

CBCS SCHEME

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18EE32

Third Semester B.E. Degree Examination, July/August 2021 Electric Circuit Analysis

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions.

- 1 a. Solve for the Mesh currents I_1 , I_2 and I_3 using Mesh analysis for the circuit given in Fig.Q1(a).

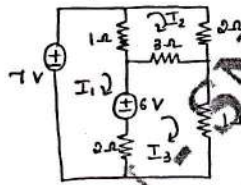


Fig.Q1(a)

(08 Marks)

- b. Find the equivalent resistance across terminals 'a' and 'b' for the circuit given in Fig.Q1(b).

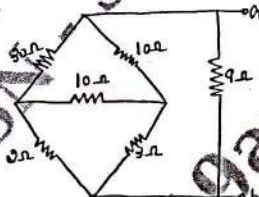


Fig.Q1(b)

(06 Marks)

- c. Use the node voltage method to find how much power the 2A source extract in Fig.Q1(c).

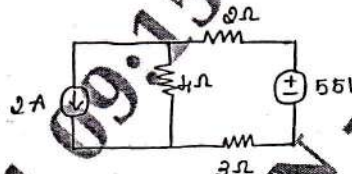


Fig.Q1(c)

(06 Marks)

- 2 a. For the circuit given in Fig.Q2(a). Using source transformation. Find the equivalent voltage source across terminals a and b.

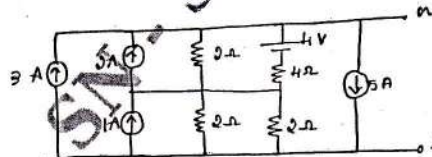


Fig.Q2(a)

(10 Marks)

- b. For the circuit given in Fig.Q2(b), using Nodal analysis. Solve for the node voltages.

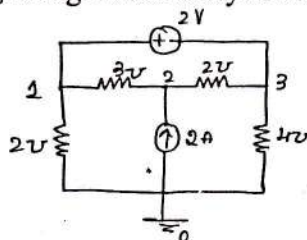


Fig.Q2(b)

(10 Marks)

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.

- 3 a. Calculate for ' I_x ' using superposition theorem for the circuit shown in Fig.Q3(a).

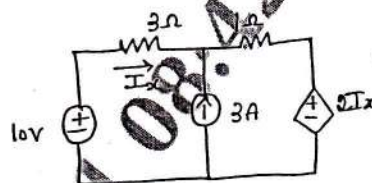


Fig.Q3(a)

(08 Marks)

- b. Deduce Thevenin's equivalent across terminals a and b for circuit shown in Fig.Q3(b).

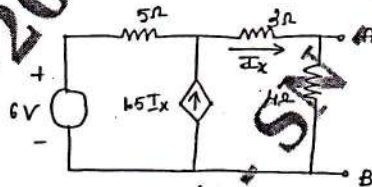


Fig.Q3(b)

(06 Marks)

- c. Deduce Norton's equivalent across terminals a and b for the circuit shown in Fig.Q3(c).

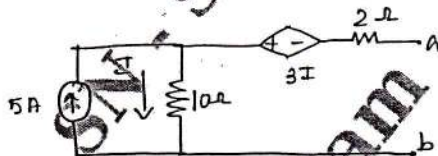


Fig.Q3(c)

(06 Marks)

- 4 a. Verify reciprocity theorem for the circuit shown in Fig.Q4(a).

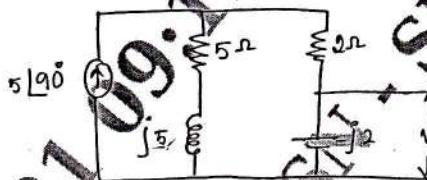


Fig.Q4(a)

(06 Marks)

- b. Calculate the maximum power in Z_L using MPT theorem for circuit shown in Fig.Q4(b).

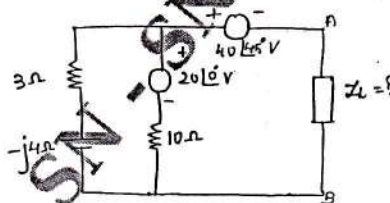


Fig.Q4(b)

(06 Marks)

- c. Find the Thevenin's equivalent circuit across A and B for the circuit shown in Fig.Q4(c).

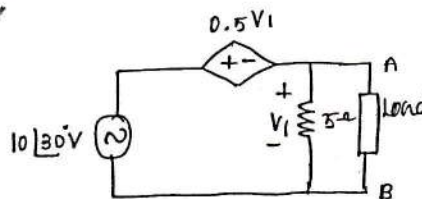


Fig.Q4(c)

(08 Marks)

- 5 a. Derive for resonant circuit, the resonant frequency $f_0 = \sqrt{f_1 f_2}$ where f_1 and f_2 are the two half power frequencies. (06 Marks)
- b. A series resonance network consisting of a resistor of 30Ω a capacitor of 247 an inductor of 20mH is connected across a sinusoidal supply voltage of 9 volts at all frequencies. Calculate the resonant frequency of the current at resonance, the voltage across the inductor and capacitor at resonance the quality factor and bandwidth of the circuit. (06 Marks)
- c. Determine $\frac{di(t)}{dt}, \frac{d^2i(t)}{dt^2}$ at $t = 0^+$ when the switch K is closed at $t = 0$ with zero current in the inductor for the circuit shown in Fig.Q5(c).

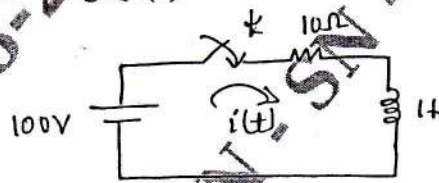


Fig.Q5(c)

(08 Marks)

- 6 a. In the given network in Fig.Q6(a), switch K is open at $t = 0$ and $t = 0^+$, solve for the value of $v, \frac{dv}{dt}, \frac{d^2v}{dt^2}$. If $I = 2\text{A}, R = 100\Omega$ and $L = 1\text{H}$.

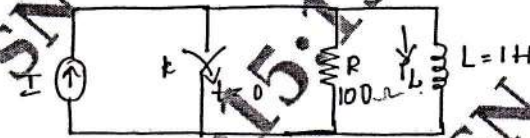


Fig.Q6(a)

(10 Marks)

- b. In the circuit shown in Fig.6(b), the steady state is reached with switch K open, the switch is closed at $t = 0$. Determine $i, i_2, \frac{di_1}{dt}$ and $\frac{di_2}{dt}$ at $t = 0^+$.

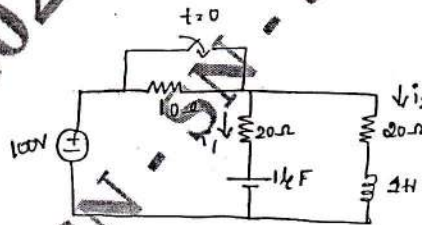


Fig.Q6(b)

(10 Marks)

- 7 a. State and prove initial value theorem and final value theorem. (10 Marks)
- b. Obtain the laplace transform of the periodic signal shown in Fig.Q7(b).

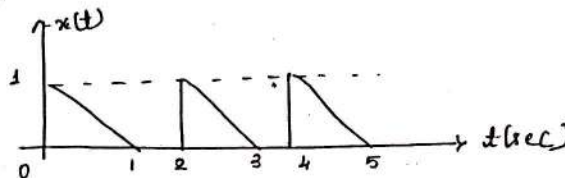


Fig.Q7(b)

(10 Marks)

8 a. Find inverse Laplace transform of the following :

i) $\frac{s^2 + 2s + 5}{(s + 3)(s + 5)^2}$

ii) $\frac{2s + 4}{s^2 + 4s + 3}$

(10 Marks)

b. For the circuit shown in Fig.Q8(b). Determine the step response $V_c(t)$ for the voltage across the capacitor.

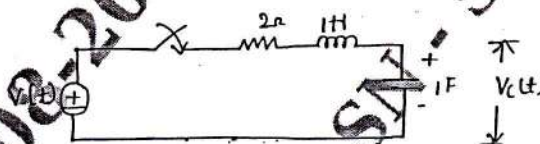


Fig.Q8(b)

(10 Marks)

9 a. The network shown in Fig.Q9(a) contains both dependent current source and dependent voltage source. For the element values given, determine the y - z parameters.

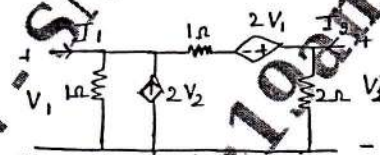


Fig.Q9(a)

(08 Marks)

b. Find y_{11} , z_{21} , A, and W from $2V_1 + 4I_2 = I_1$, $8I_2 = V_2 + 6V_1$.

(06 Marks)

c. A 440V, 3 ϕ , 4-wire unbalanced load has impedances $Z_r = 10\Omega$, $Z_y = j5\Omega$, $Z_b = -j5\Omega$. Calculate for the line currents, total active power and total reactive power.

(06 Marks)

10 a. Obtain relationship between Z in terms of Y parameters and Y in terms of Z parameter.

(08 Marks)

b. A Δ -connected load with $Z_{RY} = 10 \angle 30^\circ \Omega$, $Z_{YB} = 25 \angle 0^\circ \Omega$, $Z_{BR} = 20 \angle -30^\circ \Omega$ is connected to a 3 ϕ , 3 wire 500V RYB system. Determine the line current and total power absorbed.

(06 Marks)

c. Find the transmission parameters of the network shown in Fig.Q10(c).

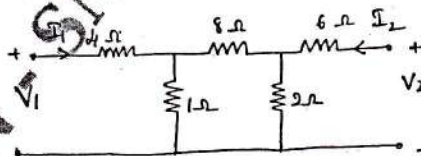


Fig.Q10(c)

(06 Marks)
