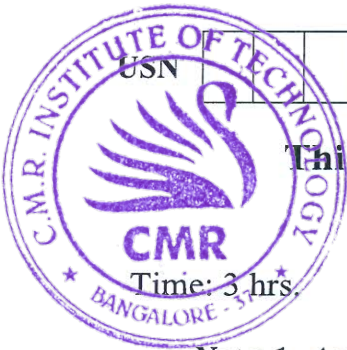


CBCS SCHEME



15EE32

Third Semester B.E. Degree Examination, Jan./Feb. 2023 Electric Circuit Analysis

Max. Marks: 80

- Note:** 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Write diagrams wherever necessary.

Module-1

- 1 a. Reduce the circuit shown in Fig. Q1 (a) using source transformation and hence find the power delivered by 50 V source

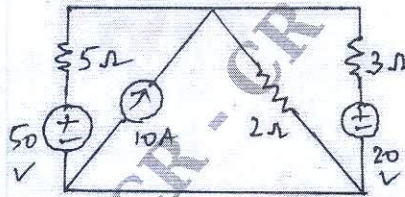


Fig. Q1 (a)

(05 Marks)

- b. Determine the equivalent resistance across terminals A and B using star delta technique for the circuit shown in Fig. Q1 (b).

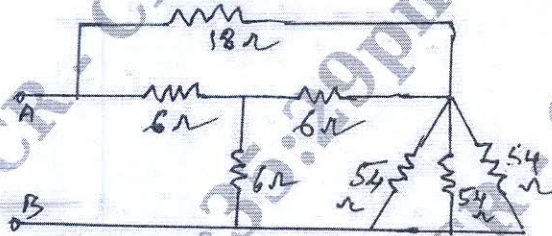


Fig. Q1 (b)

(05 Marks)

- c. Determine the current through capacitor of 6 ohm reactance, using mesh analysis for the network shown in Fig. Q1 (c).

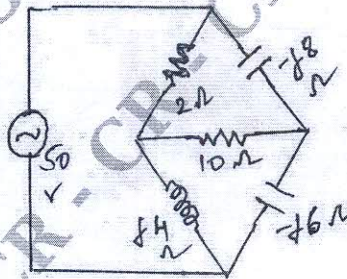


Fig. Q1 (c)

(06 Marks)

OR

- 2 a. Explain Duality in Networks. (04 Marks)
 b. Derive an expression for the relation between Resonant Frequency, Band Width and Quality Factor for a series R-L-C A.C circuit. (06 Marks)
 c. An impedance coil of 25 ohm resistance and 25 mH inductance is connected in parallel with a variable capacitor. For which value of capacitor will the circuit resonate, if 90 volts, 400 Hz source is applied? What will be the current under resonance? (06 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.

Module-2

- 3 a. Find the current through the Galvanometer of the network shown in Fig. Q3 (a) using Thevenins theorem. Take the resistance of Galvanometer as 4 ohms.

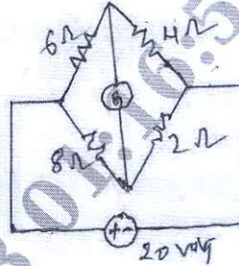


Fig. Q3 (a)

(06 Marks)

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

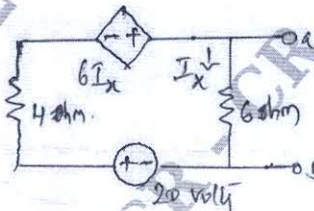


Fig. Q3 (b)

(04 Marks)

- c. Determine voltage V_x and hence verify reciprocity theorem for the circuit shown in Fig. Q3 (c).

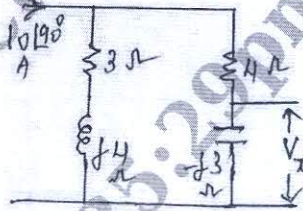


Fig. Q3 (c)

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(06 Marks)

OR

- 4 a. Using super position theorem obtain current through $R_L = 7.5$ ohms for the circuit shown in Fig. Q4 (a).

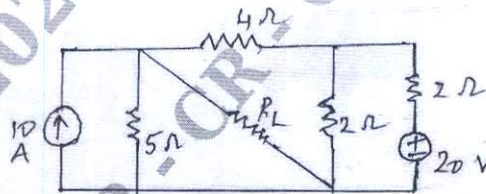


Fig. Q4 (a)

(06 Marks)

- b. State and explain Nillman's theorem. (04 Marks)
c. State and prove maximum power transfer theorem for the two cases. (06 Marks)

Module-3

- 5 a. Derive an expression for transient current $i(t)$ in a R-L circuit excited by a d.c source. (06 Marks)
b. List the initial conditions for passive elements of a network. (04 Marks)

- c. In the circuit shown in Fig. Q5 (c) initially switch is kept open for a long time. At $t = 0$ switch K is closed. Obtain the expression for current in the circuit for $t > 0$.

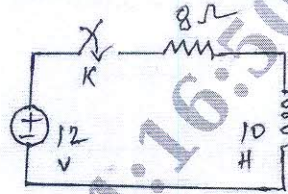


Fig. Q5 (c)

(06 Marks)

OR

- 6 a. For the circuit shown in Fig. Q6 (a) the switch is moved from position 1 to position 2 at $t = 0$. The steady state has been reached before switching. Calculate i , $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$.

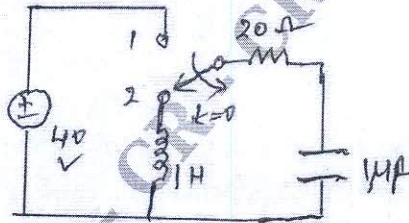


Fig. Q6 (a)

(08 Marks)

- b. In the network shown in Fig. Q6 (b) 'K' is changed from 1 to 2 at $t = 0$. Steady state having been attained in position 1. Find the values of i , $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$.

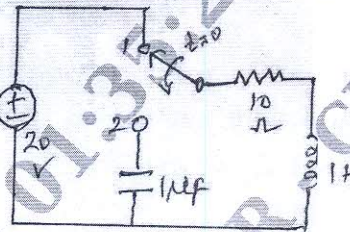


Fig. Q6 (b)

(08 Marks)

Module-4

- 7 a. Mention any four important properties of Laplace transformation as applicable to network analysis. (04 Marks)
 b. For the circuit shown in Fig. Q7 (b), find $i(0)$ and $i(\infty)$ using initial value and final value theorems.

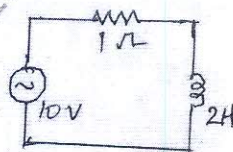


Fig. Q7 (b)

(06 Marks)

- c. Obtain the Laplace inverse of $\frac{1}{s(s+1)}$ using convolution integral. (06 Marks)

OR

- 8 a. Find the Laplace transform of the square waveform shown in Fig. Q8 (a).

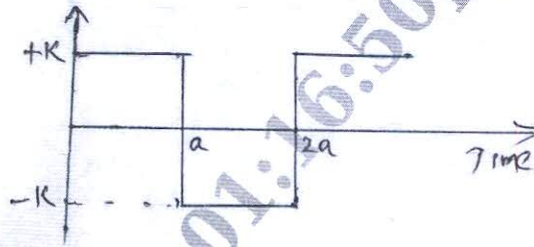


Fig. Q8 (a)

(06 Marks)

- b. Find the Laplace transformation of the waveform shown in Fig. Q8 (b).

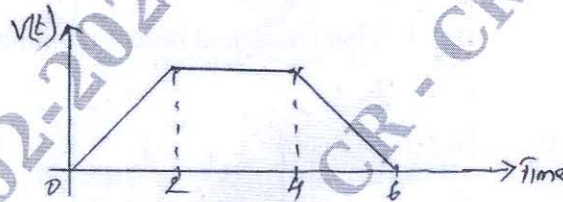


Fig. Q8 (b)

(04 Marks)

- c. Write the transform network of the circuit shown in Fig. Q8 (c) and determine voltage across capacitor using Laplace transformation. Take $i_L(0^-) = 0.25$ A and $V_C(0^-) = 4$ Volts.

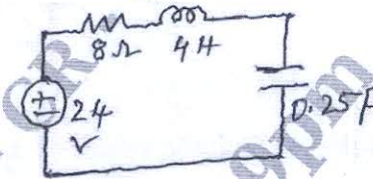


Fig. Q8 (c)

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Module-5

- 9 a. A 3 phase 400 V, 4 wire system has a star connected load with $Z_A = 10 \angle 0^\circ$ ohms ; $Z_B = 15 + j10$ ohms and $Z_C = 5 \angle 90^\circ$ ohms. Find the line currents and current through neutral. Draw the phasor diagram. (08 Marks)
- b. Three equal inductors connected in star take 5 kW at 0.7 pf lag when connected to a 400 V, 50 Hz 3 ph supply. Calculate the line currents (i) if one of the inductor is disconnected (ii) if one of the inductor is short circuited. (08 Marks)

OR

- 10 a. Explain the significance of poles and zeros. (04 Marks)
- b. Derive the relation between Z and T pavements. (06 Marks)
- c. The following equations gives the relation, between voltage and current of a Two-port network :

$$I_1 = 0.25V_1 - 0.2V_2$$

$$I_2 = -0.2V_1 + 0.1V_2$$

Obtain T-parameters.

(06 Marks)

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