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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S3 (S, FE) / S3 (PT) (S, FE) Examination December 2023 (2015 Scheme)

Course Code: EE201

Course Name: CIRCUITS AND NETWORKS

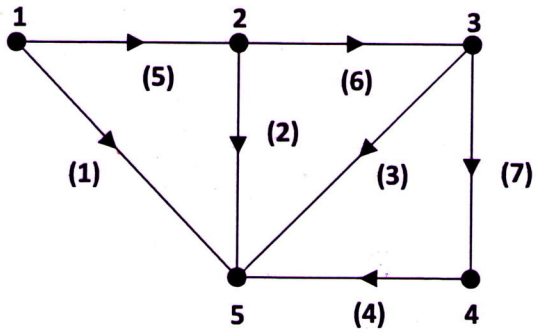
Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks. Marks

1 State and prove maximum power transfer theorem for DC circuits (5)

2 Find the tie-set matrix for the network graph given below and express branch currents in terms of loop currents. Select {1,4,6} as links. (5)



3 A series RLC circuit has $L = 1H$ and $C = 1F$ and $R = 10\Omega$. Find the expression for the current if the capacitor has an initial voltage of 10V and is discharged through the resistor and inductor. (5)

4 The current through a 2F capacitor is given by the following s-domain equation. (5)

$$I(s) = \frac{2s + 4}{s^2 + 4s + 3}$$

Determine the voltage across the capacitor, $v(t)$.

5 Derive the conditions of symmetry and reciprocity of a two port network in terms of transmission parameters. (5)

6 A two port network 'A' has $[Z]_A = \begin{bmatrix} 2 & 1 \\ 1 & 3 \end{bmatrix}$ and another two port network 'B' has $[Y]_B = \begin{bmatrix} 1 & -1 \\ -2 & 3 \end{bmatrix}$. If the two networks A and B are connected in series, find the Z parameters of the overall network. (5)

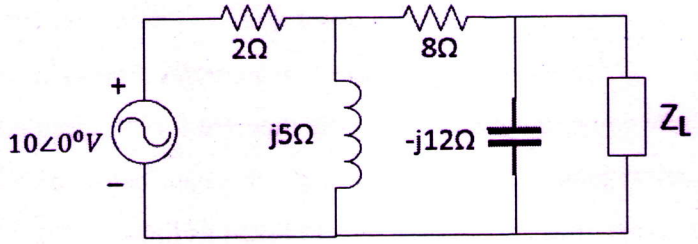
7 Test whether the polynomial $s^4 + 2s^3 + 6s^2 + 3s + 4$ is Hurwitz or not. (5)

8 List any five properties of RC driving point impedance functions. (5)

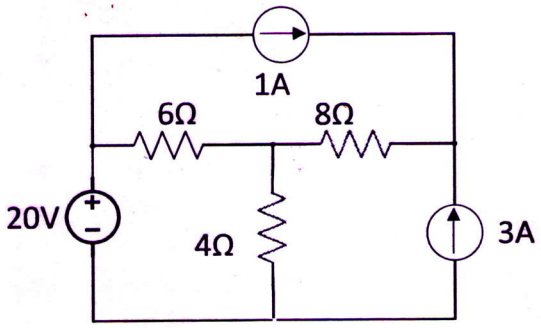
PART B

Answer any two full questions, each carries10 marks.

9 In the circuit given below, determine the value of the load impedance Z_L, for maximum power transferred by the source to the load. Also, compute the maximum power transferred. (10)



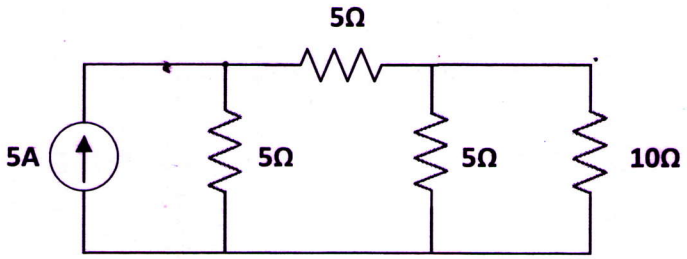
10 a) For the circuit shown below, determine the current through the 4Ω resistor using Norton's theorem. (5)



b) The incidence matrix of a graph is given below. Draw the oriented graph. (5)

Nodes ↓	Branches → 1	2	3	4	5	6	7
1	1	0	0	0	1	0	0
2	0	1	0	0	-1	1	0
3	0	0	1	0	0	-1	1
4	0	0	0	1	0	0	-1

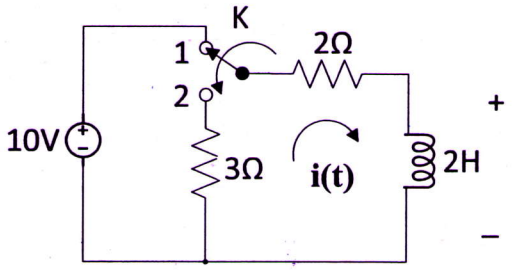
11 Obtain the oriented graph of the following circuit and determine the voltage across the 10Ω resistor using the network equilibrium equations based on KCL. (10)



PART C

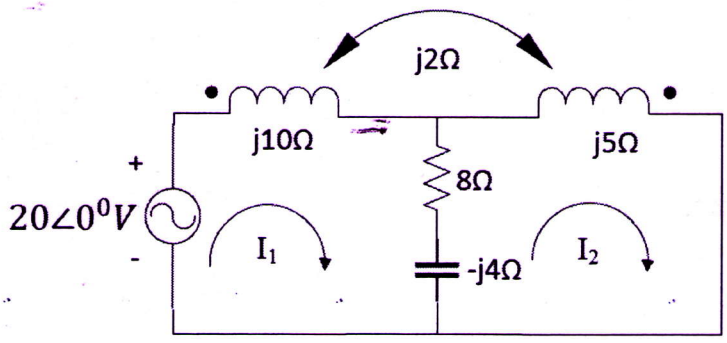
Answer any two full questions, each carries10 marks.

12 In the circuit shown below, the switch was initially at position 1 and the steady state condition is reached. At $t = 0$, the switch is changed to position 2. Determine (i) voltage across the inductor immediately after the switching operation (ii) expression for the current $i(t)$ for $t > 0$ and (iii) expression for the voltage across the inductor for $t > 0$. (10)

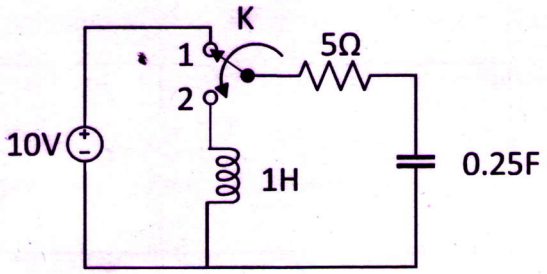


13 a) A resistor R and a 1F capacitor is connected in series with a 50V DC supply. Determine the value of the resistance R if the voltage across the capacitor reaches 50% of its steady state value in 5 seconds. (5)

b) Determine the current I_2 in the following circuit. (5)



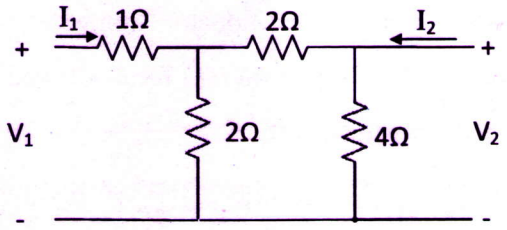
14 The switch K in the following circuit has been at position 1 for a long time and the steady state condition is reached. At $t = 0$, the switch is moved to position 2. Using Laplace transform, find an expression for the current through the resistor for $t > 0$. (10)



PART D

Answer any two full questions, each carries 10 marks.

15 a) Find the z parameters of the following network and hence determine whether the network is reciprocal. (5)



b) Find the equivalent T network of a two port network represented by the following equations. (5)

$V_1 = 2I_1 + I_2$

$V_2 = I_1 + 3I_2$

16 a) Express hybrid parameters in terms of Y parameters. (5)

b) Test whether the following function is a positive real function. (5)

$$Z(s) = \frac{s(s+3)(s+5)}{(s+1)(s+4)}$$

17 Obtain the Foster I and II forms of the following impedance function (10)

$$Z(s) = \frac{s(s+4)(s+6)}{(s+1)(s+5)}$$

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