Q.5 Attempt any two questions:

i. Obtain the *y* parameters for the circuit in figure 12 **5**

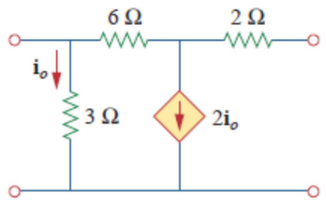

Figure 12

ii. Derive expression for the h parameter in terms of Z parameter for a two port network. **5**

iii. The **ABCD** parameters of the two-port network in Figure 13 are **5**

$$\begin{bmatrix} 4 & 20 \\ 0.1s & 2 \end{bmatrix}$$

The output port is connected to a variable load for maximum power transfer. Find R_L and the maximum power transferred.

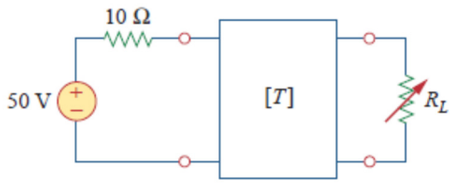

Figure 13

Q.6 i. What do you mean by positive real function? Write any two properties. **2**

ii. Check the following polynomial is Hurwitz or not. **3**

$$P(s) = s^5 + s^4 + 8s^3 + 15s + 8$$

iii. Find the Foster first form for the driving point impedance function. **5**

$$Z(s) = \frac{2(s^2+1)(s^2+9)}{s(s^2+4)}$$

OR iv. Synthesise the impedance function and obtain Cauer II realisation: **5**

$$Z(s) = \frac{s(s^2+3)(s^2+5)}{(s^2+2)(s^2+4)}$$

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Total No. of Questions: 6 *Total No. of Printed Pages:4*

Enrollment No.....

Faculty of Engineering

End Sem (Odd) Examination Dec-2019

EC3CO05 / EI3CO05 Circuit Analysis and Synthesis

Programme: B.Tech. Branch/Specialisation: EC / EI

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. The dependent source in Figure 1 is: **1**

(a) Voltage-controlled current source (b) Voltage-controlled voltage source

(c) Current-controlled voltage source (d) Current-controlled current source

ii. For the circuit in Figure 2, v_1 and v_2 are related as **1**

(a) $v_1 = 6i + 8 + v_2$ (b) $v_1 = 6i - 8 + v_2$

(c) $v_1 = -6i + 8 + v_2$ (d) $v_1 = -6i - 8 + v_2$

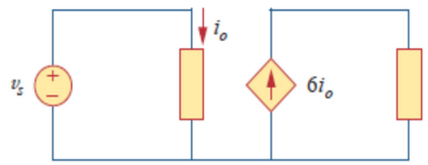

Figure 1

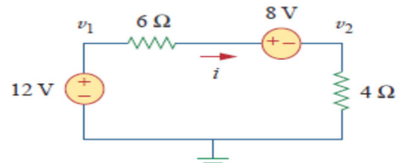

Figure 2

iii. A load is connected to a network. At the terminals to which the load is connected, R_{th} = 10 Ohm and V_{th} = 40V. The maximum possible power supplied to the load is: **1**

(a) 160 W (b) 80 W (c) 40 W (d) 1 W

iv. An RC circuit has R=2 Ohm and C=4F. The time constant is: **1**

(a) 0.5 S (b) 2 S (c) 4 S (d) 8 S

v. The current through an *RL* series circuit with input voltage $v(t)$ is given in the *s*-domain as: **1**

(a) $V(s)\left[R + \frac{1}{sL}\right]$ (b) V(s)(R + sL) (c) $\frac{V(s)}{R+\frac{1}{sL}}$ (d) $\frac{V(s)}{R+sL}$

vi. The Laplace transform of u(t – 2) is: **1**

(a) $\frac{1}{s+2}$ (b) $\frac{1}{s-2}$ (c) $\frac{e^{2s}}{s}$ (d) $\frac{e^{-2s}}{s}$

vii. What is the condition for reciprocity in terms of h parameters? **1**

(a) $h_{11} = h_{22}$ (b) $h_{12}\, h_{21} = h_{11}\, h_{22}$ (c) $h_{12} + h_{21} = 0$ (d) $h_{12} = h_{21}$

viii. For a symmetrical two port network, **1**

(a) $z_{11} = z_{22}$ (b) $z_{12} = z_{21}$

(c) $z_{11}\, z_{22} - z_{12}^2 = 0$ (d) $z_{11} = z_{22}$ and $z_{12} = z_{21}$

P.T.O.

ix. The following property relates to LC impedance or admittance functions: **1**

(a) The poles and zeros are simple and lie on the jω axis.

(b) There must be either a zero or a pole at origin and infinity.

(c) The highest (or lowest) power of numerator and denominator differ by unity.

(d) All of these

x. The network function $F(s) = \frac{s+2}{(s+1)(s+3)}$ represents an **1**

(a) RC impedance (b) RL impedance

(c) RC impedance and RL admittance (d) RC admittance and RL impedance

Q.2 i. Explain cut sets and tie set. **2**

ii. Calculate the phasor currents I_1 and I_2 in the circuit of Figure 3 **3**

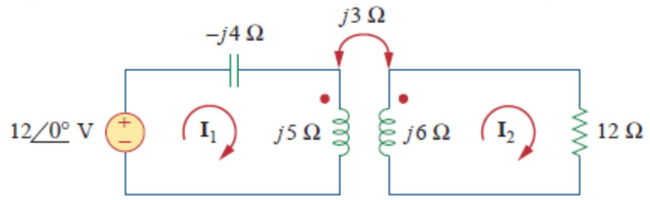

Figure 3

iii. Use mesh analysis to find the current I_0 in the circuit of Figure 4. **5**

OR iv. In the circuit of Figure 5 determine the currents i_1, i_2, and i_3 **5**

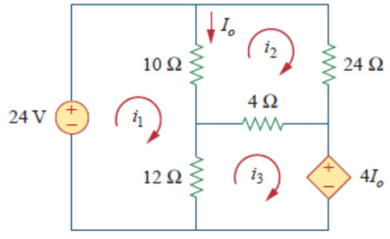

Figure 4

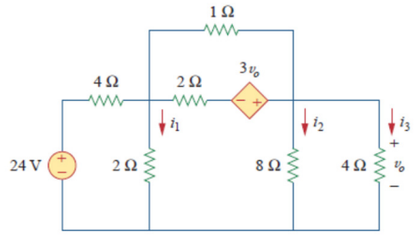

Figure 5

Q.3 Attempt any two:

i. Use superposition to find v_x in the circuit of Figure 6 **5**

ii. The switch in Figure 7 was open for a long time but closed at t=0. Determine: **5**

(a) $i(0^+)$, $v(0^+)$ (b) $\frac{di(0+)}{dt}$, $\frac{dv(0+)}{dt}$ (c) i(∞) , v(∞)

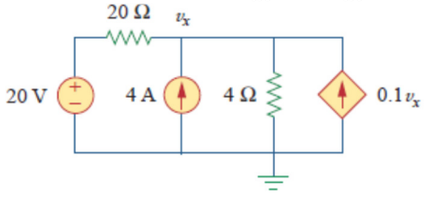

Figure 6

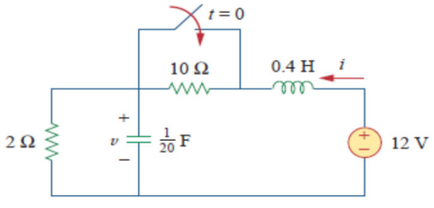

Figure 7

iii. The switch in Figure 8 has been in position *A* for a long time. At t=0, the switch moves to *B*. Determine v(t) for t>0 and calculate its value at t =1 s and 4 s. **5**

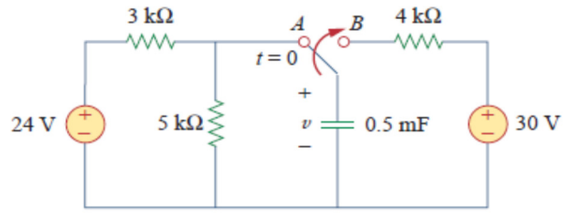

Figure 8

Q.4 i. Find initial and final value of the function given as: **2**

$$F(s) = \frac{4(s+1)}{s^2+4s+6}$$

ii. Find the transfer function $H(s) = \frac{I_1(s)}{I_0(s)}$ in the circuit of figure 9. **3**

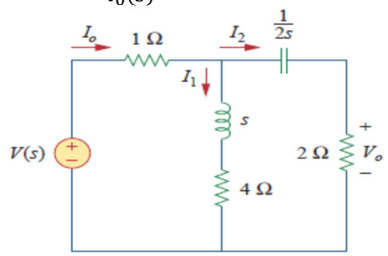

Figure 9

iii. Find v_0(t) in the circuit of figure 10 using Laplace transform. Assume $v_0(0)$= 5V. **5**

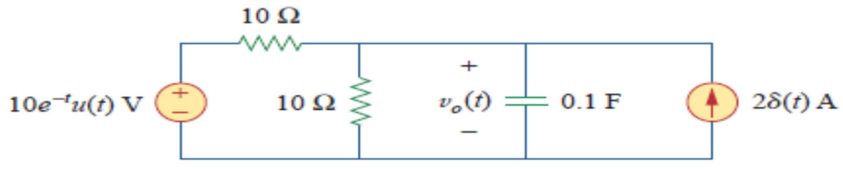

Figure 10

OR iv. Consider the circuit in figure 11. Find the value of the voltage across the capacitor assuming that the value of v_s(t) = 10u(t)V and assume that at t=0, -1A flows through the inductor and +5V is drop across the capacitor. **5**

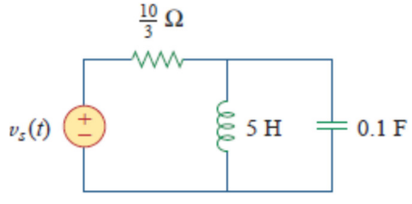

Figure 11

P.T.O.

Marking Scheme

EC3CO05 / EI3CO05 Circuit Analysis and Synthesis

Q.1 i. The dependent source in Figure 1 is: **1**

(d) Current-controlled current source

ii. For the circuit in Figure 2, v_1 and v_2 are related as **1**

(a) $v_1 = 6i + 8 + v_2$

iii. A load is connected to a network. At the terminals to which the load is connected, R_{th} = 10 Ohm and V_{th} = 40V. The maximum possible power supplied to the load is: **1**

(c) 40 W

iv. An RC circuit has R=2 Ohm and C=4F. The time constant is: **1**

(d) 8 S

v. The current through an *RL* series circuit with input voltage $v(t)$ is given in the *s*-domain as: **1**

(d) $\frac{V(s)}{R+sL}$

vi. The Laplace transform of u(t – 2) is: **1**

(d) $\frac{e^{-2s}}{s}$

vii. What is the condition for reciprocity in terms of h parameters? **1**

(c) $h_{12} + h_{21} = 0$

viii. For a symmetrical two port network, **1**

(a) $z_{11} = z_{22}$

ix. The following property relates to LC impedance or admittance functions: **1**

(d) All of these

x. The network function $F(s) = \frac{s+2}{(s+1)(s+3)}$ represents an **1**

(c) RC impedance and RL admittance

Q.2 i. Cut sets 1 mark **2**

Tie set 1 mark

ii. Equation 1 mark **3**

Phasor currents I_1 and I_2 1 mark for each (1 mark * 2) 2 marks

iii. Mesh analysis to find the current I_0 in the circuit **5**

Equation 1 mark

I_1 1.5 marks

I_2 1.5 marks

I_0 1 mark

OR iv. In the circuit Determine the currents i_1, i_2, and i_3 **5**

Equation 2 marks

I_1 1 mark

I_2 1 mark

I_3 1 mark

Q.3 Attempt any two:

i. Use superposition to find v_x in the circuit of Figure 6 **5**

Due to 20V 2 marks

Due to 4 A 2 marks

Find v_x 1 mark

ii. Determine: **5**

(a) $i(0^+)$, $v(0^+)$ 1.5 marks

(b) $\frac{di(0+)}{dt}$, $\frac{dv(0+)}{dt}$ 2 marks

(c) $i(\infty)$, $v(\infty)$ 1.5 marks

iii. Determine v(t) for t>0 4 marks **5**

Calculate its value at t =1 s and 4 s 1 mark

Q.4 i. Find initial 1 mark **2**

Final value of the function 1 mark

ii. Find the transfer function $H(s) = \frac{I_1(s)}{I_0(s)}$ in the circuit **3**

iii. Find $v_0(t)$ in the circuit of figure 10 using Laplace transform. **5**

5 domain circuit 1 mark

For equation 1 mark

For $v_0(s)$ 1 mark

For $v_0(t)$ 2 marks

OR iv. Find the value of the voltage **5**

Stepwise marking

Q.5 Attempt any two questions:

i. Obtain the *y* parameters for the circuit **5**

Equation 1 mark

Y_{11} 1 mark

Y_{12} 1 mark

Y_{21} 1 mark

Y_{22} 1 mark

	ii.	Derive expression for the		**5**
		h parameter equation	1 mark	
		Z parameter equation	1 mark	
		Derivation	3 marks	
	iii.	Find R_L and the maximum power transferred.		**5**
		Equation	1 mark	
		V_{tn}	1.5 marks	
		R_{tn}	1.5 marks	
		P_{max}	1 mark	
Q.6	i.	Positive real function	1 mark	**2**
		Any two properties	1 mark	
	ii.	Check the following polynomial is Hurwitz or not.		**3**
		Stepwise marking		
	iii.	Find the Foster first form for the driving point impedance function.		**5**
		Stepwise marking		
OR	iv.	Synthesise the impedance function and obtain Cauer II realisation:		**5**
		Stepwise marking		

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