KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

ELECTRICAL ENGINEERING DEPARTMENT

EE 202

EXAM I

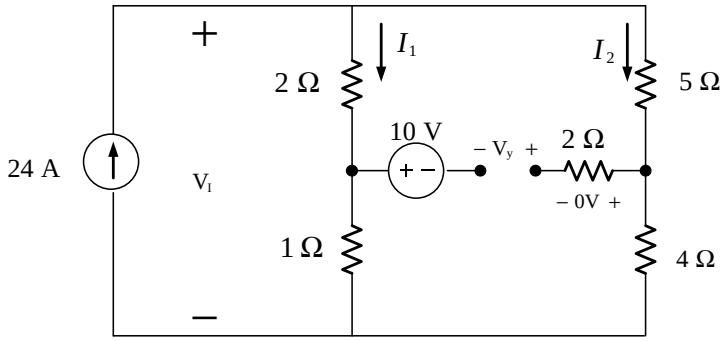
DATE: Wednesday 27/2/2013

TIME: 6:00 PM-7:30 PM

ID#	
Name	
Section#	

	Maximum Score	**Score**
Q1	**32**	
Q2	**30**	
Q3	**28**	
Q4	**10**	
Total	**100**	

Q2 (30)



For the circuit shown above , find the followings :

(a) The current I_1 **using the current division** ?

(b) The voltage V_y ?

(c) The power deliver by the current source ?

(d) The power deliver by the voltage source ?

(*a*) $I_1 = \dfrac{(5+4)}{(5+4)+(2+1)}(24) = 18$ A -------**(8)**

(b) $I_2 = 24-18 = 6$ A **OR** $I_2 = \dfrac{(2+1)}{(5+4)+(2+1)}(24) = 6$ A -------**(2)**

KVL on the upper (or lower) loop $5I_2 + 0 + V_y - 10 - 2I_1 = 0$

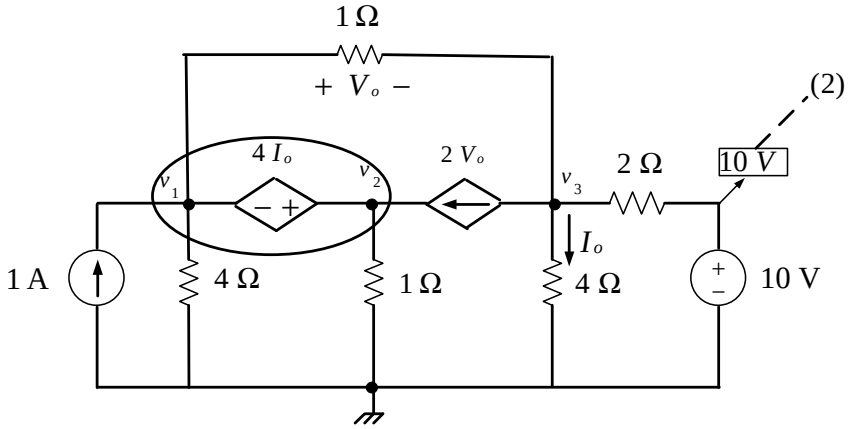
$5(6) + 0 + V_y - 10 - 2(18) = 0 \Rightarrow V_y = 16$ V -------**(8)**

(c) $V_I = 3I_1 = 3(18) = 54$V **OR** $V_I = 9I_2 = 9(6) = 54$V -------**(4)**

$P_{24\text{ A}}^{\text{absorbed}} = -V_I(24) = -54(24) = -1296$ W ---**(2)** $\Rightarrow P_{24\text{ A}}^{\text{deliver}} = 1296$ W ---**(2)**

(d) $P_{24\text{ A}}^{\text{absorbed}} = (10)(0) = 0$ W $\Rightarrow P_{24\text{ A}}^{\text{deliver}} = 0$ W ---**(4)**

Q3 (28)



For the circuit shown above find the nodal equations necessary to solve for the node voltages v_1, v_2, v_3 and put your results in the matrix form

$$\begin{bmatrix} & & \\ & & \\ & & \end{bmatrix}\begin{bmatrix} v_1 \\ v_2 \\ v_3 \end{bmatrix} = \begin{bmatrix} \\ \\ \end{bmatrix}$$

KCL on the supper Node

$$-1+\frac{v_1}{4}+\frac{v_1-v_3}{1}+\frac{v_2}{1}-2V_o=0 \text{ ---(6)} \qquad V_o=v_1-v_3 \text{ ---(3)}$$

$$\Rightarrow\ -3v_1+4v_2+4v_3=4 \quad \textbf{(eq1)} \text{ --------(2)}$$

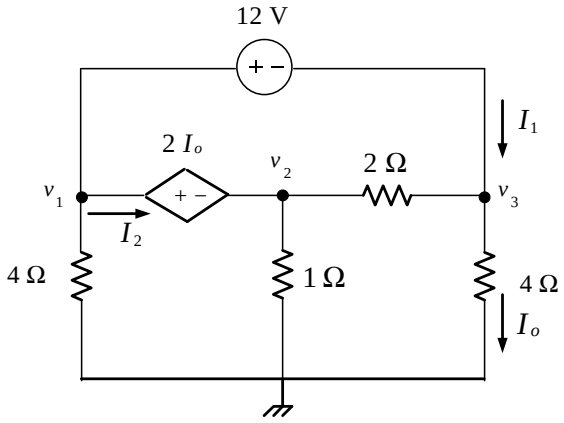
Voltage Restriction $\underbrace{v_2-v_1=4I_o}_{\text{---(2)}} = 4\ \underbrace{\frac{v_3}{4}}_{\text{---(1)}} = v_3 \ \Rightarrow\ v_1-v_2+v_3=0$ **(eq2)-----(2)**

KCL at node voltage v_3

$$\underbrace{\frac{v_3-v_1}{1}+\frac{v_3-10}{2}+\frac{v_3}{4}+2V_o=0}_{\text{---(6)}} \ \Rightarrow\ 4v_1-v_3=20 \quad \textbf{(eq3)----(2)}$$

$$\Rightarrow \begin{bmatrix} -3 & 4 & 4 \\ 1 & -1 & 1 \\ 4 & 0 & -1 \end{bmatrix}\begin{bmatrix} v_1 \\ v_2 \\ v_3 \end{bmatrix} = \begin{bmatrix} 4 \\ 0 \\ 20 \end{bmatrix} \quad \text{------(2)}$$

Q4 (10)



For the circuit shown above if the node voltages are

$v_1 = -3$ V $\qquad v_2 = 4.5$ V $\qquad v_3 = -15$ V

Find the followings :

(a) The power deliver by the independent voltage source ?

(b) The power deliver by the dependent voltage source ?

(*a*) $I_1 = \frac{v_3 - v_2}{2} + \frac{v_3}{4} = \frac{-15-4.5}{2} + \frac{-15}{4} = -13.5$ A---**(2)**

$P_{12\text{ V}}^{\text{absorbed}} = 12(I_1) = 12(-13.5) = -162$ W---**(2)** $\Rightarrow P_{12\text{ V}}^{\text{deliver}} = 162$ W ---**(1)**

(*b*) $I_2 = \frac{v_2}{1} + \frac{v_2 - v_3}{2} = \frac{3v_2 - v_3}{2} = \frac{3(4.5)+15}{2} = 14.25$ A---**(2)**

$P_{2I_o}^{\text{absorbed}} = (2I_o)(I_2) = \left(2\frac{v_3}{4}\right)(14.25) = \left(2\frac{-15}{4}\right)(14.25) = -106.875$ W---**(2)** $\Rightarrow P_{2I_o}^{\text{deliver}} = 106.875$ W---**(1)**