OR iii. Find the voltage $v(t)$ in the circuit shown in figure 9. Use Laplace transform method to solve the equations. **6**

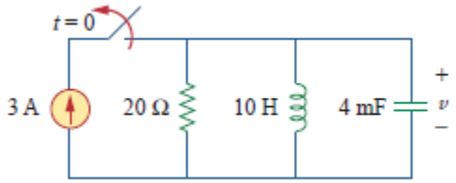

Figure 9

Q.5 i. Derive expression for the h-parameters in terms of Z-parameters for a two port network. **4**

ii. Determine the y parameters for the two-port network shown in figure 10. **6**

OR iii. Find the transmission parameters for the two-port network shown in figure 11. **6**

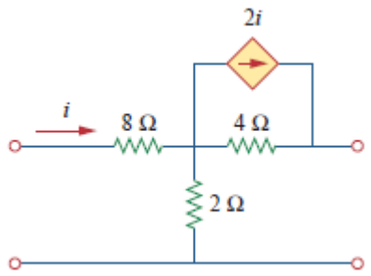

Figure 10

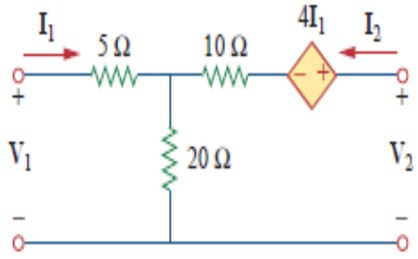

Figure 11

Q.6 i. What are the three conditions to be satisfied by a transfer function so that it represents a stable network? **3**

ii. Find the Foster first and second form for the following driving point impedance function: **7**

$$Z(s) = \frac{10(s^2+4)(s^2+16)}{s(s^2+9)}$$

OR iii. Find the Cauer first and second form for the following impedance function: **7**

$$Z(s) = \frac{s(s^2+4)(s^2+6)}{(s^2+1)(s^2+5)}$$

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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-2018

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. Three resistances of two ohms each are connected in star. In the equivalent delta representation each resistance will have a value of _____ohms. **1**

(a) 3.4 (b) 6 (c) 0.06 (d) 5.2

ii. How much inductance is needed to resonate at 5 kHz with a capacitance of 12 nF? **1**

(a) 2.652 mH (b) 11.844 H (c) 3.333 H (d) 84.43 mH

iii. In the circuit in figure 1, $v(\infty)$ is: **1**

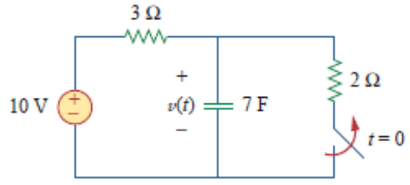

Figure 1

(a) 10 V (b) 7 V (c) 6 V (d) 4 V

iv. Which one of the following theorems is a manifestation of law of conservation of energy? **1**

(a) Tellegen's Theorem (b) Reciprocity Theorem

(c) Thevenins's Theorem (d) Superposition Theorem

v. Given that $F(s) = e^{-2s}/(s+1)$, then $f(t)$ is **1**

(a) $e^{-2(t-1)}u(t-1)$ (b) $e^{-(t-2)}u(t-2)$

(c) $e^{-t}u(t-2)$ (d) $e^{-t}u(t+1)$

vi. If the input to a linear system is $\delta(t)$ and the output is $e^{-2t}\,u(t)$, the transfer function of the system is: **1**

(a) $\frac{1}{(S+2)}$ (b) $\frac{1}{(S-2)}$ (c) $\frac{S}{(S+2)}$ (d) $\frac{S}{(S-2)}$

vii. If a two-port is reciprocal, which of the following is *not* true? **1**

(a) $Z_{21} = Z_{12}$ (b) $Y_{21} = Y_{12}$ (c) $h_{21} = h_{12}$ (d) $AD = BC+1$

P.T.O.

viii. For the two port network shown in figure 2 the Z parameter matrix is given by **1**

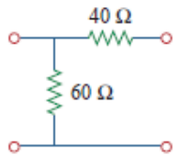

Figure 2

(a) $\begin{bmatrix} 60 & 100 \\ 100 & 60 \end{bmatrix}$ (b) $\begin{bmatrix} 60 & 60 \\ 100 & 40 \end{bmatrix}$

(c) $\begin{bmatrix} 60 & 40 \\ 40 & 100 \end{bmatrix}$ (d) $\begin{bmatrix} 60 & 60 \\ 60 & 100 \end{bmatrix}$

ix. The denominator polynomial in a transfer function may not have any missing terms between the highest and the lowest degree, unless? **1**

(a) All odd terms are missing

(b) All even terms are missing

(c) All even or odd terms are missing

(d) All even and odd terms are missing

x. If the ratio of the polynomial *P(s)* and its derivative gives a continued fraction expansion with _____ coefficients, then the polynomial *P(s)* is Hurwitz. **1**

(a) All negative (b) All positive

(c) Positive or negative (d) Positive and negative

Q.2 i. Two coils are mutually coupled, with L_1 = 25 mH, L_2 = 60 mH and k=0.5. Calculate the maximum possible equivalent inductance if the two coils are connected in series. **2**

ii. Explain with illustrative examples the meaning of the following terms: **3**

(a) Incidence matrix (b) Tie-set

(c) Cut-set

iii. Find v_x and i_x in the circuit shown in figure 3 **5**

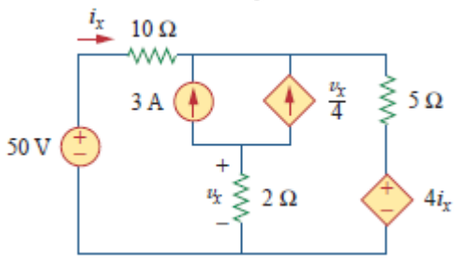

Figure 3

OR iv. Determine the phasor currents $\mathbf{I}_1$ and $\mathbf{I}_2$ in the circuit of figure 4 **5**

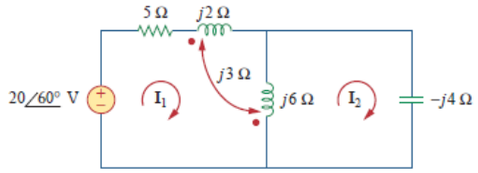

Figure 4

Q.3 Attempt any two questions:

i. Find the Thevenin and Norton equivalent between terminals *a-b* of the circuit in figure 5. **5**

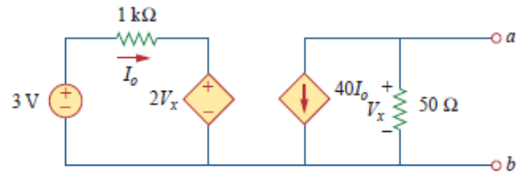

Figure 5

ii. In the circuit shown in figure 6 below, find i_o, v_o and i for all time, assuming that the switch was open for a long time. Use conventional method to solve the equations. **5**

iii. Use superposition to find V_o in the circuit of figure 7 below. **5**

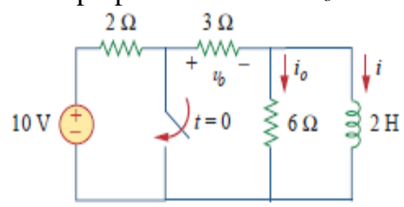

Figure 6

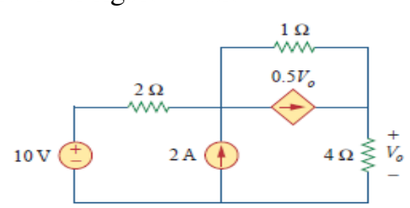

Figure 7

Q.4 i. The output of a linear system is $y(t) = 10\,e^{-t}\cos 4t\,u(t)$ when the input is $x(t) = e^{-t}\,u(t)$. Find the transfer function of the system and its impulse response. **4**

ii. Find the voltage *v(t)* in the circuit shown in figure 8. Use Laplace transform method to solve the equations. **6**

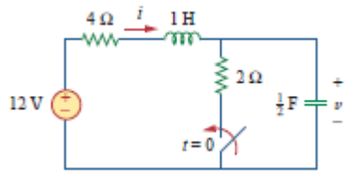

Figure 8

P.T.O.

Marking Scheme

EC3CO05/EI3CO05 Circuit Analysis and Synthesis

Q.1 i. Three resistances of two ohms each are connected in star in the equivalent delta representation each resistance will have a value of _____ohms. **1**

(b) 6

ii. How much inductance is needed to resonate at 5 kHz with a capacitance of 12 nF? **1**

(d) 84.43 mH

iii. In the circuit in figure 1, $v(\infty)$ is: **1**

(a) 10 V

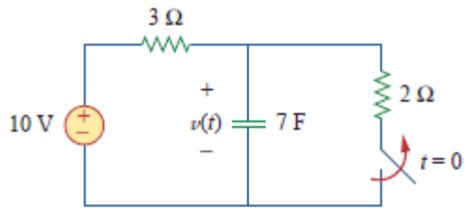

Figure 1

iv. Which one of the following theorems is a manifestation of law of conservation of energy? **1**

(a) Tellegen's Theorem

v. Given that $F(s) = e^{-2s}/(s+1)$, then *f(t)* is **1**

(b) $e^{-(t-2)}u(t-2)$

vi. If the input to a linear system is δ(t) and the output is $e^{-2t}\,u(t)$, the transfer function of the system is: **1**

(a) $\frac{1}{(S+2)}$

vii. If a two-port is reciprocal, which of the following is *not* true? **1**

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

viii. For the two port network shown in figure 2 the Z parameter matrix is given by **1**

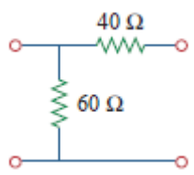

Figure 2

(d) $\begin{bmatrix} 60 & 60 \\ 60 & 100 \end{bmatrix}$

ix. The denominator polynomial in a transfer function may not have any missing terms between the highest and the lowest degree, unless? **1**

(c) all even or odd terms are missing

x. If the ratio of the polynomial *P(s)* and its derivative gives a continued fraction expansion with _____ coefficients, then the polynomial *P(s)* is Hurwitz. **1**

(b) All positive

Q.2	i.	Calculation of M	1 mark	**2**
		Equivalent inductance	1 mark	
	ii.	(a) Incidence matrix	1 mark	**3**
		(b) Tie-set	1 mark	
		(c) Cut-set	1 mark	
	iii.	For writing proper equations	3 marks	**5**
		Voltage calculation	1 mark	
		Current calculation.	1 mark	
OR	iv.	For writing proper equations	2 marks	**5**
		Current calculation.	3 marks	

Q.3 Attempt any two questions:

	i.	Open circuit voltage calculation		**5**
		Equation	1 mark	
		Calculation	1 mark	
		Short circuit current calculations		
		Equation	1 mark	
		Calculation	1 mark	
		Equivalent circuit representation.	1 mark	
	ii.	Initial current, time constant , final current , v_0 and i_0 calculation .		**5**
		1 mark for each	(1 mark *5)	
	iii.	Calculation of v_0 for the circuit containing voltage	2 marks	**5**
		Calculation of current source acting alone	2 marks	
		Applying superposition principle.	1 mark	

Q.4	i.	Conversion from time domain to frequency domain	1 mark	**4**
		Calculation of transfer function in s domain	1 mark	
		Conversion of transfer function from frequency domain to time domain	1 mark	
		Calculation of impulse response	1 mark	

	ii.	Calculation of initial conditions	1 mark	**6**
		Conversion from time domain to frequency domain.	1 mark	
		Calculation of v in s domain	2 marks	
		Conversion of v from frequency domain to time domain.	2 marks	
	iii.	Calculation of initial conditions	1 mark	**6**
		Conversion from time domain to frequency domain .	1 mark	
		Calculation of *v* in s domain	2 marks	
		Conversion of *v* from frequency domain to time domain	2 marks	
Q.5	i.	Writing equation of Z and h parameters.	2 marks	**4**
		Calculation of parameters.	2 marks	
	ii.	The y parameters for the two-port network		**6**
		1.5 marks for each parameter.	(1.5 marks *4)	
OR	iii.	Transmission parameters for the two-port network		**6**
		1.5 marks for each parameter.	(1.5 marks *4)	
Q.6	i.	Any three conditions to be satisfied by a transfer function so that it represents a stable network		**3**
		1 marks for each condition.	(1 mark *3)	
	ii.	Foster first form element calculation	3 marks	**7**
		Foster second form element calculation	3 marks	
		Circuit representation.	1 mark	
OR	iii.	Cauer first form element calculation	3 marks	**7**
		Cauer second form element calculation	3 marks	
		Circuit representation.	1 mark.	

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