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Question Paper Code : 20922

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023

Second Semester

Electronics and Communication Engineering

EC 3251 – CIRCUIT ANALYSIS

(Common to Electronics and Telecommunication Engineering)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. In a circuit consisting of two 50 Ω resistors connected in series and third resistor R is connected across the series resistors. The equivalent resistance is found to be 60 Ω. Calculate the resistance value, R.

2. Find the value of the current I, for the circuit shown in Fig. 1

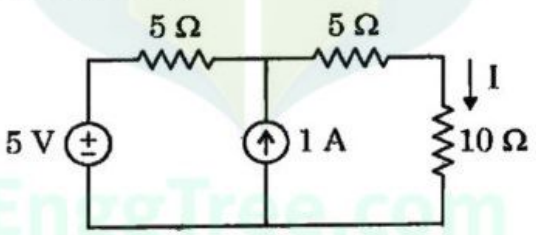

Fig. 1

3. Recall the statement of Norton's theorem.

4. Draw the dual of the network shown in Fig. 2

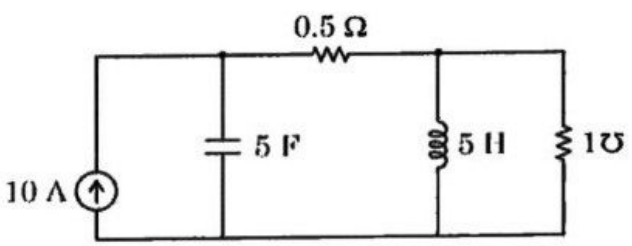

Fig. 2

5. Show the waveform representation of applied voltage across inductor, and the resulting current and the power.

6. A voltage of 240 sin 377t is applied to a 6Ω resistor. Find the instantaneous power and average power.

7. Calculate the impedence at resonance for an RLC series circuit, having R = 20 Ω, L = 50 mH, and C = 1μ*F*.

8. An RC series circuit has R = 20 Ω and C = 400 μ*F*. What is its time constant?

9. Two 2H inductance coils are connected in series and are also magnetically coupled to each other, the coefficient of coupling being 0.1. Find the total inductance of the combination.

10. List the properties of incidence matrix.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Determine the potential difference across A and B, V_{AB} in the circuit shown in Fig. 3. (9)

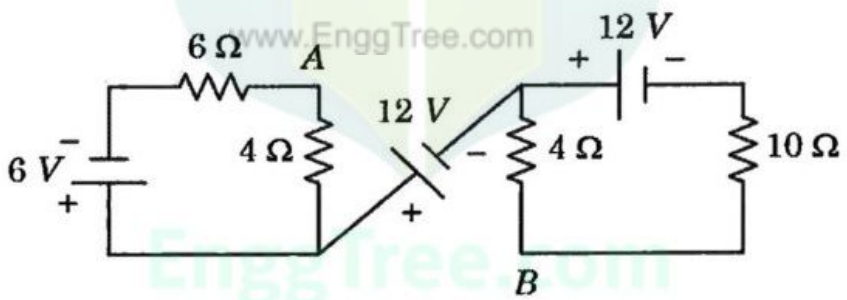

Fig. 3

(ii) Calculate the equivalent resistance between the terminals A and B of circuit shown in Fig. 4. (4)

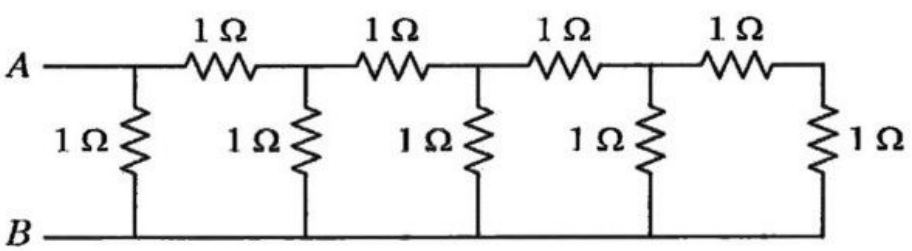

Fig. 4

Or

(b) (i) Determine the voltage drop across all the resistances for the circuit shown in Fig. 5. using nodal analysis (6)

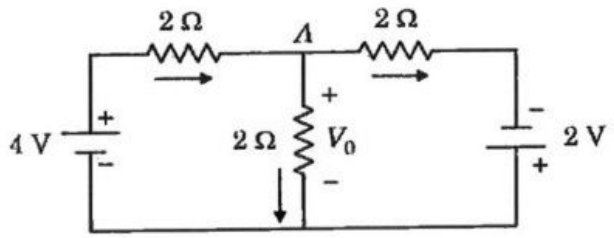

Fig. 5

(ii) Determine the current passing through 15 Ω resistor in the circuit shown in Fig. 6 using mesh analysis. (7)

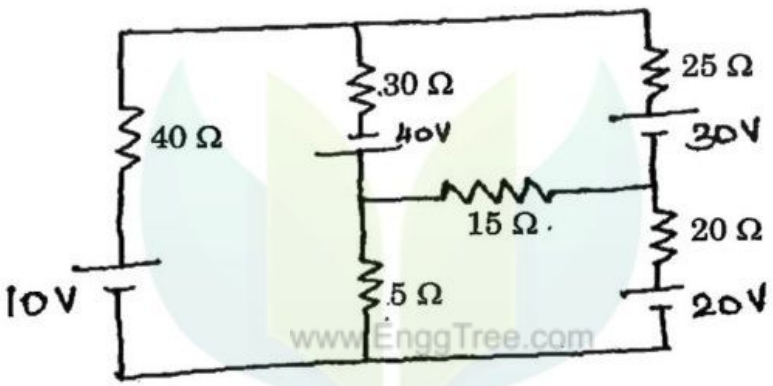

Fig. 6

12. (a) Determine the value of R_L for maximum power transfer in Fig. 7. Also find the maximum power.

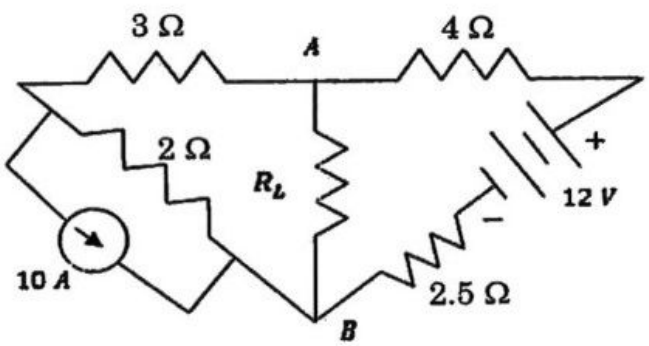

Fig. 7

Or

(b) (i) Determine i_x for the following network shown in Fig. 8. (7)

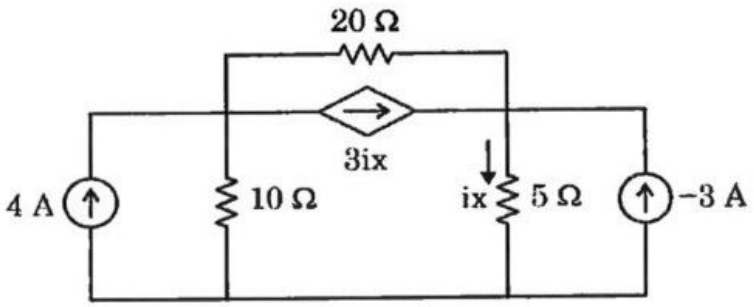

Fig. 8

(ii) Using Thevenin's theorem, Calculate the power loss in R_L in Fig. 9. (6)

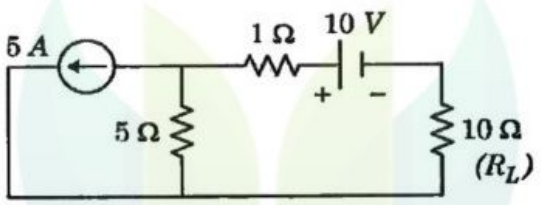

Fig. 9

13. (a) In the circuit, source voltage is v = 200 sin [314t+(π/6) and the current is i = 20 sin.[314t=(π/3)] Find

(i) frequency

(ii) Maximum values of voltage and current

(iii) RMS value of voltage and current

(iv) Average values of both

(v) Draw the phasor diagram

(vi) Circuit element and its values

Or

(b) (i) By nodal analysis determine V in Fig. 10. (6)

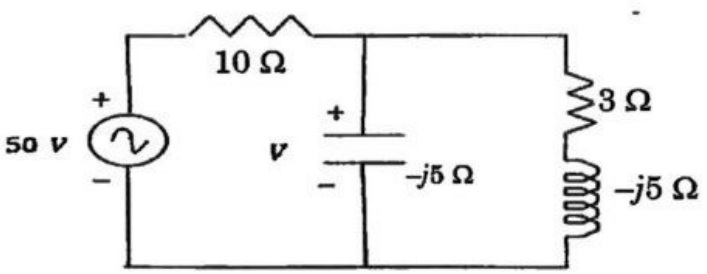

Fig. 10

(ii) For the network shown in Fig. 11, Calculate the voltage across 7 Ω using Nortons theorem. (7)

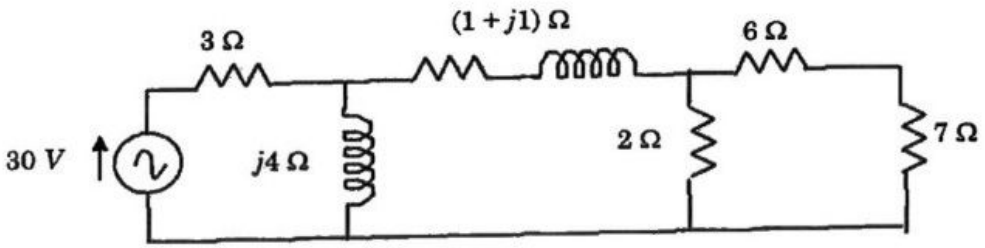

Fig. 11

14. (a) (i) Show that $\omega_1 \omega_2 = \omega_r^2$ for a series resonant circuit. (6)

(ii) A coil has a resistance of 20 Ω and inductance of 80 mH and is connected in series with a 100 μF capacitor across 200 V, 50 Hz supply, Determine the resonant frequency. Also determine, at resonance, the circuit impedance and BW. (7)

Or

(b) (i) Examine the transient response of RC series circuit for unit step input. (6)

(ii) In the circuit of Fig. 12, the switch S has been in position 1 for sufficient time to establish steady-state conditions. The switch is then moved to position 2. Determine the current transient.

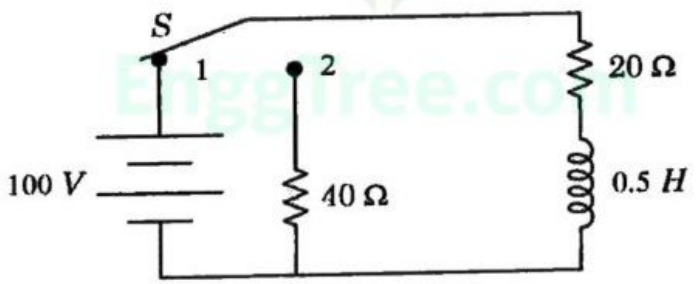

Fig. 12

15. (a) (i) Two identical coupled coils have an equivalent inductance of 80 mH when connected series aiding, and 35 mH series opposing. Calculate the self inductance of the coils, mutual inductance between them, and coefficient of coupling. (6)

(ii) For the coupled circuit shown in Fig. 13, Show the ratio V_2/V_1 which results in zero current I_1.

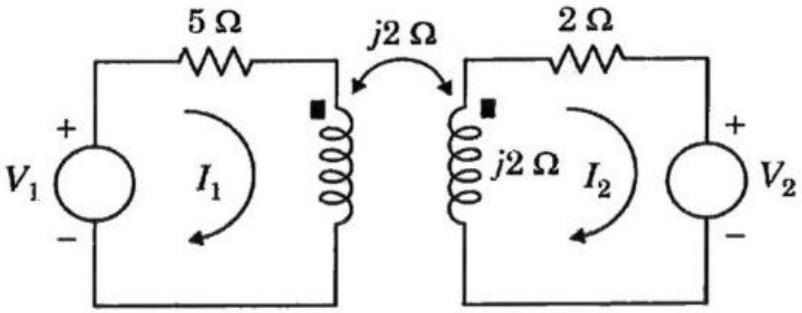

Fig. 13

Or

(b) (i) The oriented graph of a network is shown in Fig. 14. Obtain the incidence matrix. (5)

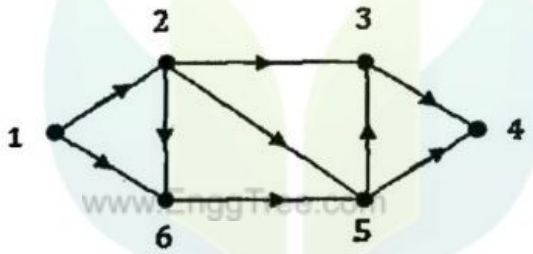

Fig. 14

(ii) For the graph shown in Fig. 14, select a tree of your own choice and Determine the tie-set schedule. (8)

PART C — (1 × 15 = 15 marks)

16. (a) (i) Determine equivalent resistance across the terminals a and b for the circuit shown in Fig. 15. (8)

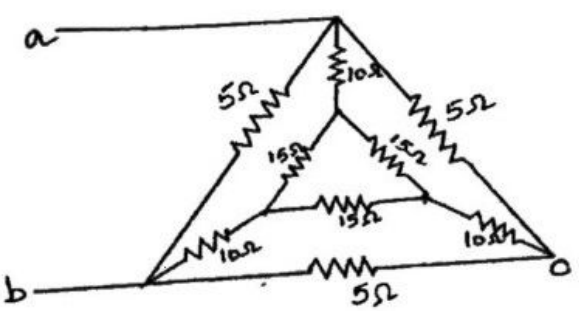

Fig. 15

(ii) Find the voltage across the 2Ω resistor by using superposition theorem for the circuit shown in Fig. 16. (7)

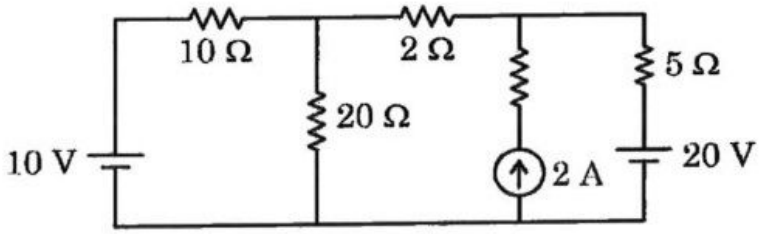

Fig. 16

Or

(b) Analyze the transient response of RLC Series circuit for sinusoidal excitation.