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Question Paper Code : 40976

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2024

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. Recall current division law and Voltage division law.
2. Find the current I for the circuit as shown in Fig.1

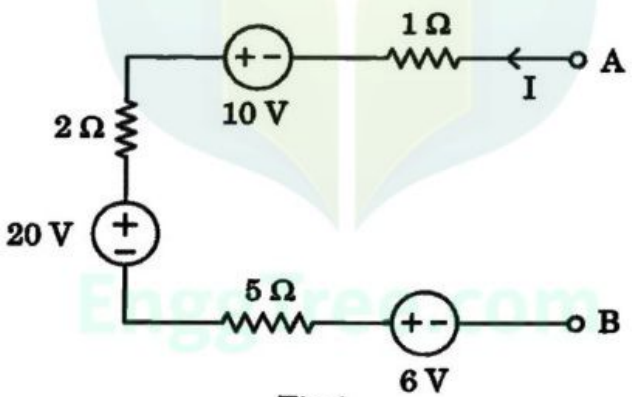

Fig.1

3. Find the equivalent resistance of the circuit shown in Fig.2

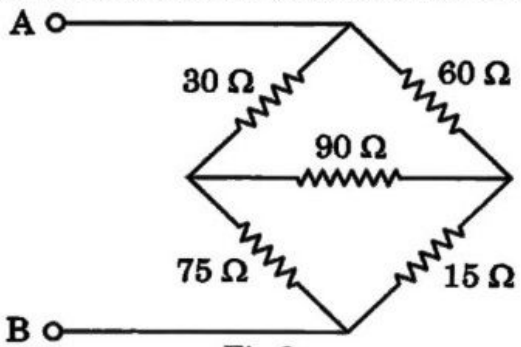

Fig.2

4. Determine the Norton's equivalent circuit at terminals AB for the circuit shown in Fig.3

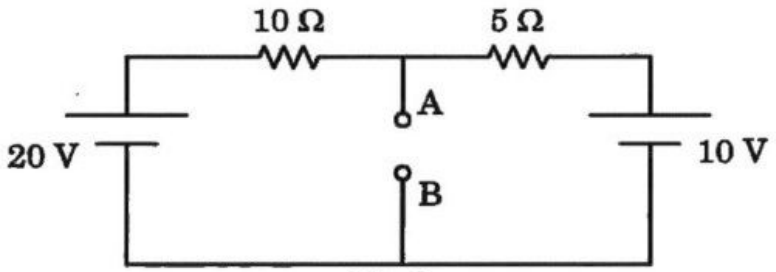

Fig.3

5. A resistor having a resistance of 10Ω and an unknown capacitor are in series. The voltage across the resistor is $V_R = 40\sin(1000t + 45°)$. If the current leads the applied voltage by 45°, what is the unknown capacitance?

6. In a pure inductive circuit, will the current lead or lag the voltage. Draw its phasor diagram.

7. Determine the value of L and C_2 for the circuit shown in fig.4. It has to pass a 5000Hz wave and block a 7000 Hz wave.

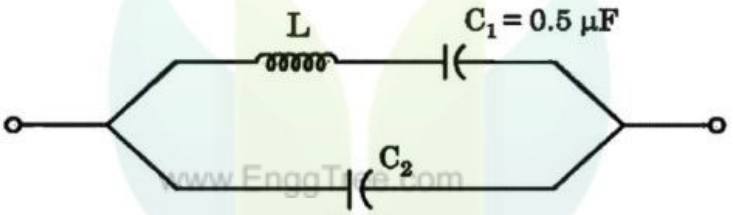

Fig.4

8. What is the time constant of a series R-L circuit having R = 2Ω, L = 10H?

9. For the shown in Fig.5, draw any two tree structures

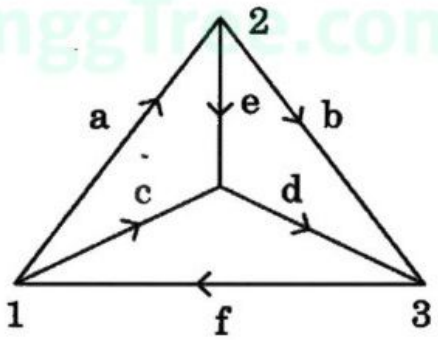

Fig.5

10. Two coupled coils having self-inductance $L_1 = 50\,mH$ and $L_2 = 200\,mH$ and a coefficient of coupling K = 0.5. If coil 2 has 1000 turns and $i_1 = 5\sin 400t$. Find the voltage at coil 2.

PART B — (5 × 13 = 65 marks)

11. (a) Determine the power dissipated in the 10Ω resistor shown in Fig.6

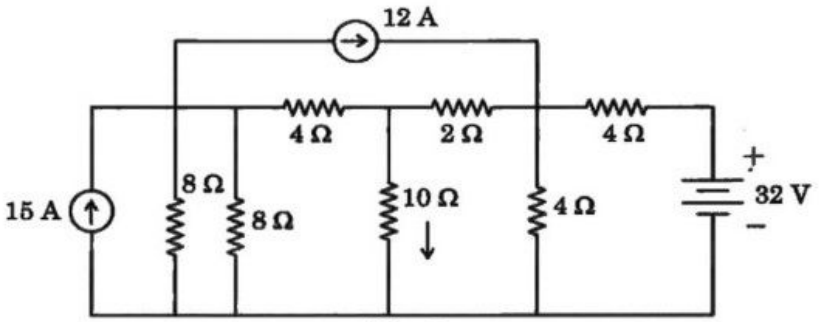

Fig.6

Or

(b) Determine the currents in various branches of the circuit shown in Fig.7 by mesh analysis

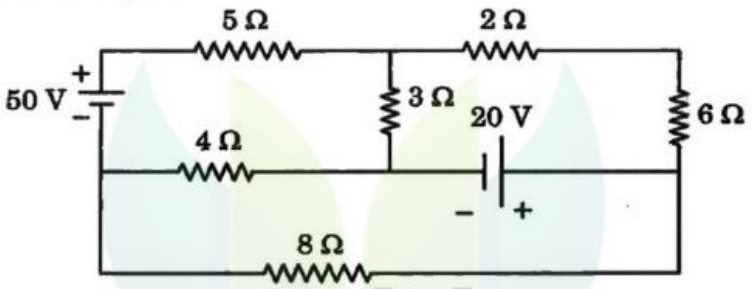

Fig.7

12. (a) Compute the current in 23Ω resistor using Superposition theorem for the circuit shown in Fig.8

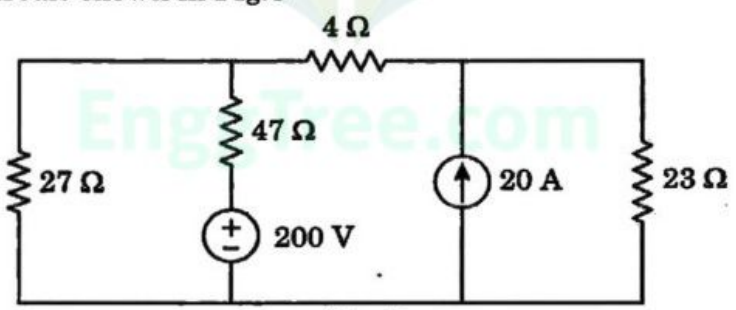

Fig.8

Or

(b) (i) Obtain dual of the network shown in Fig.9 (6)

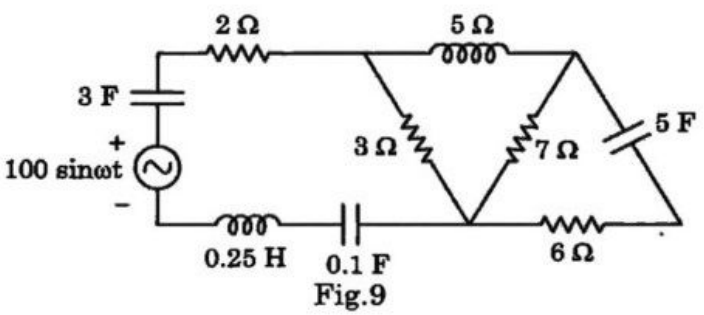

Fig.9

(ii) Find the power loss in the 1Ω resistor by applying Thevenin's theorem for the circuit shown in Fig.10 (7)

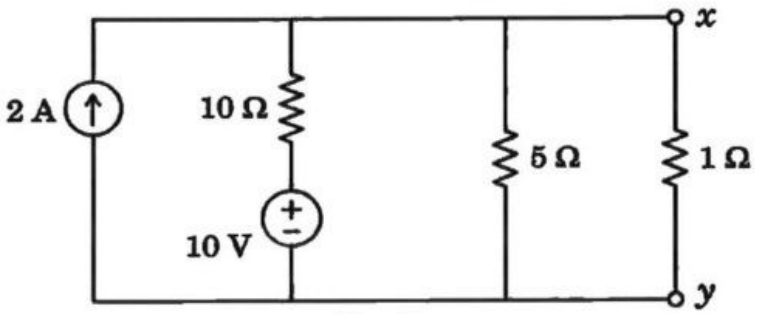

Fig.10

13. (a) Find the branch current for the circuit shown in Fig.11

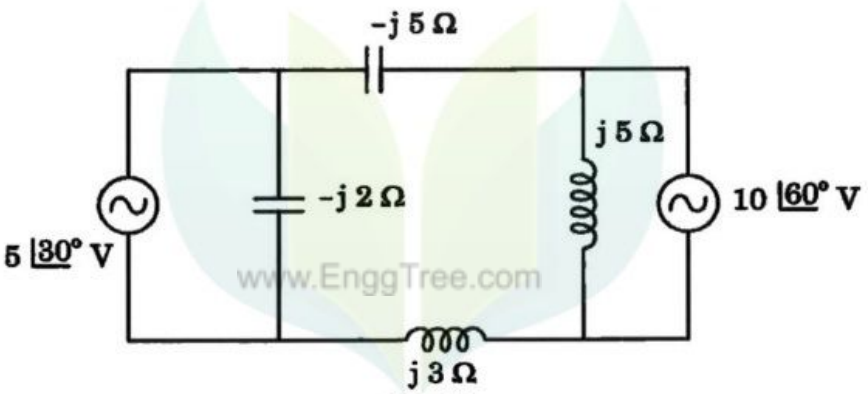

Fig.11

Or

(b) (i) Find the admittance Y_{AB} for the circuit shown in Fig.12. The Supply frequency is 50 Hz. (6)

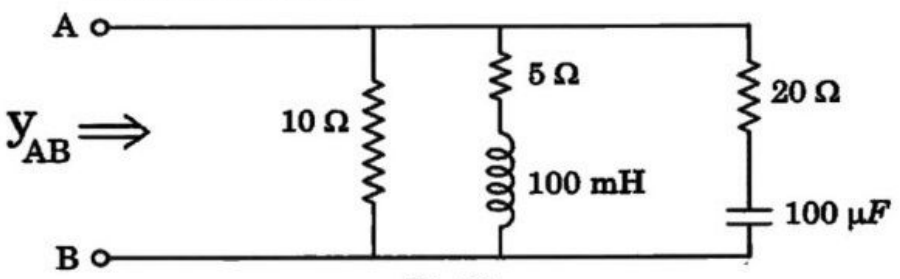

Fig.12

(ii) A series RC circuit has the following parameter values, $R = 10\,\Omega$, $C = 0.02\ \mu F$, voltage source $e(t) = 10\sin 100\,t$. Find the power dissipated and power factor. (7)

14. (a) In the circuit shown in Figure 13, the switch K is closed at position A at t = 0. After the lapse of time equivalent to one time constant, the switch is moved to position B. Determine the complete current.

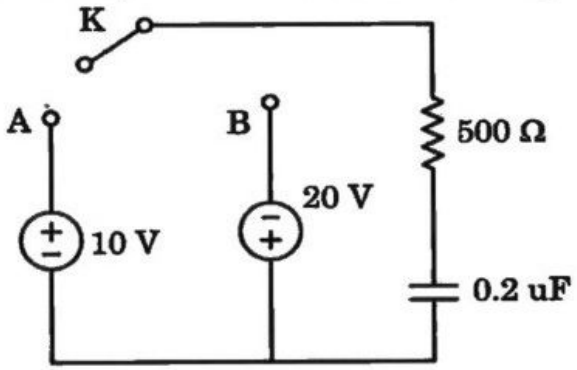

Fig.13

Or

(b) (i) A coil having a Q-factor of 100 is connected in parallel with a capacitor of 100 pF. The circuit resonates at a frequency of 5 MHz. Determine. (7)

(1) the BW of the circuit

(2) the amount of resistance required in parallel to increase the BW to 250 KHz

(3) the amount of resistance required in series with the inductor in order to produce the same Bandwidth.

(ii) A current source is applied to the parallel R, L, C circuit, where R = 12Ω, L = 2H and C = 3μF. Compute the resonant frequency, quality factor, bandwidth. Compute the lower and upper cut-off frequencies and the voltage across the parallel elements, when the input signal is i (t) = 10 sin 1800 t. (6)

15. (a) For the circuit shown in Fig.14. Find the ratio of output voltage V_2 to the input voltage V_1.

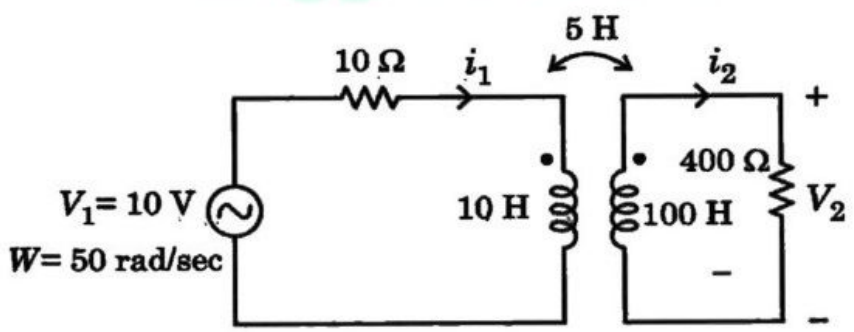

Fig.14

Or

(b) The reduced incidence matrix of a network is given below. Draw the oriented graph. Choose a suitable tree and write the basic cut-set matrix.

→ elements

↓ nodes

	1	2	3	4	5	6	7	8
1	1	0	0	–1	0	0	1	0
2	0	0	1	0	–1	0	1	0
3	0	1	0	0	0	–1	–1	0
4	0	–1	0	0	1	0	0	0
5	–1	0	0	0	0	0	0	0
6	0	0	0	1	0	0	0	0

PART C — (1 × 15 = 15 marks)

16. (a) (i) Find the voltage drop across the capacitor and resistor as shown in Fig.15 (8)

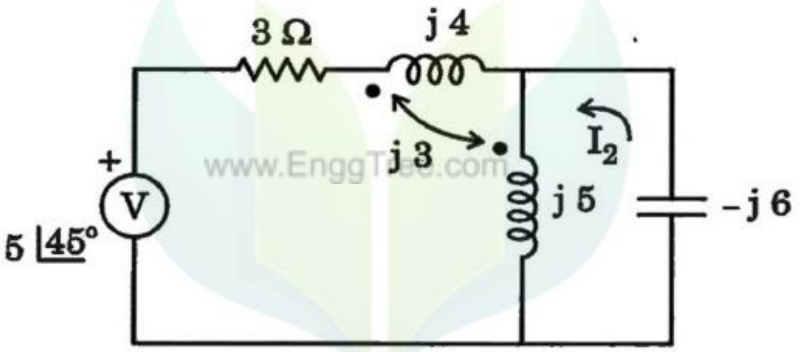

Fig.15

(ii) In the coupled coil circuit shown in Fig.16, Prove that (7)

$$\frac{|I_1|}{|I_2|} = \frac{L_2}{M}\left[1 + \frac{R_2^2}{\omega^2 L_2^2}\right]^{1/2}$$

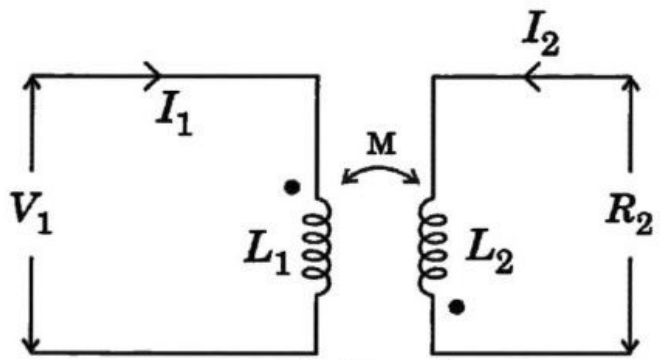

Fig.16

Or

(b) Calculate the current in 20Ω resistor using Thevenin's theorem for the circuit shown in Fig.17 and verify the results using Norton's theorem.

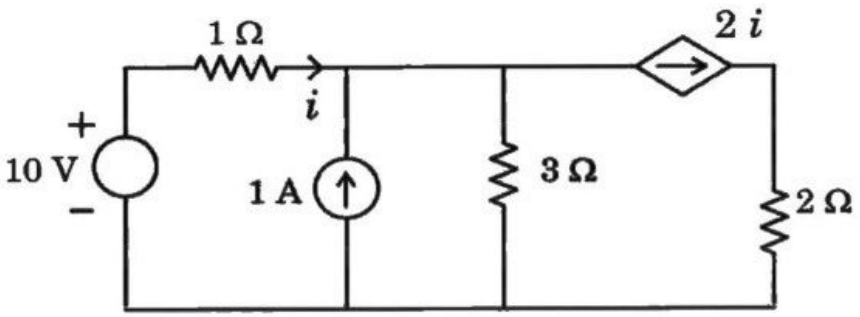

Fig.17