Total No. of Questions – [3] Total No. of Printed Pages: 4

Paper code: U239-133(T1)

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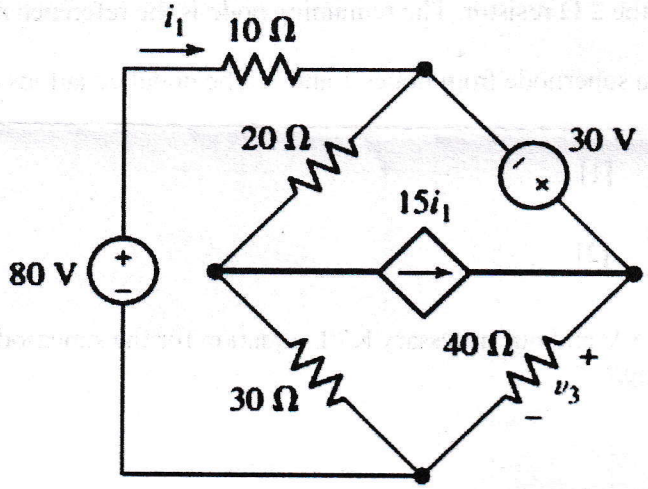
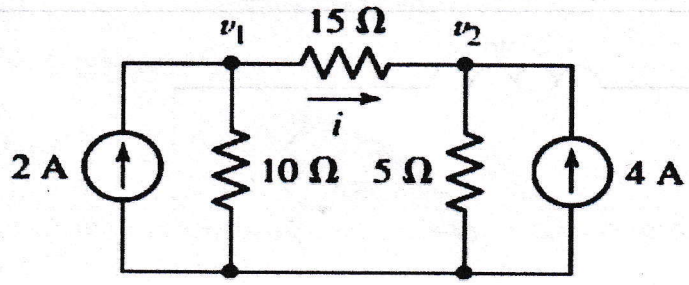
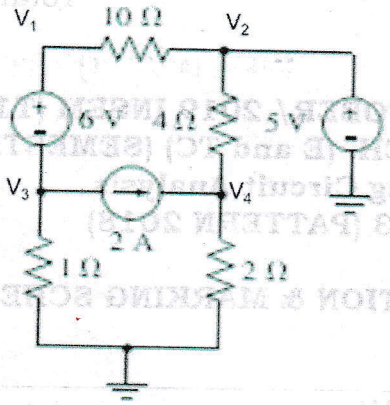
S. Y. B.TECH. (E and TC) (SEMESTER – III)
COURSE NAME: Engineering Circuit Analysis
COURSE CODE: ETUA21183 (PATTERN 2018)

SOLUTION & MARKING SCHEME

[Max. Marks: 20]

Q1	Attempt any ONE [4+4=8M]	CO	BT level
	Determine V_3 that is, voltage across 40 ohm resistor using loop analysis.  Ans: Loop equations – 3M V_3 = 104.2 V ------ 1M	CO1	Analysis
	 Node analysis 3 M V1=20V and V2=20V Hence current is 0 A ---------1M	CO1	Analysis
	OR		
	Refer the network below. Using nodal analysis determine all four nodal voltages.	CO1	Analysis



Each node – 1M

We define v_1 at the top left node; v_2 at the top right node; v_3 the top of the 1 Ω re and v_4 at the top of the 2 Ω resistor. The remaining node is the reference node.

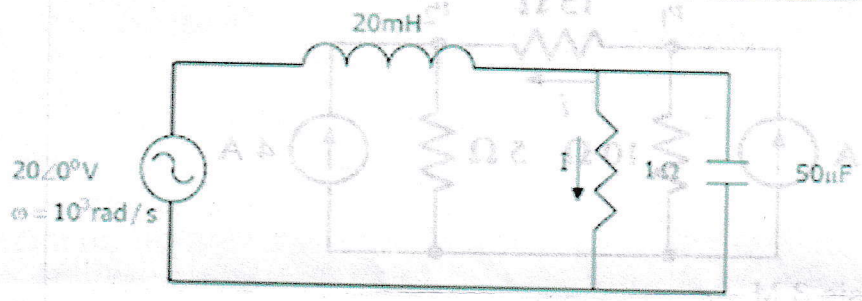
We may now form a supernode from nodes 1 and 3. The nodal equations are:

$$-2 = \frac{v_3}{1} + \frac{v_1 - v_2}{10} \qquad [1]$$

$$2 = \frac{v_4}{2} + \frac{v_4 - v_2}{4} \qquad [2]$$

By inspection, $v_2 = 5$ V and our necessary KVL equation for the supernode is $v_1 - v_3 = 6$. Solving,

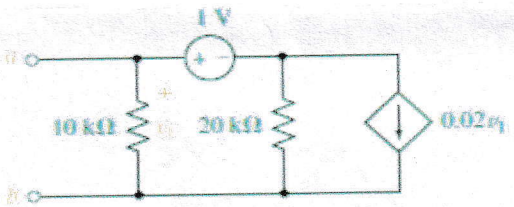
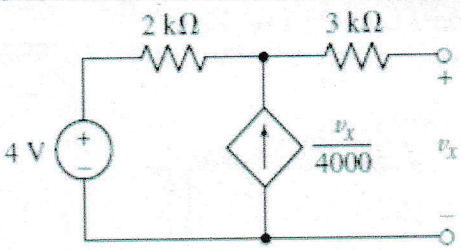
$v_1 = 4.019$ V
$v_2 = 5$ V
$v_3 = -1.909$ V
$v_4 = 4.333$ V



Conversion into rectances – 20j and -20j -------1.5 M
Source transformation step- current source- -j1 A 1.5 M
Answer I= $1\angle -90^0$ A =-j A ------- 1M

CO1 Analysis

Q2 Attempt any ONE [4+4=8M]

	(a) With the right-hand voltage source short-circuited and the current source open-circuited, we have $2 \parallel 5 = 10/7\ \Omega$ By voltage division, $v_x\big\|_{\text{lefthand 4 V}} = (4)\dfrac{1}{3+1+10/7} = 0.7368\ \text{V}$ With the other voltage source short-circuited and the current source open-circuited, we have $(3 + 1) \parallel 5 = 2.222\ \Omega$. $v_{5\Omega} = 4\dfrac{2.222}{2.222+2} = 2.105\ \text{V}$. Then, $v_x\big\|_{\text{righthand 4 V}} = -2.105\dfrac{1}{4} = -0.5263\ \text{V}$ Finally, with both voltage sources short-circuited, we find that $v_x\big\|_{2\text{ A}} = (1)\left[2\dfrac{3}{3+1+10/7}\right] = 1.105\ \text{V}$ Adding these three terms together, $v_x = 1.316\ \text{V}$	CO2	
	 We define nodal voltage v_1 at the top left node, and nodal voltage v_2 at the top right. The bottom node is our reference node. By nodal analysis, $-0.02v_1 = \dfrac{v_1}{10\times10^3} + \dfrac{v_2}{20\times10^3}$ [1] and $v_2 - v_1 = 1$ [2] Solving, $v_1 = -2.481\ \text{mV} = v_{oc} = v_{TH}$ $R_{TH} = v_{test}/1 = 49.63\ \Omega$	CO2	Analysis
	OR		
	State and prove maximum power transfer theorem for network with reactive components. Statement – 1M Proof- 3M	CO2	Knowledge
	 **Solution-** $-4 + 2\times10^3\left(-\dfrac{v_x}{4000}\right) + 3\times10^3(0) + v_x = 0$ $v_x = 8\ \text{V} = V$	CO2	Analysis

	Determination of Isc ------ 2M $R_{TH} = \frac{V_{oc}}{I_{sc}} = \frac{8}{0.8 \times 10^{-3}} = 10\,\text{k}\Omega$ ---------- **2M** **I_N=Isc =0.8 mA R_{TH}=10K ohm**		
Q3	Attempt any ONE [4M]		
	Compare Series resonance with Anti resonance on the basis of their parameters (at least 4 points) — 4 m	CO3	Comprehe nsion
	OR		
	Far=7.11 KHz --------1.5M Zar=400Kohm--------1.5M Iar=V/Zar= 25micro A--------1M	CO3	Knowledge

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