Reg. No. : | | | | | | | | | | | | |

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.

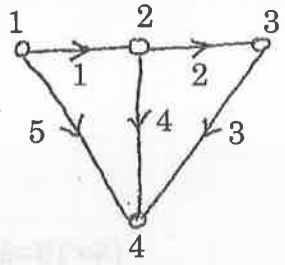

Figure 1

3. State Millman's theorem.

4. Determine the current flowing through 5 Ω resistor shown in figure 2.

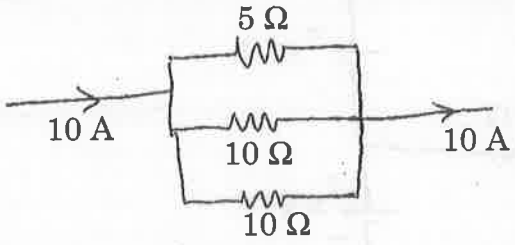

Figure 2

5. Define coefficient of coupling.

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.

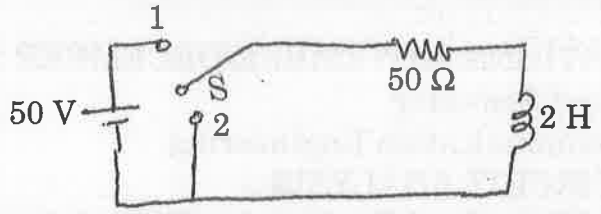

Figure 3

8. Determine the nature of damping in a RLC series circuit having R = 2 Ω; L = 1 H and C = 1 F.
9. State symmetrical properties of π 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.

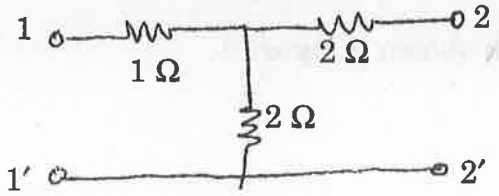

Figure 4

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)**

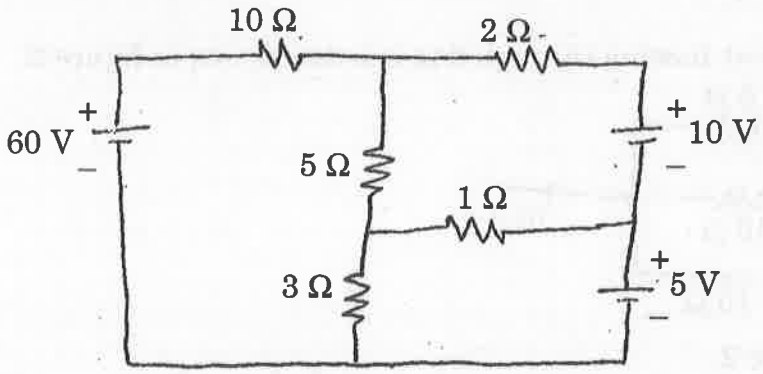

Figure 5

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

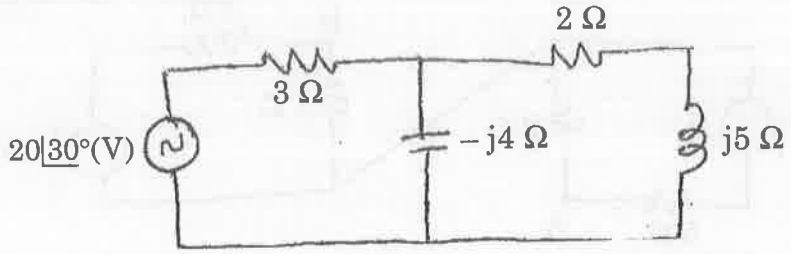

Figure 6

(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)**

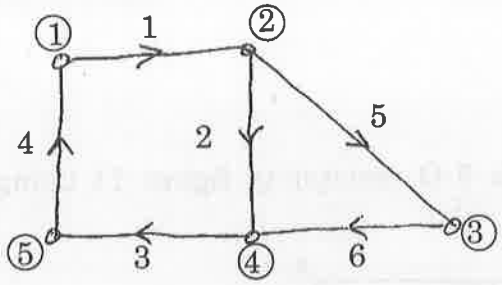

Figure 7

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

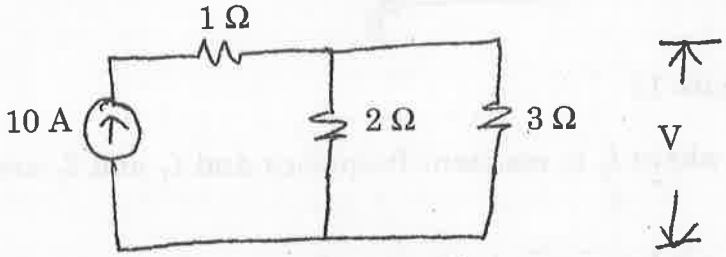

Figure 8

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

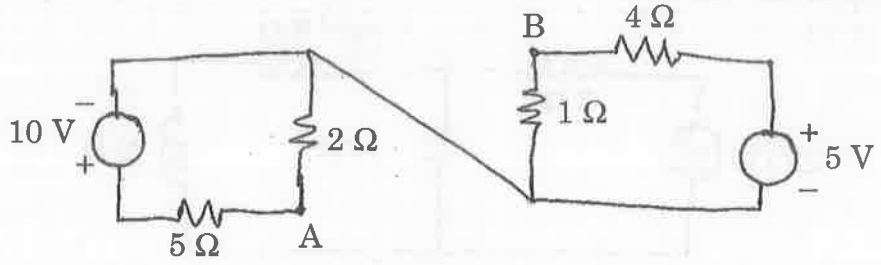

Figure 9

(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)**

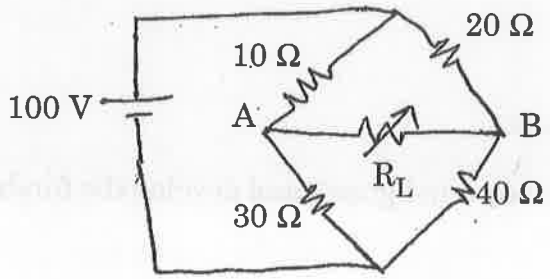

Figure 10

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

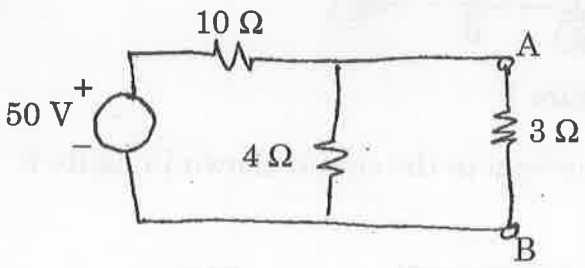

Figure 11

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 Ω; L = 0.5 mH and C = 10 μF. **(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)**

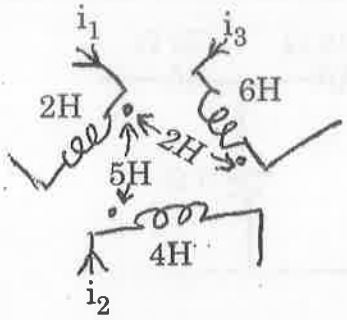

Figure 12

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)**

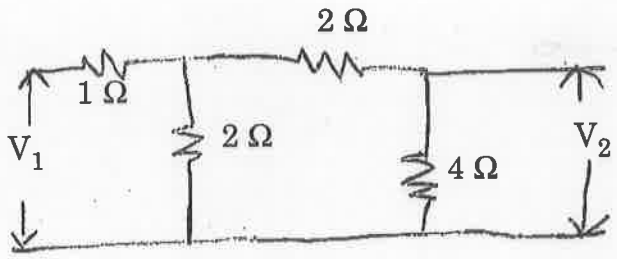

Figure 13

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 π network. **(6)**

(OR)

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)**

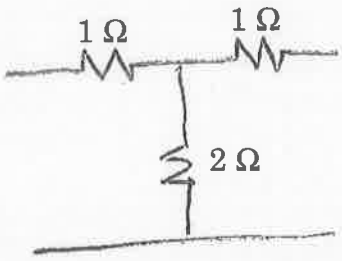

Figure 14 (a)

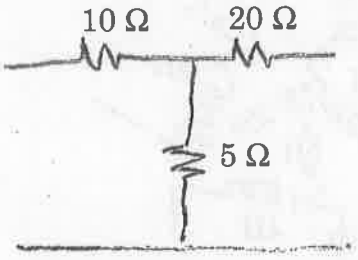

Figure 14 (b)

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)**

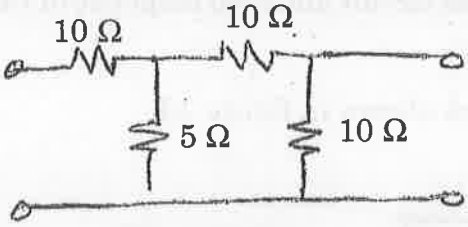

Figure 15 (a)

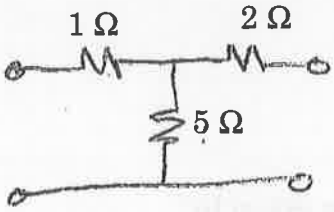

Figure 15 (b)

(OR)

b) i) Find the value of L at which the circuit resonates at a frequency of 1000 rad/sec in the circuit shown in figure 16. **(7)**

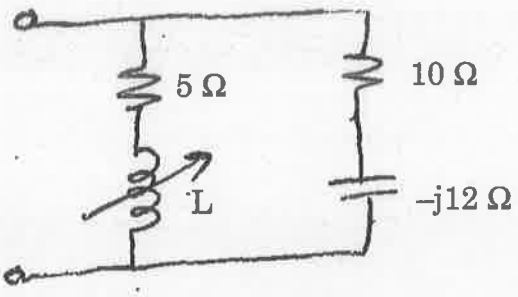

Figure 16

ii) A voltage v(t) = 10sinωt is applied to a series RLC circuit. At the resonant frequency of the circuit, maximum voltage across the capacitor is found to be 500 V. Moreover, the bandwidth is known to be 400 rad/sec and the impedance at resonance in 100 Ω. Find the resonant frequency. Also find the values of L and C of the circuit. **(8)**