

Third Semester B.E. Degree Examination, Jan./Feb. 2023 Network Theory

Max. Marks: 100

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

Module-1

- 1 a. Find the equivalent resistance between MN using star-delta transformation in the circuit in Fig. Q1 (a).

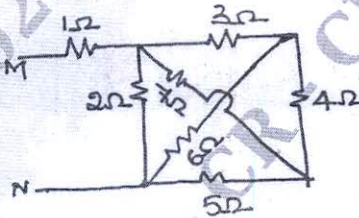


Fig. Q1 (a)

(06 Marks)

- b. Find I_o in the circuit in the Fig. Q1 (b) using node analysis.

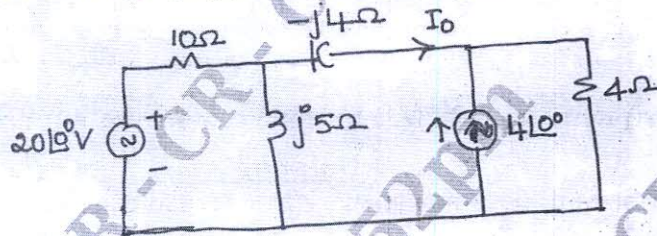


Fig. Q1 (b)

(08 Marks)

- c. Find the current I_x in the circuit shown in Fig. Q1 (c) using mesh analysis.

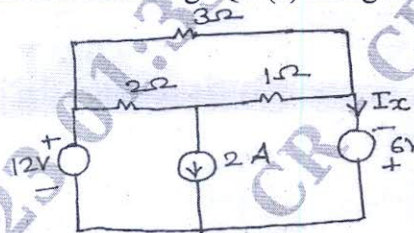


Fig. Q1 (c)

(06 Marks)

OR

- 2 a. Find the current i_a in the circuit in Fig. Q2 (a) using mesh analysis.

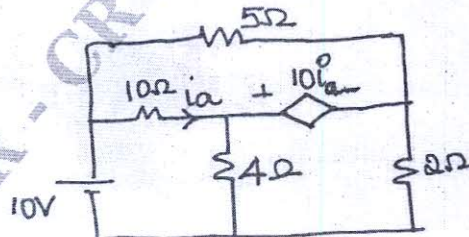


Fig. Q2 (a)

(08 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.

- b. Find the node voltage using node analysis in the Fig. Q2 (b).

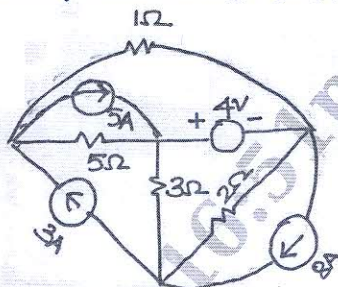


Fig. Q2 (b)

(08 Marks)

- c. Define the following terms with examples :

- (i) Active elements
- (ii) Linear circuit
- (iii) Bilateral circuit
- (iv) Lumped elements

(04 Marks)

Module-2

- 3 a. In the circuit shown in Fig. Q3 (a), find the current through $10\ \Omega$ using Thevenin's theorem.

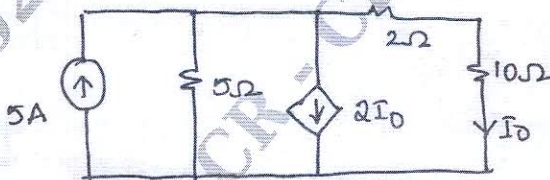


Fig. Q3 (a)

(08 Marks)

- b. Find the current through $(3 + j4)\ \Omega$ in the Fig. Q3 (b) using superposition theorem.

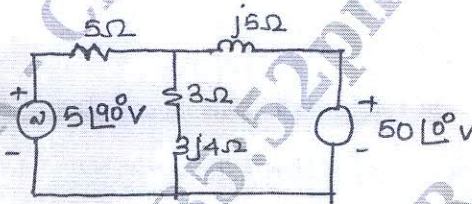


Fig. Q3 (b)

(08 Marks)

- c. For the circuit shown in Fig. Q3 (c), find the current flowing in $10 - j3$ impedance using Millman's theorem.

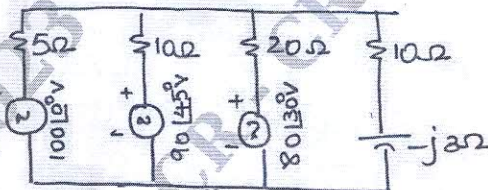


Fig. Q3 (c)

(04 Marks)

OR

- 4 a. State superposition theorem. Find V_a in the circuit in Fig. Q4 (a) using superposition theorem.

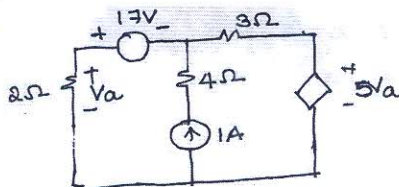


Fig. Q4 (a)

(10 Marks)

- b. State and find the condition for maximum power transfer in a 4C circuit, where both R_L and X_L are varying.

(10 Marks)

Module-3

- 5 a. In the circuit in Fig. Q5 (a), the switch K is closed at $t = 0$, find $\frac{di_1(0+)}{dt}$ and $\frac{di_2(0+)}{dt}$.

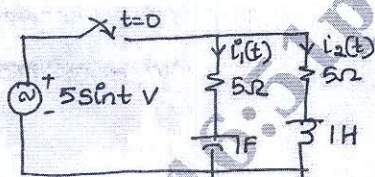


Fig. Q5 (a)

(07 Marks)

- b. In the circuit shown in Fig. Q5 (b), the switch K is moved from position 1 to position 2 at $t = 0$, the steady state has been reached before switching, calculate $i(t)$, $\frac{di(t)}{dt}$ and $\frac{d^2i(t)}{dt^2}$ at $t = 0+$.

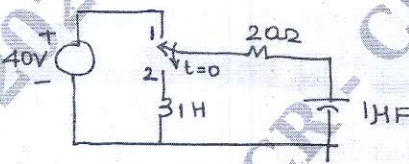


Fig. Q5 (b)

(08 Marks)

- c. What is time constant? Explain the time constant in case of series RL and RC circuits.

(05 Marks)

OR

- 6 a. The Switch K is in the circuit in Fig. Q6 (a) is open for a long time. At $t = 0$ it is closed. Find $i_1(t)$, $i_2(t)$, $\frac{di_1(t)}{dt}$, $\frac{di_2(t)}{dt}$, $\frac{d^2i_1(t)}{dt^2}$, $\frac{d^2i_2(t)}{dt^2}$ at $t = 0+$.

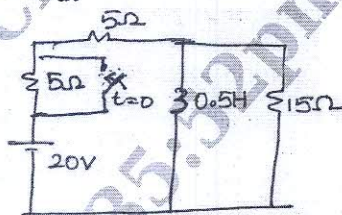


Fig. Q6 (a)

(10 Marks)

- b. In the circuit in Fig. Q6 (b), the switch across 10Ω is closed at $t = 0$. Find the current $i_1(t)$, $i_2(t)$, $\frac{di_1(t)}{dt}$, $\frac{di_2(t)}{dt}$ at $t = 0+$.

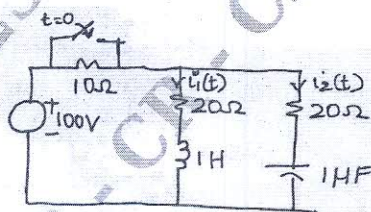


Fig. Q6 (b)

(10 Marks)

Module-4

- 7 a. For a series RLC circuit, shown in Fig. Q7 (a), the initial condition are $i_L(0-) = 2A$ and $V_C(0-) = 2V$. It is connected to a DC voltage of $5V$ at $t = 0$. Find the current $i(t)$ after switching action, using Laplace transforms.

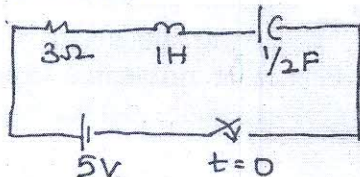


Fig. Q7 (a)

(10 Marks)

- b. Find the Laplace transform of the waveform in Fig. Q7 (b).

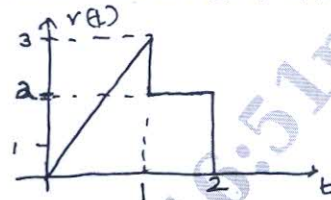


Fig. Q7 (b)

(05 Marks)

- c. Find the Laplace transform of unit step and unit ramp function.

(05 Marks)

OR

- 8 a. State and prove initial value theorem and final value theorem. (10 Marks)
 b. In the network Fig. Q8 (b) the switch is opened at $t = 0$. Find out the node voltage $V_1(t)$ and $V_2(t)$ after opening the switch.

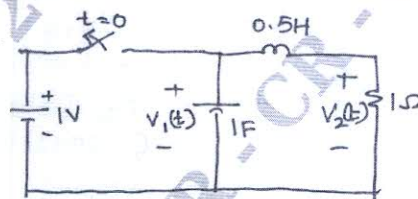


Fig. Q8 (b)

(10 Marks)

Module-5

- 9 a. Obtain Z parameter for the circuit in Fig. Q9 (a).

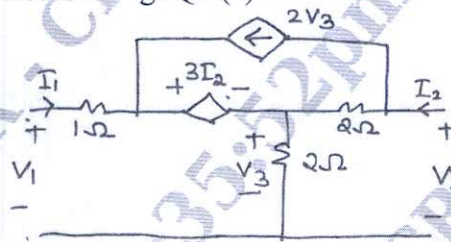


Fig. Q9 (a)

(10 Marks)

- b. Obtain an expression for resonant frequency in a parallel resonant circuit. (06 Marks)
 c. Find the value of R_1 for which the circuit shown in Fig. Q9 (c) at resonance.

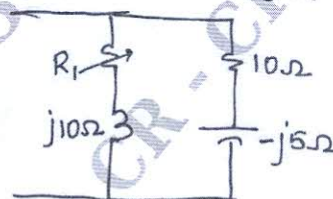


Fig. Q9 (c)

(04 Marks)

OR

- 10 a. Define h-parameters and obtain the expression of h-parameters in terms of Y-parameters. (10 Marks)
 b. The elements of RLC series circuit are $R = 10 \Omega$, $L = 0.04 \text{ H}$ and $C = 22 \mu\text{F}$. When the circuit is excited by a variable frequency source 100 V, determine the voltage across inductance and capacitance at resonance. Also, determine the frequencies at which the voltage across L and C is maximum and the maximum voltage across L. (10 Marks)

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