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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Third Semester B.Tech Degree Regular and Supplementary Examination December 2022 (2019 scheme)

Course Code: EET201

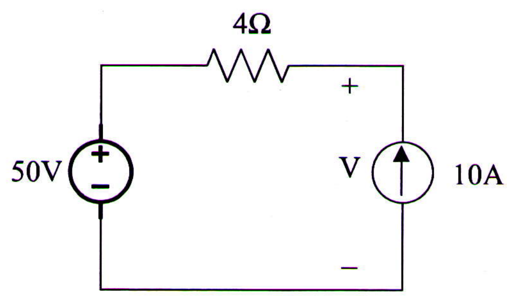
Course Name: CIRCUITS AND NETWORKS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions. Each question carries 3 marks Marks

1	State and explain Reciprocity theorem using an example.	(3)
2	For the circuit given below, find the voltage 'V' across the 10A source, using superposition principle.	(3)



3	Derive an expression for the current in a series RL circuit connected to a DC source.	(3)
4	Define time constant of a circuit. A series RC circuit is connected to a DC source of 10V at time $t = 0$. Find the voltage across the capacitor at $t = 1s$, if the time constant of the circuit is 2 seconds.	(3)
5	Define transfer function of a network. Derive the transfer function of a series RLC circuit by taking the current through the resistor as the output.	(3)
6	Explain the use of dot convention in the analysis of coupled circuits.	(3)
7	Determine the current through the neutral wire in a three phase 4 wire system, if the phase currents of the load are $I_R = 10\angle -30^0 A, I_Y = 5\angle -50^0 A$ and $I_B = 5\angle 50^0 A$.	(3)
8	A series RLC circuit with $R = 10\Omega, L = 2H\ and\ C = 40\mu F$ is connected to a variable frequency AC supply. Determine the frequency of the supply, for which the phase angle between the circuit current and supply voltage is zero.	(3)
9	Define h parameters of a two-port network. Why are they called hybrid parameters?	(3)
10	Obtain Y parameters of a two-port network whose Z parameters are given by $z_{11} = 4\Omega$, $z_{12} = 2\Omega$, $z_{21} = 3\Omega$ and $z_{22} = 4\Omega$.	(3)

PART B

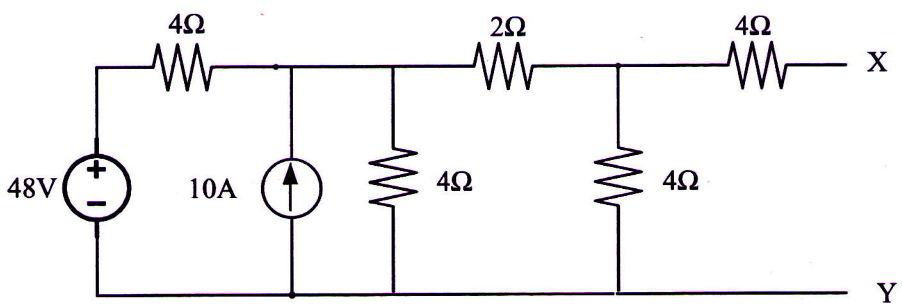
Answer any one full question from each module. Each question carries 14 marks

Module 1

11 For the circuit given below,

a) Determine the Thevenin's equivalent circuit across the terminals X and Y. (10)

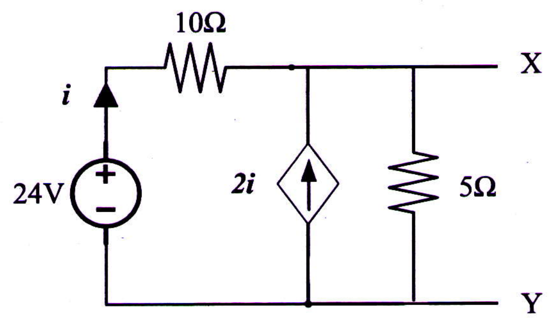
b) Determine the value of resistance to be connected across X and Y so that maximum power is transferred to it. Also, calculate the maximum power transferred. (4)



12 For the circuit given below,

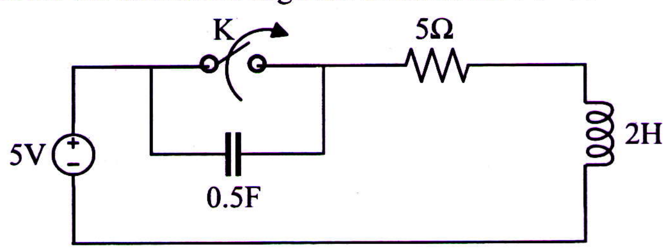
a) Find the Norton's equivalent circuit across the terminals X and Y. (10)

b) If a 10Ω resistor is connected across the terminals X and Y, find the power dissipated in it. (4)

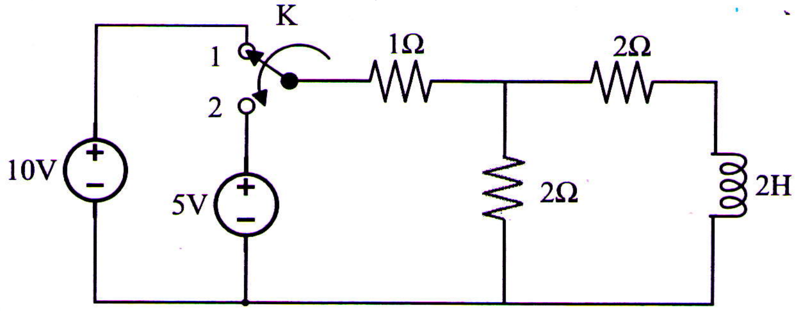


Module 2

13 The switch K in the circuit given below has been in the closed position for a long time and steady state condition is reached. At $t = 0$, the switch is opened. Find the expression for the current through the inductor for $t > 0$. (14)



14 The switch K in the circuit given below was initially at position 1 and the circuit has been at steady state condition. At time $t = 0$, the switch is moved to position 2. Find the expression for the current through the inductor for $t > 0$. (14)

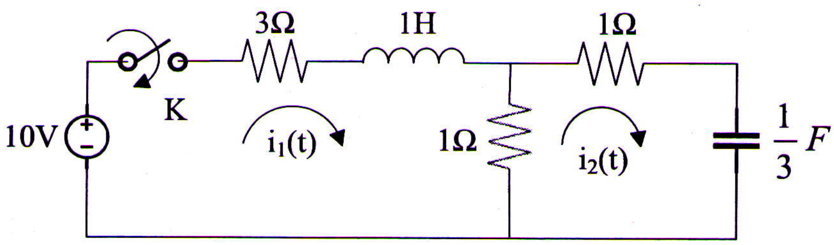


Module 3

15 In the network given below, the inductor and capacitor are initially relaxed. The switch K is closed at time $t = 0$.

a) Model the circuit in s-domain for $t > 0$ (4)

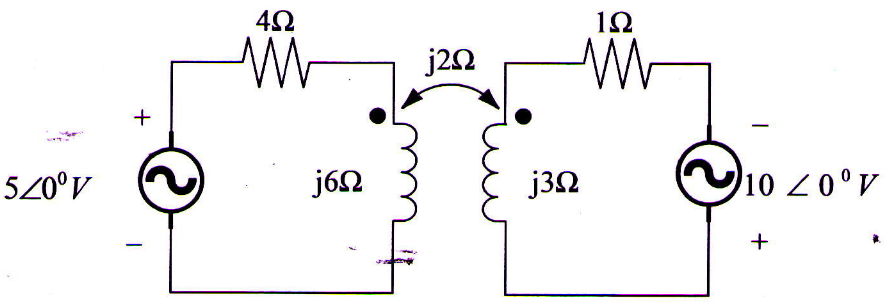
b) Using mesh analysis, determine the expression for the current through the inductor for $t > 0$. (10)



16 For the circuit given below,

a) Find the steady state current through the 1Ω and 4Ω resistors. (8)

b) Obtain the conductively coupled equivalent circuit. (6)



Module 4

17 A 400V, three-phase balanced supply feeds a delta-connected load having phase impedances $Z_{RY} = 40\angle 30^0\Omega$, $Z_{YB} = 50\angle 0^0\Omega$ and $Z_{BR} = 40\angle -30^0\Omega$. Determine the following;

(i) Phase currents (4)

(ii) Line currents (6)

(iii) Active and reactive power delivered to the load (4)

18 A resistor, a capacitor and an inductor are connected in series with a 230 V, variable frequency AC source. When the supply frequency is varied to 25Hz, the circuit offered a minimum impedance of 50Ω. If the inductance of the circuit is $1H$, determine the following;

(i) Resistance and capacitance of the circuit. (4)

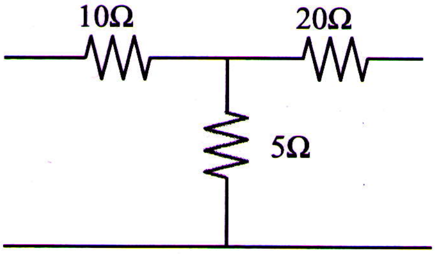
(ii) The voltage across the capacitor. (2)

(iii) The supply frequencies at which the power dissipated in the resistor is half that of at 25Hz. (4)

(iv) Q factor at resonance and bandwidth of the circuit. (4)

Module 5

19 a) Determine the h parameters of the following network. (8)



b) Derive the condition for symmetry and reciprocity of a two-port network in terms of transmission parameters. (6)

20 a) Show that Y parameters of two parallel connected two port networks is equal to the sum of their individual Y parameters. (6)

b) A two-port network is represented by the following network equations. (8)

$$V_1 = 4I_1 + 2I_2$$
$$V_2 = 2I_1 + 6I_2$$

Determine the equivalent π network.

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