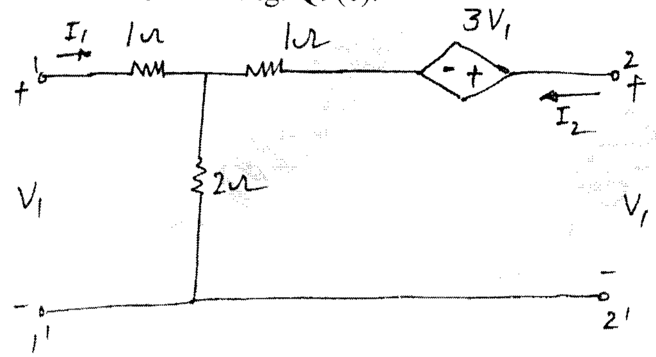


Fig. Q9(c)

OR

10 a. A three phase, 339.4V , ABC system has a delta connected load with $Z_{AB} = 10\angle 0^0\ \Omega$, $Z_{BC} = 10\angle 30^0\ \Omega$ and $Z_{CA} = 15\angle -30^0\ \Omega$. Obtain phase and line currents as well as draw the phasor diagram. Assume V_{BC} as a reference phasor. **(10 Marks)**

b. Obtain [Z] and [Y] for the two port network shown in Fig. Q10(b).

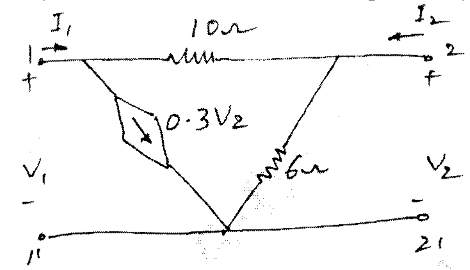


Fig. Q10(b)

(10 Marks)

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