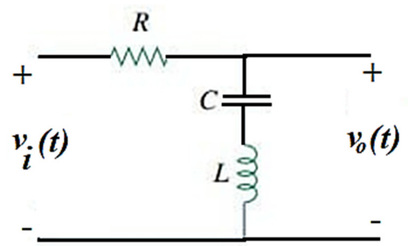
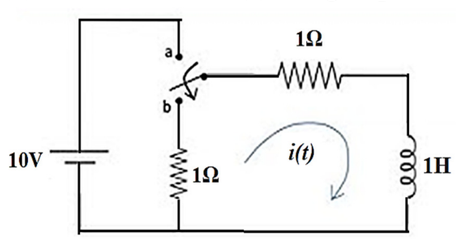
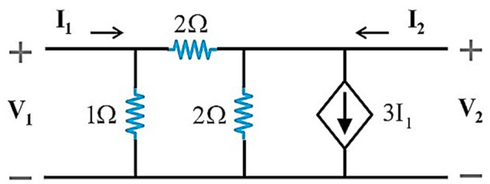
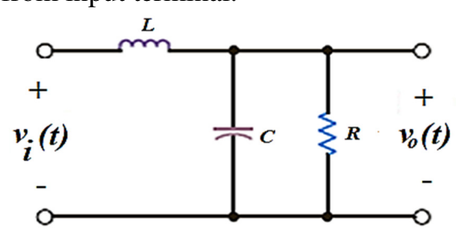
	ii.	Find out the frequency response of the given passive filter.	**7**	2	1, 4	3	1, 4
							
OR	iii.	For the given circuit the steady state has been reached when the switch was at position: (a) Then move to position (b) Find the current *i(t)* using Laplace transform method.	**7**	3	1, 4	3	1, 4
							
Q.5	i.	Define ABCD parameters.	**2**	1	1, 4	1	1, 4
	ii.	Find the open circuit parameters for the network as shown in figure below:	**8**	3	1, 4	4	1, 4
							
OR	iii.	Find out the transfer function and driving point impedance for the given network in s-domain as seen from input terminal.	**8**	3	1, 4	4	1, 4
							

Total No. of Questions: 6 *Total No. of Printed Pages:5*

Enrollment No.....

Faculty of Engineering
End Sem Examination Dec 2024
EE3CO49 Electrical Circuit Analysis

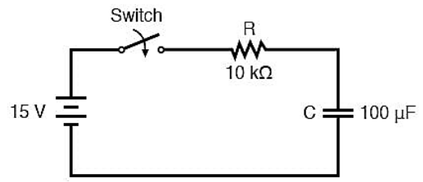
Programme: B.Tech. Branch/Specialisation: EE

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. Assume suitable data if necessary. Notations and symbols have their usual meaning.

			Marks	BL	PO	CO	PSO
Q.1	i.	If the resonant frequency of a parallel RLC circuit is 1 kHz and the resistance is 10 Ω, what is the bandwidth (BW) if Q-factor is 10? (a) 100 Hz (b) 200 Hz (c) 50 Hz (d) 10 Hz	**1**	2	1, 4	2	1, 4
	ii.	Two coils connected in series have a self-inductance of 20mH and 60mH respectively. The total inductance of the combination was found to be 100mH. Determine the amount of mutual inductance that exists between the two coils assuming that they are aiding each other- (a) 5 mH (b) 10 mH (c) 15 mH (d) 20 mH	**1**	2	1, 4	2	1, 4
	iii.	According to the Superposition Theorem, the response in a linear circuit with multiple sources can be found by: (a) Adding the voltages only (b) Considering the effects of all sources simultaneously (c) Analyzing one source at a time and summing the results (d) Ignoring all but the largest source	**1**	1	1, 4	1	1, 4
	iv.	Which theorem states that a change in the source in a linear network will result in a proportional change in the response? (a) Compensation theorem (b) Reciprocity theorem (c) Superposition theorem (d) Maximum power transfer theorem	**1**	1	1, 4	1	1, 4

v. In the RC circuit given below, the value of current (i) just after closing the switch at $t = 0^+$, is- **1** 2 1, 4 2 1, 4



(a) 0 mA (b) 0.5 Ma (c) 1.5 mA (d) 2.5 mA

vi. Which type of filter allows signals above a certain frequency to pass through while attenuating lower frequencies? **1** 1 1, 4 1 1, 4

(a) Low pass filter (b) High pass filter
(c) Band pass filter (d) Band elimination filter

vii. In a two-port network, the ABCD parameters relate to: **1** 1 1, 4 1 1, 4

(a) Input impedance only
(b) Current flowing through a single branch
(c) Power dissipation across components
(d) Voltage and current relationships at both ports

viii. The poles of a network function are important because they indicate: **1** 1 1, 4 1 1, 4

(a) The maximum output voltage
(b) The type of components used
(c) The stability of the system
(d) The frequency of the input signal

ix. A transfer function is said to be realizable if it meets which of the following criteria? **1** 1 1, 4 1 1, 4

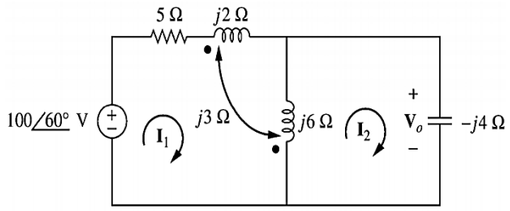
(a) It is a complex function
(b) It adheres to the Hurwitz stability criterion
(c) It can be implemented with any circuit design
(d) It has no poles

x. Which of the following forms is used to synthesize passive networks, ensuring the response remains positive real? **1** 1 1, 4 1 1, 4

(a) Bode form (b) Foster form
(c) Cauer form (d) Both (b) and (c)

Q.2 i. Explain the concept of an incidence matrix and its significance in network graph theory. **3** 1 1, 4 1 1, 4

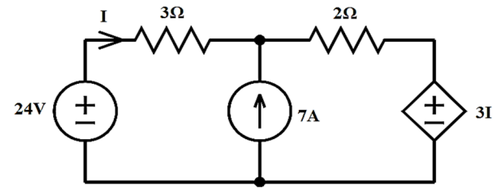
ii. Write the complete phasor equation for the magnetically coupled circuit given below: **7** 2 1, 4 2 1, 4



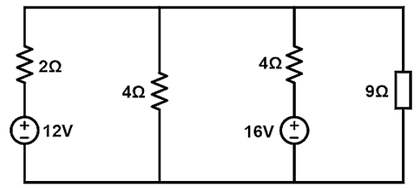
OR iii. What is resonance? A parallel resonance network consisting of a resistor of 60Ω, a capacitor of 120µF and an inductor of 200mH is connected across a sinusoidal supply voltage which has a constant output of 100 volts at all frequencies. Calculate, the resonant frequency, the quality factor and the bandwidth of the circuit, the circuit current at resonance. **7** 2 1, 4 2 1, 4

Q.3 i. State the maximum power transfer theorem and deduce the condition at which the circuit will draw the maximum power. **4** 2 1, 4 3 1, 4

ii. Find the current I using superposition theorem for the circuit given below: **6** 3 1, 4 5 1, 4



OR iii. Find the current and voltage across the load terminal using Millman's theorem. **6** 3 1, 4 5 1, 4



Q.4 i. Define the following functions: **3** 1 1, 4 1 1, 4

(a) Unit Step (b) Unit Ramp
(c) Unit Impulse

Q.6 Attempt any two:

i.	Explain the significance of the Hurwitz property in determining the realizability of a transfer function.	**5**	2	1, 4	2	1, 4
ii.	Consider the transfer function- $$H(S) = \frac{S+3}{S^2+4S+5}$$ Calculate and determine if the function is positive real by evaluating its real part.	**5**	2	1, 4	2	1, 4
iii.	For the given transfer function- $$H(S) = \frac{1}{S^2+2S+1}$$ Find the Foster form representation and identify the values of the series impedances.	**5**	2	1, 4	2	1, 4

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[5]

Q.6 Attempt any two:

i.	Explain the significance of the Hurwitz property in determining the realizability of a transfer function.	**5**	2	1, 4	2	1, 4
ii.	Consider the transfer function- $$H(S) = \frac{S+3}{S^2+4S+5}$$ Calculate and determine if the function is positive real by evaluating its real part.	**5**	2	1, 4	2	1, 4
iii.	For the given transfer function- $$H(S) = \frac{1}{S^2+2S+1}$$ Find the Foster form representation and identify the values of the series impedances.	**5**	2	1, 4	2	1, 4

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Marking Scheme
EE3CO49 (T) Electrical Circuit Analysis (T)

Q.1	i)	If the resonant frequency of a parallel RLC circuit is 1 kHz and the resistance is 10 Ω, what is the bandwidth (BW) if Q-factor is 10? **(a) 100 Hz**	**1**
	ii)	Two coils connected in series have a self-inductance of 20mH and 60mH respectively. The total inductance of the combination was found to be 100mH. Determine the amount of mutual inductance that exists between the two coils assuming that they are aiding each other. **(b) 10 mH**	**1**
	iii)	According to the Superposition Theorem, the response in a linear circuit with multiple sources can be found by: **(c) Analyzing one source at a time and summing the results**	**1**
	iv)	Which theorem states that a change in the source in a linear network will result in a proportional change in the response? **(b) Reciprocity Theorem**	**1**
	v)	**(c) 1.5 mA**	**1**
	vi)	Which type of filter allows signals above a certain frequency to pass through while attenuating lower frequencies? **(b) High Pass Filter**	**1**
	vii)	In a two-port network, the ABCD parameters relate to: **(d) Voltage and current relationships at both ports**	**1**
	viii)	The poles of a network function are important because they indicate: **(c) The stability of the system**	**1**
	ix)	A transfer function is said to be realizable if it meets which of the following criteria? **(b) It adheres to the Hurwitz stability criterion**	**1**
	x)	Which of the following forms is used to synthesize passive networks, ensuring the response remains positive real? (d) **Both (b) and (c)**	**1**
Q.2	i.	Theory	**3**
	ii.	Expression	**7**
OR	iii.	Resonance frequency = 32.5 Hz, Quality Factor = 1.47, BW = 22 Hz, I = 1.67 A	**7**
Q.3	i.	Theory/Statement	**4**
	ii.	I = 1.25A	**6**
OR	iii.	10V and 1A	**6**
Q.4	i.	Definition	**3**
	ii.	Expression	**7**
OR	iii.	Expression	**7**
Q.5	i.	Definition	**2**
	ii.	$Z_{11} = -0.4\ \Omega,\ Z_{12} = -0.4\ \Omega,\ Z_{21} = -3.2\ \Omega,\ Z_{22} = 1.2\ \Omega$	**8**
OR	iii.	Expression	
Q.6			
	i.	Explanation	**5**
	ii.	Expression	**5**
	iii.	Expression	**5**

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