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**Question Paper Code : 90171**

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019  
Second Semester  
Electronics and Communication Engineering  
EC8251 – CIRCUIT ANALYSIS  
(Common to Medical Electronics/Biomedical Engineering/Electronics and  
Telecommunication Engineering)  
(Regulations 2017)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions

PART – A

(10×2=20 Marks)

1. State Kirchhoff's voltage law.
2. Obtain the incidence matrix of the graph shown in figure 1.

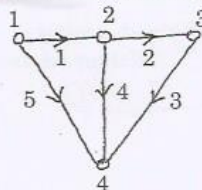


Figure 1

3. State Millman's theorem.
4. Determine the current flowing through 5 Ω resistor shown in figure 2.

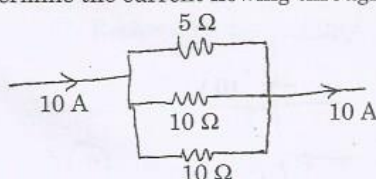


Figure 2

5. Define coefficient of coupling.

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6. Show the variation of impedance with frequency in a series RLC circuit.
7. Calculate the initial value of current passing through the circuit shown in figure 3 when the switch placed from position 1 to 2 at time  $t = 0$ .

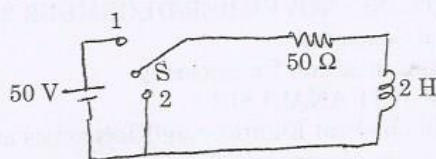


Figure 3

8. Determine the nature of damping in a RLC series circuit having  $R = 2 \Omega$ ;  $L = 1 \text{ H}$  and  $C = 1 \text{ F}$ .
9. State symmetrical properties of  $\pi$  networks.
10. Obtain the short circuit driving point admittance at port 1 - 1' with port 2 - 2' short circuited in the circuit shown in figure 4.

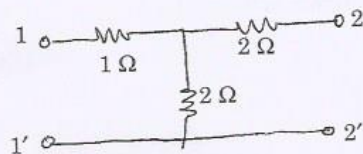


Figure 4

PART - B

(5×13=65 Marks)

11. a) i) Using mesh current method determine the current supplied by the 60 V source of the network shown in figure 5 (7)

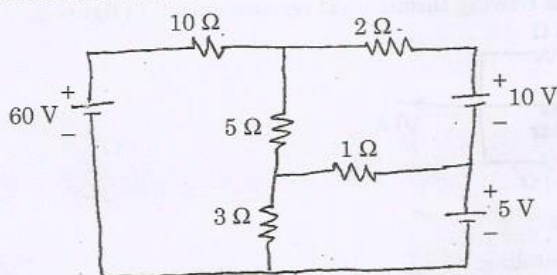


Figure 5



- ii) For the circuit shown in figure 6, determine the power dissipated in each resistor of the circuit. (6)

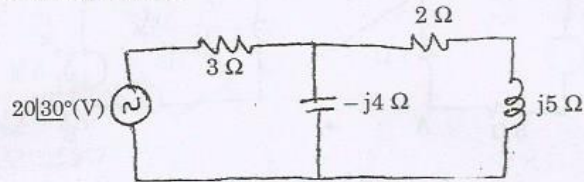


Figure 6

(OR)

- b) i) A reduced incidence matrix of a graph is given by

$$A = \begin{bmatrix} 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & -1 & 1 & -1 & 0 & 0 \\ -1 & 0 & -1 & 0 & -1 & 0 \end{bmatrix}$$

Obtain possible number of trees. (5)

- ii) Show the cut-sets for the graph shown in figure 7 and develop the fundamental cut-set matrix. (8)

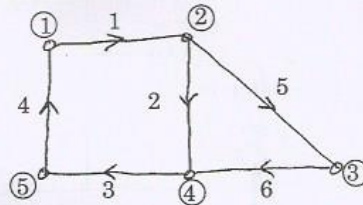


Figure 7

12. a) i) Verify Reciprocity theorem in the circuit shown in figure 8. (7)

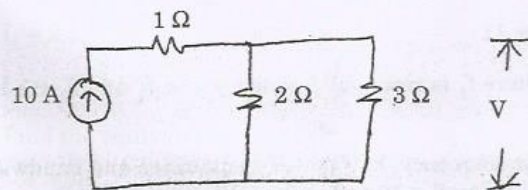


Figure 8

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- ii) Determine the Thevenin's equivalent circuit across terminals AB in figure 9. (6)

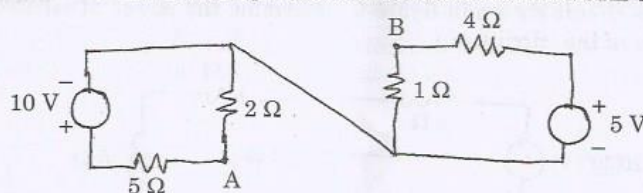


Figure 9

(OR)

- b) i) Determine the value of the load resistance to receive maximum power from the source. Also find the maximum power delivered to the load  $R_L$  in the circuit shown in figure 10. (8)

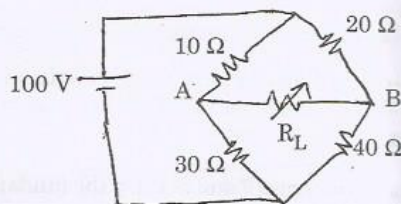


Figure 10

- ii) Calculate the current through 3Ω resistor in figure 11 using Norton's theorem. (5)

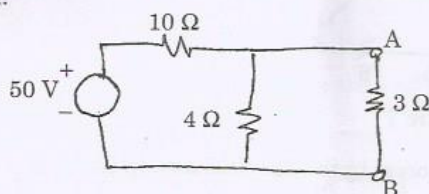


Figure 11

13. a) i) Prove that  $f_r^2 = f_1 f_2$  where  $f_r$  is resonant frequency and  $f_1$  and  $f_2$  are half power frequencies. (7)  
ii) Determine the resonant frequency, half power frequencies and bandwidth of a series RLC circuit having  $R = 10 \Omega$ ;  $L = 0.5 \text{ mH}$  and  $C = 10 \mu\text{F}$ . (6)

(OR)



- b) i) Derive the expression for maximum amplification of a single tuned circuit. (8)  
 ii) For the circuit shown in figure 12, write the inductance matrix. (5)

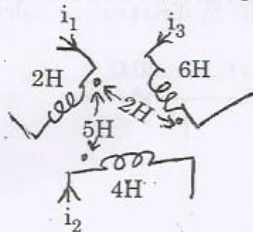


Figure 12

14. a) Derive the expression for the transient current flowing through a RLC series circuit to step input voltage for all possible damping with necessary waveform. (13)

(OR)

- b) Obtain the impulse response of RL series circuit and step response of RC series circuit. (13)

15. a) i) Find the h parameters of the network shown in figure 13. (7)

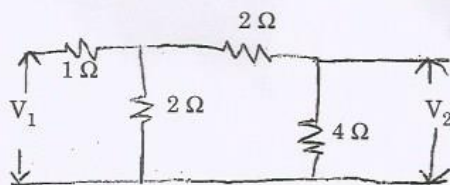


Figure 13

- ii) The port currents of a two port network are given by

$$I_1 = 2.5 V_1 - V_2$$

$$I_2 = -V_1 + 5 V_2$$

Find the equivalent  $\pi$  network.

(6)

(OR)

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- b) Two networks shown in figure 14 (a) and 14 (b) are connected in series. Obtain the Z parameters of the combination. Also verify by direct correct calculation. (13)

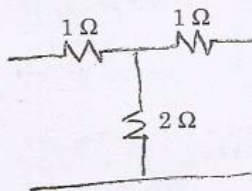


Figure 14 (a)

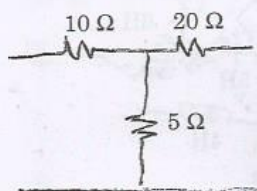


Figure 14 (b)

PART - C

(1×15=15 Marks)

16. a) Two networks are shown in figure 15 (a) and 15 (b). Obtain the transmission parameters of the resulting circuit when both the circuits are in cascade. (15)

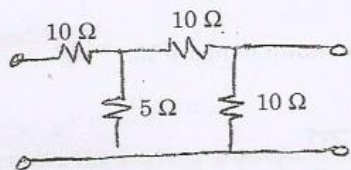


Figure 15 (a)

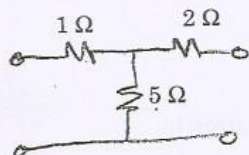


Figure 15 (b)

(OR)



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- b) i) Find the value of  $L$  at which the circuit resonates at a frequency of  $1000 \text{ rad/sec}$  in the circuit shown in figure 16. (7)

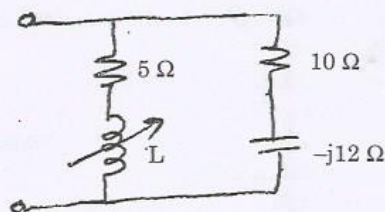


Figure 16

- ii) A voltage  $v(t) = 10\sin\omega t$  is applied to a series RLC circuit. At the resonant frequency of the circuit, maximum voltage across the capacitor is found to be  $500 \text{ V}$ . Moreover, the bandwidth is known to be  $400 \text{ rad/sec}$  and the impedance at resonance is  $100 \Omega$ . Find the resonant frequency. Also find the values of  $L$  and  $C$  of the circuit. (8)