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18EC32

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

Time: 3 hrs. 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).

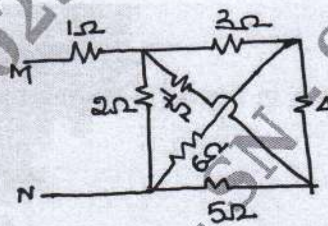

Fig. Q1 (a) **(06 Marks)**

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

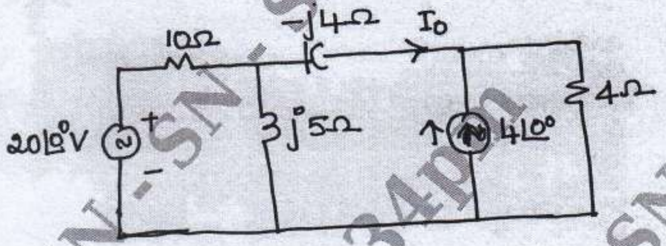

Fig. Q1 (b) **(08 Marks)**

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

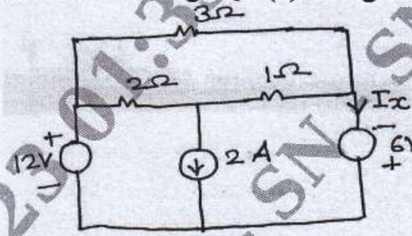

Fig. Q1 (c) **(06 Marks)**

OR

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

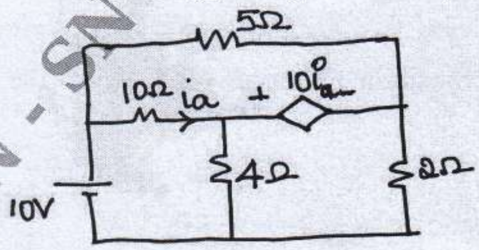

Fig. Q2 (a) **(08 Marks)**

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

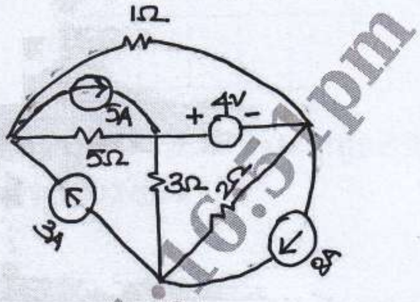

Fig. Q2 (b) **(08 Marks)**

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 Ω using Thevenin's theorem.

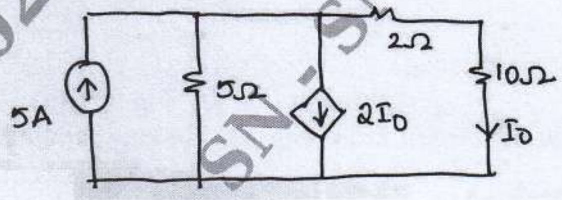

Fig. Q3 (a) **(08 Marks)**

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

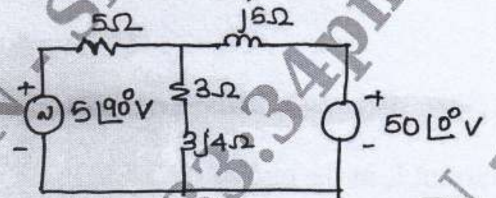

Fig. Q3 (b) **(08 Marks)**

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

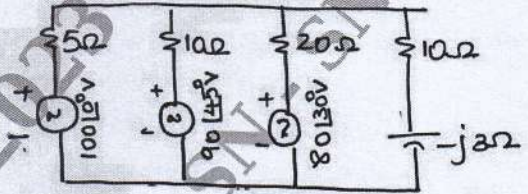

Fig. Q3 (c) **(04 Marks)**

OR

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

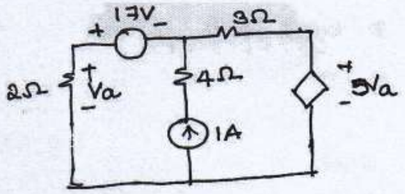

Fig. Q4 (a) **(10 Marks)**

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 $\frac{di_2(0+)}{dt}$.

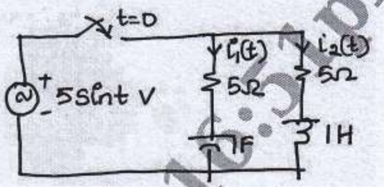

Fig. Q5 (a) **(07 Marks)**

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+.

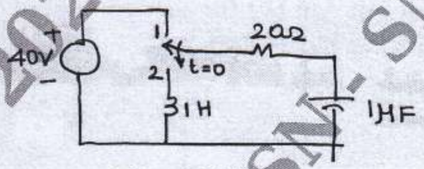

Fig. Q5 (b) **(08 Marks)**

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 $i_1(t)$, $i_2(t)$, $\frac{di_1(t)}{dt}$, $\frac{di_2(t)}{dt}$, $\frac{d^2i_1(t)}{dt^2}$, $\frac{d^2i_2(t)}{dt}$ at t = 0+.

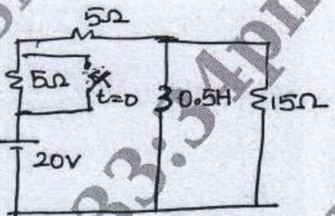

Fig. Q6 (a) **(10 Marks)**

b. In the circuit in Fig. Q6 (b), the switch across 10 Ω 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+.

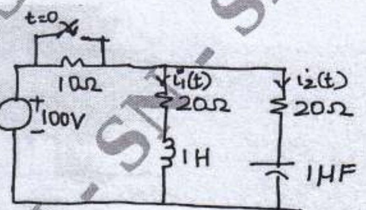

Fig. Q6 (b) **(10 Marks)**

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 5 V at t = 0. Find the current i(t) after switching action, using Laplace transforms.

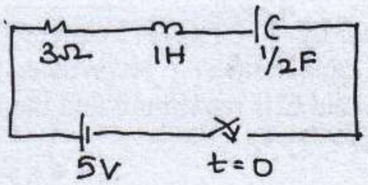

Fig. Q7 (a) **(10 Marks)**

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

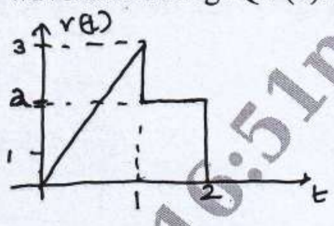

Fig. Q7 (b) **(05 Marks)**

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.

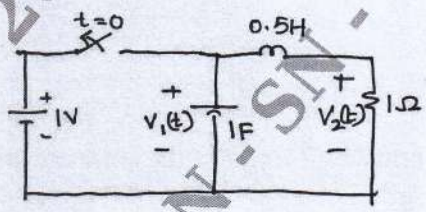

Fig. Q8 (b) **(10 Marks)**

Module-5

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

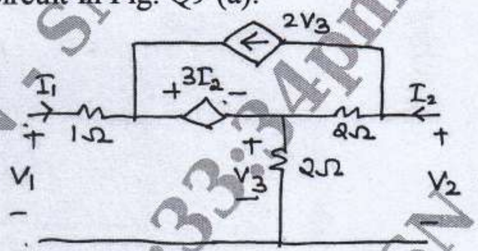

Fig. Q9 (a) **(10 Marks)**

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.

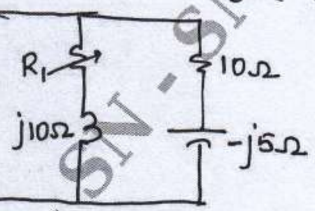

Fig. Q9 (c) **(04 Marks)**

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 Ω, L = 0.04 H and C = 22 μF. 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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