CBCS SCHEME

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17EE32

Third Semester B.E. Degree Examination, July/August 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. Reduce the network shown in Fig. Q1 (a) into a single voltage source in series with a resistance between terminals AB. **(06 Marks)**

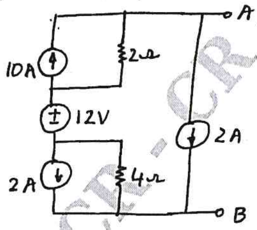

Fig. Q1 (a)

b. Use mesh current method to determine the current in the capacitor of 6 Ω of the bridge circuit shown in Fig. Q1 (b). **(08 Marks)**

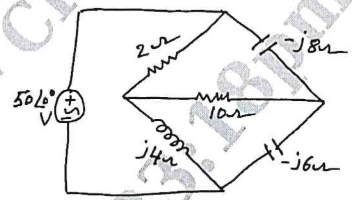

Fig. Q1 (b)

c. Determine the equivalent resistance between the terminals AB for the circuit shown in Fig. Q1 (c). **(06 Marks)**

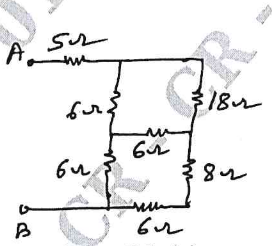

Fig. Q1 (c)

OR

2 a. For the network shown in Fig. Q2 (a) determine the voltage V using source shift and / or source transformation techniques only. **(08 Marks)**

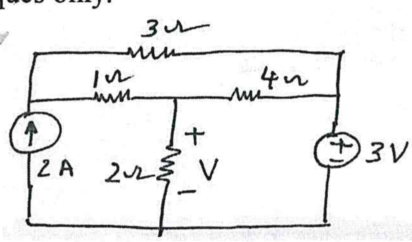

Fig. Q2 (a)

b. Using nodal analysis determine the power supplied (or absorbed) by the controlled voltage source in the network shown in Fig. Q2 (b). **(06 Marks)**

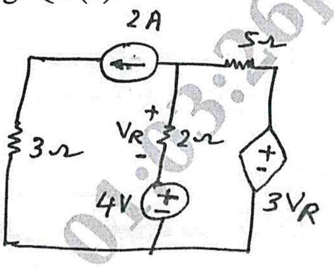

Fig. Q2 (b)

c. Draw the dual of the network shown in Fig. Q2 (c) and write integro differential equations in nodal form. **(06 Marks)**

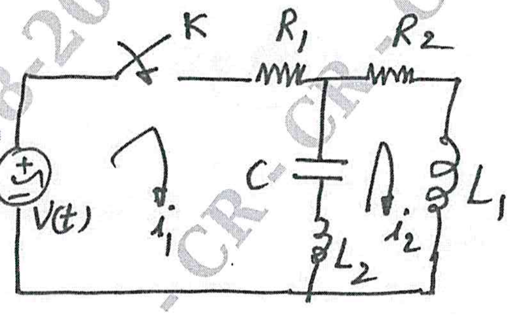

Fig. Q2 (c)

Module-2

3 a. Find the Thevenin's equivalent circuit at the terminals A and B for circuit shown in Fig. Q3 (a). **(08 Marks)**

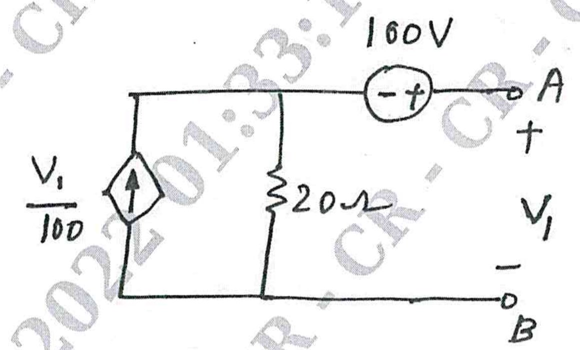

Fig. Q3 (a)

b. Find the value of R_L in the network shown in Fig. Q3 (b) that will absorb a maximum power and compute the value of maximum power. **(06 Marks)**

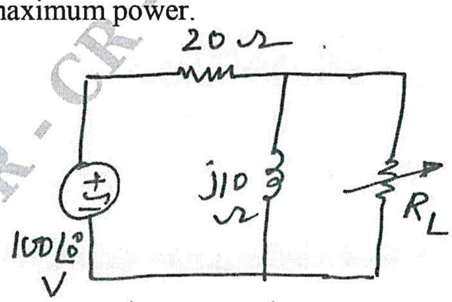

Fig. Q3 (b)

c. State and prove reciprocity theorem. **(06 Marks)**

OR

4 a. Use superposition theorem to find the current I in the circuit shown in Fig. Q4 (a). **(08 Marks)**

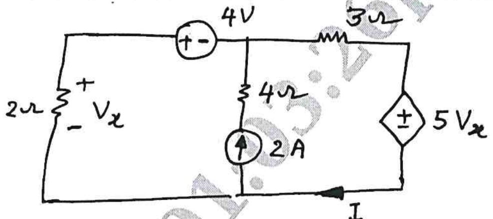

Fig. Q4 (a)

b. Determine current through 1 Ω resistor using Nortan's theorem for the circuit shown in Fig. Q4 (b). **(06 Marks)**

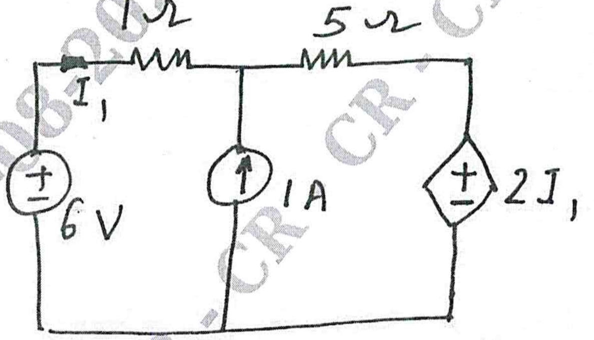

Fig. Q4 (b)

c. Use Millman's theorem to find current I for the circuit shown in Fig. Q4 (c). **(06 Marks)**

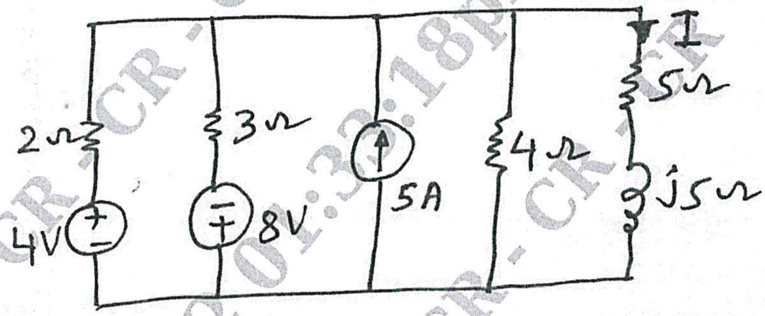

Fig. Q4 (c)

Module-3

5 a. In a series resonant circuit show that resonant frequency is the geometric mean of half power frequencies. **(06 Marks)**

b. An impedance coil having a resistance of 28.8 Ω and an inductance of 0.024 H is connected in series with a 0.08 μF capacitor. Calculate
   (i) Resonant frequency.
   (ii) Impedance at resonance.
   (iii) Q of the circuit.
   (iv) Half power frequencies.
   (v) Separation between half power frequencies. **(10 Marks)**

c. What are initial conditions in network? Write the equivalent form of the network elements in terms of the initial conditions. **(04 Marks)**

OR

6 a. A two branch antiresonance circuit with L = 0.4 H and C = 40 μF. 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. A parallel R-L circuit is energized by a current source of 1 A. The switch across the source is opened at t = 0. Solve for V, DV and D^2V all at t = 0+
Given R = 100 Ω and L = 1 H. **(08 Marks)**

c. Determine R_L and R_C for which the circuit shown in Fig. Q6 (c), resonates at all frequencies.

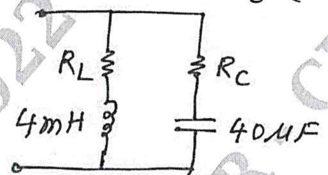

Fig. Q6 (c) **(04 Marks)**

Module-4

7 a. State and prove initial and final value theorems pertaining to Laplace transformation. **(08 Marks)**

b. Find the Laplace transform of the signal shown in Fig. Q7 (b). **(08 Marks)**

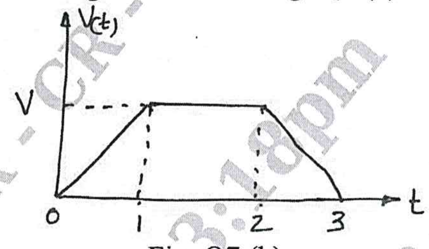

Fig. Q7 (b)

c. Find the Laplace transform of unit step function. **(04 Marks)**

OR

8 a. State and prove shifting theorem. **(05 Marks)**

b. Verify initial value theorem given $f(t) = 10e^{5t}$. **(05 Marks)**

c. A rectangular voltage pulse of unit height and duration T is applied to a series RC circuit combination at t = 0. Determine the voltage across the capacitance C as a function of time. Use Laplace transformation method. **(10 Marks)**

Module-5

9 a. Three impedances $Z_1 = 20\angle 30^\circ\,\Omega$, $Z_2 = 40\angle 60^\circ\ \Omega$ and $Z_3 = 10\angle -90^\circ\ \Omega$ are delta connected to a 400 V 3 phase system as shown in Fig. Q9 (a). Determine the (i) Phase currents (ii) Line currents. **(06 Marks)**

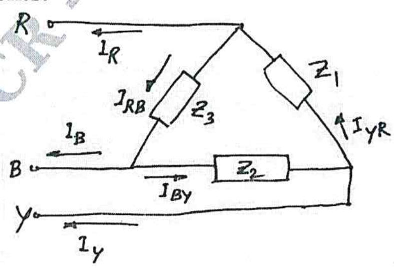

Fig. Q9 (a)

b. Determine the [y] parameters for the network shown in Fig. Q9 (b). **(08 Marks)**

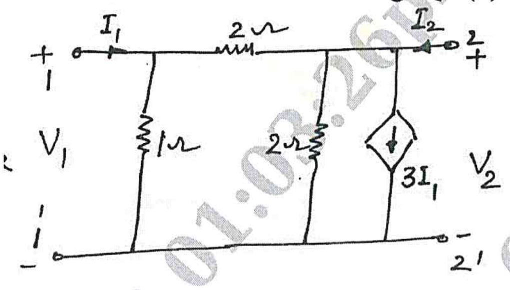

Fig. Q9 (b)

c. Express [z] in terms of [T]. **(06 Marks)**

OR

10 a. An unbalanced fair wire, star connected load has a balanced voltage of 400 V, the loads are $Z_1 = (4 + j8)\Omega$, $Z_2 = (3 + j4)\Omega$ and $Z_3 = (15 - j20)\Omega$. Calculate the (i) line currents (ii) current in the neutral wire. **(06 Marks)**

b. Obtain [z] and [y] parameters for the two port network shown in Fig. Q10 (b). **(08 Marks)**

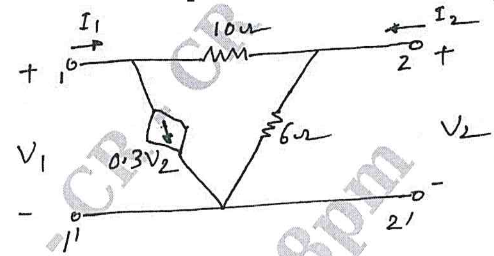

Fig. Q10 (b)

c. Two 2-port network are connected in cascade. Obtain [T] of the interconnected network. **(06 Marks)**

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