LINEAR CIRCUIT ANALYSIS ASSIGNMENT

SUBMITTED BY: AKSHAY S RAO

1BM17EC007

EC, 3A

1.

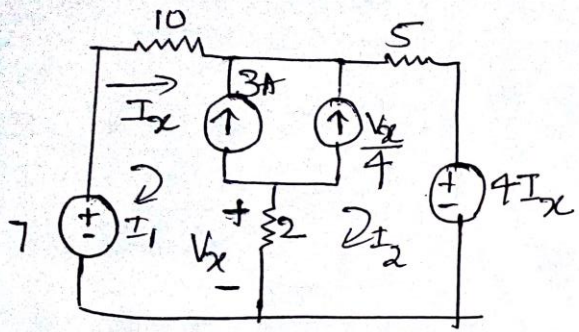


fig. 1

$-7 + 10I_1 + 5I_2 + 4I_x = 0$

$I_1 = I_x$ & $I_2 - I_1 = 2A$

$\Rightarrow 10I_x + 5(2 + I_x) + 4I_x = 7$

$I_x = -0.157\,A$, $I_2 = 1.843\,A$

$\Rightarrow 4I_x = -0.628\,V$

from fig 1

$-V_x = \left(\frac{V_x}{4} + 3\right) 2$

$-\frac{3}{2} V_x = 6$

$V_x = -4\,V$

$\frac{V_x}{4} = -1A$

$P_{7V} = 7 \times 0.157 = 1.099\,W$

$P_{10\Omega} = I_x^2 R = 0.24649\,W$

$P_{5\Omega} = I_2^2 R = 16.9832\,W$

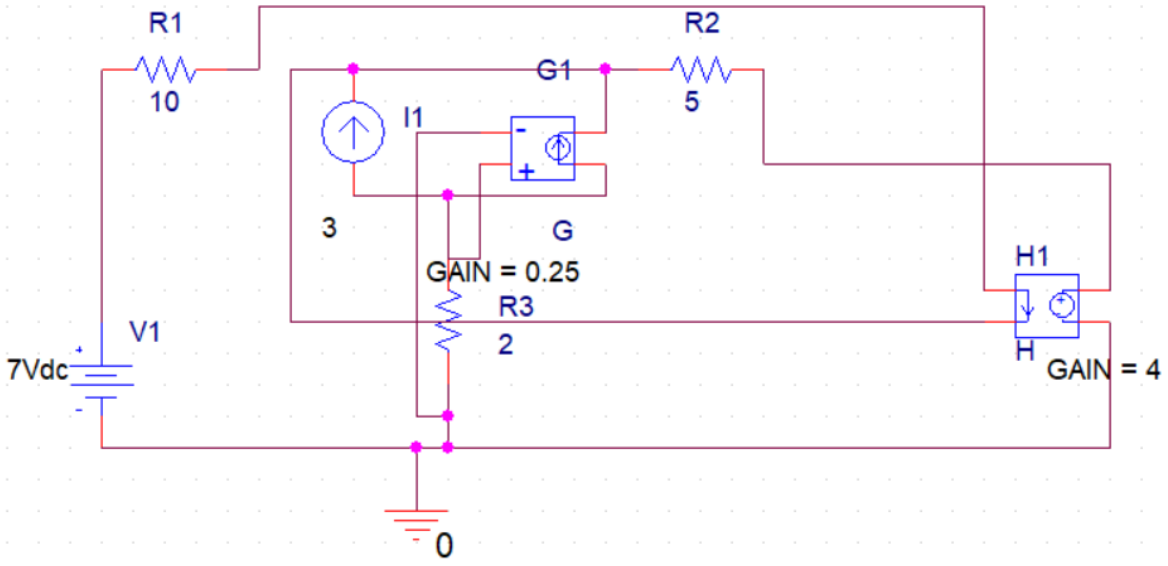
$P_{3A} = (-I_x \times 10 + 7 - V_x) \times 3$

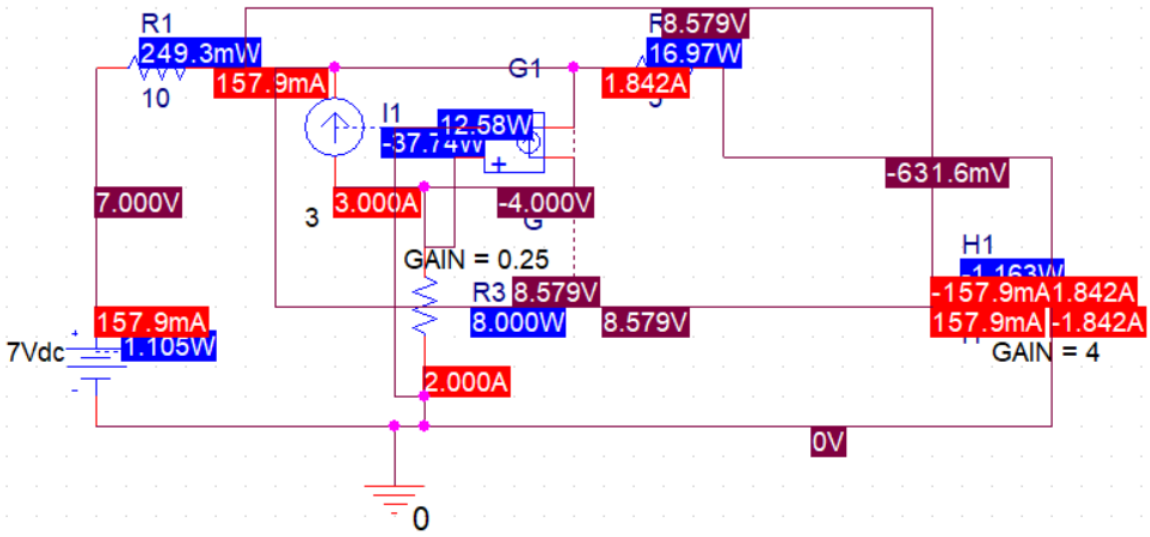
$= 37.71\,W$ (negative)

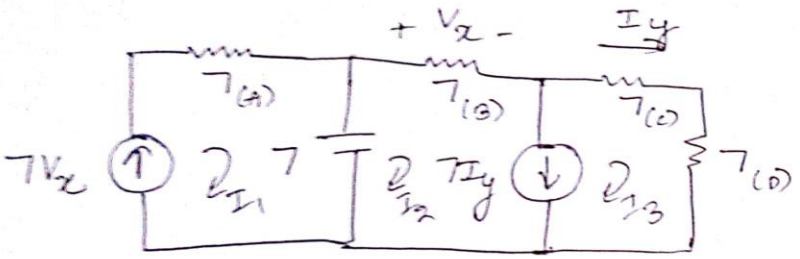
$P_{4I_x} = -0.628 \times 1.843 = 1.15$ (neg

$P_{2\Omega} = 2^2 \times 2 = 8\,W$

$P_{\frac{V_x}{4}} = 12.587\,W$


R1
10
R2
5
G1
I1
3
G
GAIN = 0.25
R3
2
H1
H
GAIN = 4
V1
7Vdc
0


R1
249.3mW
157.9mA
10
8.579V
16.97W
1.842A
G1
I1
12.58W
-631.6mV
7.000V
3.000A
-4.000V
3
G
GAIN = 0.25
H1
R3 8.579V
8.000W
8.579V
-157.9mA1.842A
157.9mA
-1.842A
GAIN = 4
157.9mA
7Vdc
1.105W
2.000A
0V
0



$$-7 + 7I_2 + 14I_3 = 0$$

$$8I_3 + 2I_3 = 1$$

$$I_3 = 0.1\,A$$

$$\Rightarrow I_2 = 0.8\,A$$

$$\Rightarrow I_1 = 39.2\,A$$

$$I_1 = 7V_x = 49I_2$$

$$I_2 - I_3 = 7I_y$$

$$= 7I_3$$

$$I_2 = 8I_3$$

Power delivered by $7I_y$ current source $= (I_2 + I_3)(7I_3)$
$= 0.98\,W$

Power dissipated by $7_{(A)} = I_1^2 \times 7 = 10.76\,kW$

—— 11 —— $7_{(B)} = I_2^2 \times 7 = 4.480\,W$

—— 11 —— $7_{(C)} =$ } $I_3^2(7) = 0.07\,W$

—— 11 —— $7_{(D)} =$ }

Power delivered by $7V_x$ current source $= I_1(7I_1 + 7)$

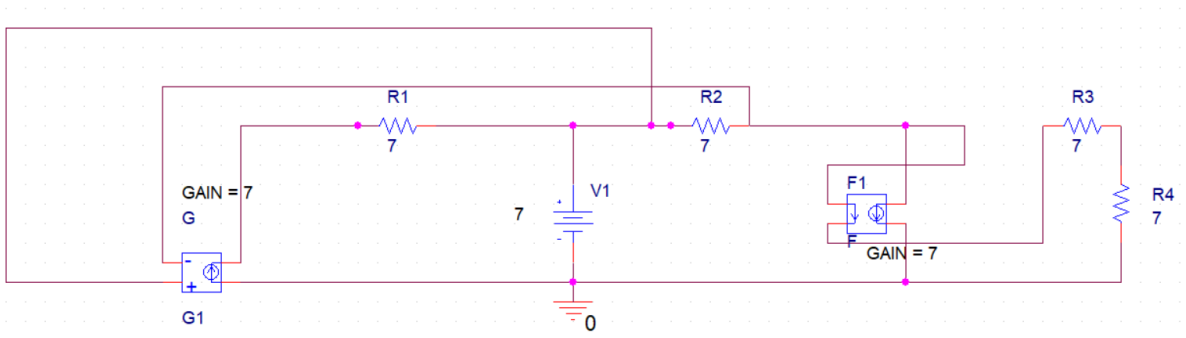
$= I_1(281.4)$

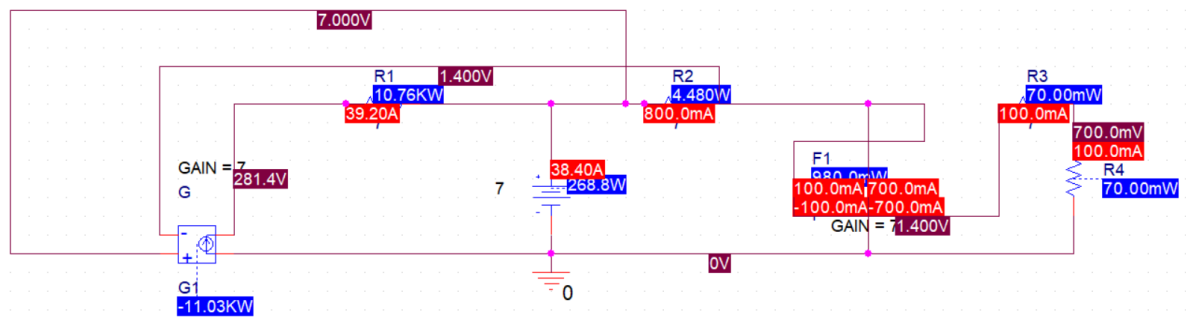
$= 11.03\,kW$ (-ve

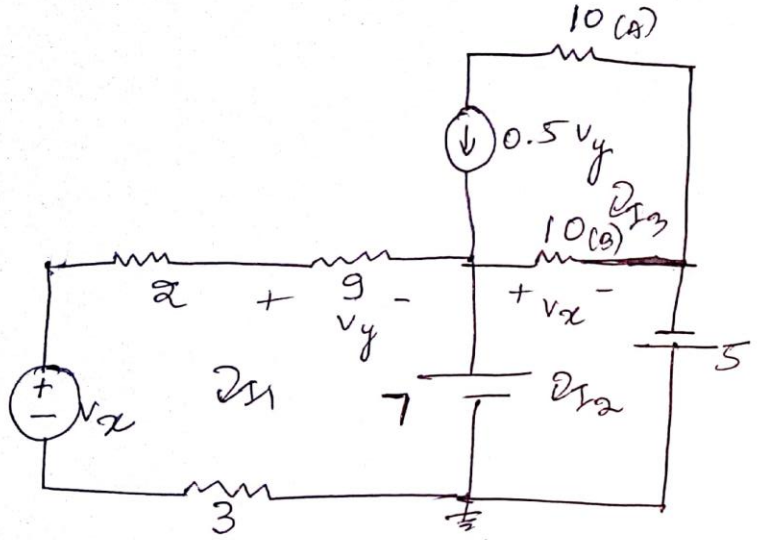
Power delivered by 7V source

$= 7(I_1 - I_2) = 268.8\,W$

2.


R1
7
R2
7
R3
7
R4
7
GAIN = 7
G
G1
7
V1
0
F1
F
GAIN = 7


7.000V
R1
1.400V
10.76KW
39.20A
R2
4.480W
800.0mA
R3
70.00mW
100.0mA
700.0mV
100.0mA
R4
70.00mW
GAIN = 7
281.4V
G
G1
-11.03KW
7
38.40A
268.8W
F1
100.0mA
700.0mA
-100.0mA
-700.0mA
GAIN = 7
1.400V
0V
0



$14I_1 - 10I_2 + 10I_3 = -7$

$-I_3 = 4.5I_1$

$-31I_1 - 10I_2 = -7$

$12 = 10I_2 + 45I_1$

$I_1 = 0.357A$

$I_2 = -0.407A$

$P_{2\Omega} = I_1^2 \times 2 = 255.1mW$

$P_{9\Omega} = I_1^2 \times 9 = 1.148W$

$P_{3\Omega} = I_1^2 \times 3 = 0.382mW$

$P_{10\Omega(A)} = I_3^2 \times 10 = 25.83W$

$P_{(10\Omega)(B)} = (I_2 - I_3)^2 \times 10 = 14.40W.$

Power delivered by 5V $= I_2 \times 5 = 2.035W$

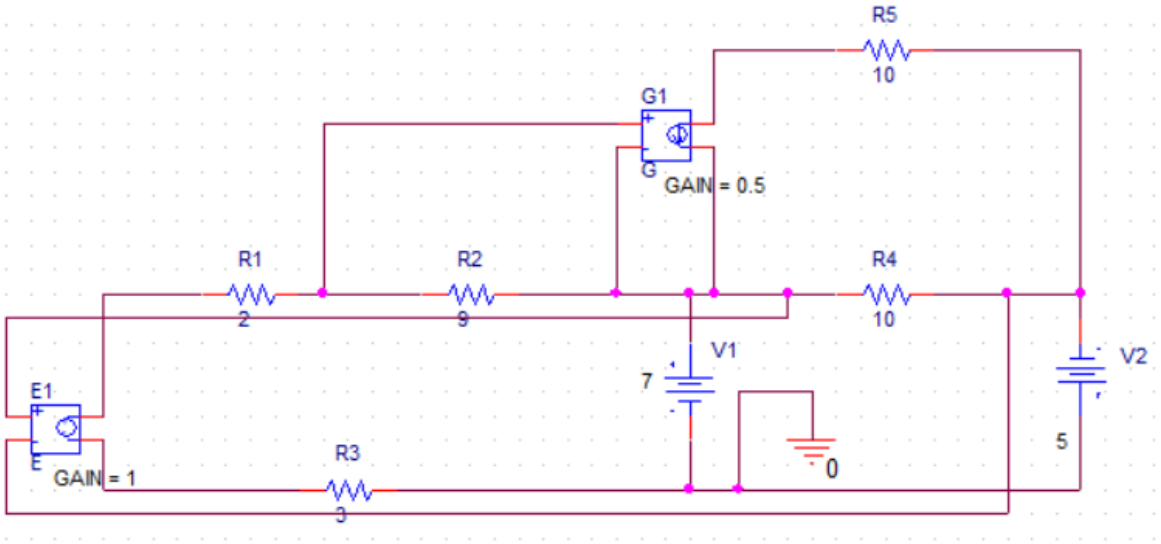
—11— by 7V $= (I_2 - I_1)7 = 5.348W$

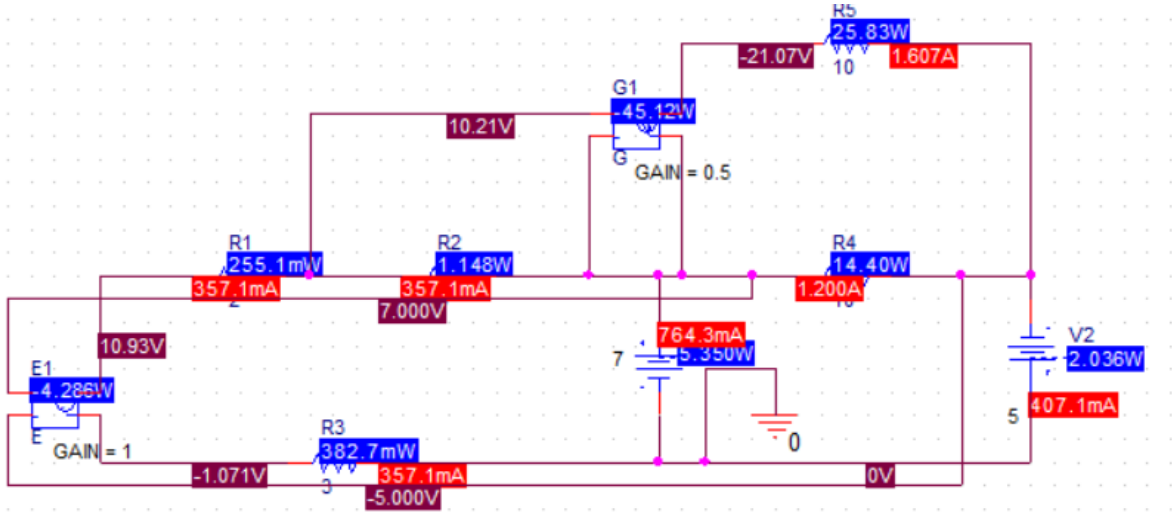
—11— by V_x source $= (I_3 - I_2)10 \times I_1$

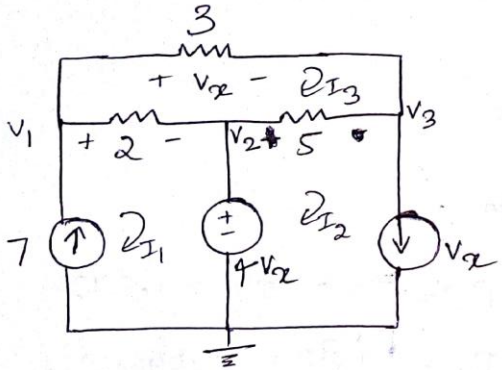
$= -4.286W$

—11— by $0.5V_y$ source $= 0.5V_y \times (I_3 \times 10 + (I_3 - I_2)10)$

$= -45.12W$


R5
10
G1
G
GAIN = 0.5
R1
2
R2
9
R4
10
V1
7
V2
5
E1
E
GAIN = 1
R3
3
0


R5
25.83W
-21.07V
10
1.607A
G1
-45.12W
10.21V
G
GAIN = 0.5
R1
255.1mW
357.1mA
2
R2
1.148W
357.1mA
7.000V
R4
14.40W
1.200A
10.93V
764.3mA
7
5.350W
V2
2.036W
E1
-4.286W
E
GAIN = 1
R3
382.7mW
-1.071V
357.1mA
3
-5.000V
0
0V
5
407.1mA



$I_1 = 7A$

$I_2 = V_x = 3I_3$

$3I_3 + (I_3 - I_2)5 + (I_3 - I_1)2 = 0$

$3I_3 - 10I_3 + 2I_3 = 14$

$-5I_3 = 14$

$I_3 = \frac{-14}{5} = -2.8A$

power dissipated by $3\Omega = 3 \times (2.8)^2 = 23.52$ watts.

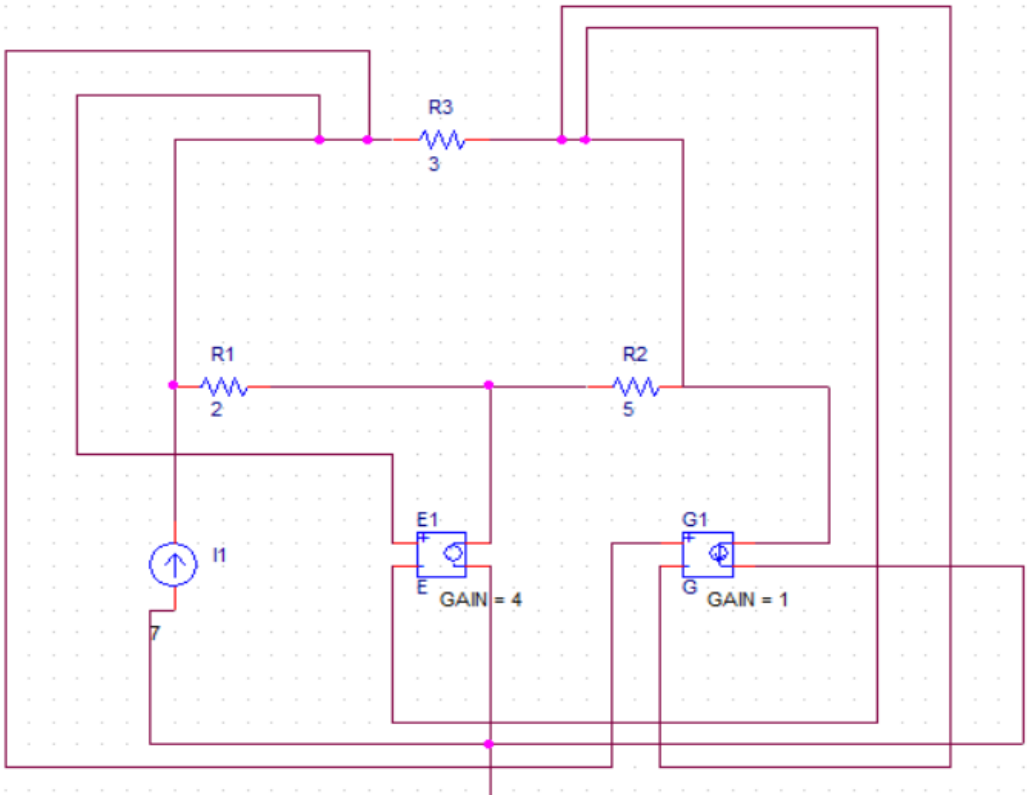
—11— $2\Omega = 2 \times (9.2)^2 = 169.10$ watts

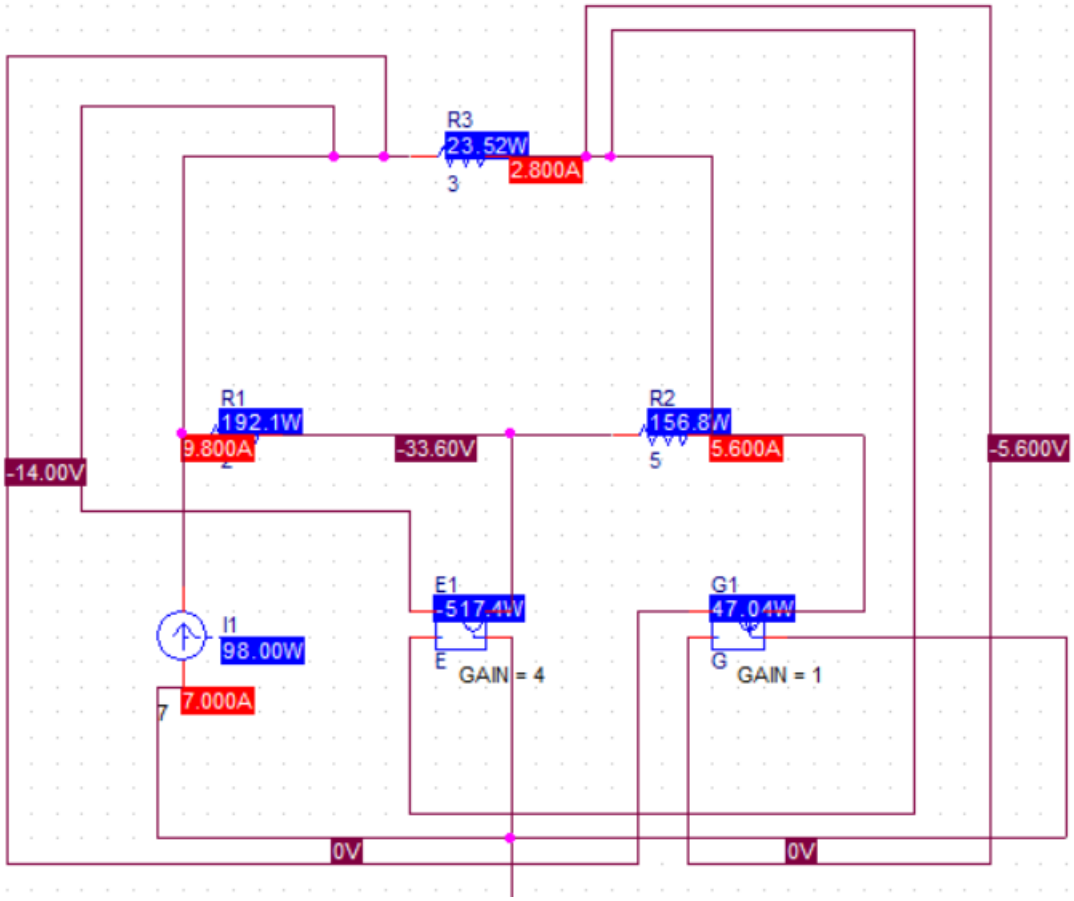
—11— $5\Omega = 5 \times 31.36 = 156.8$ watts

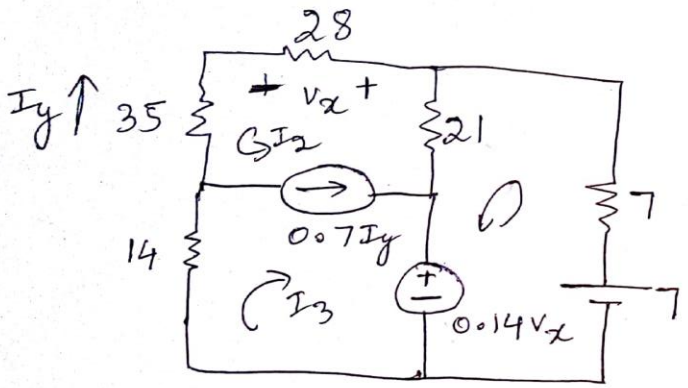
Power delivered by 7A source $= \left(2(I_1 - I_3) + 4 \times 3 \times I_3\right) \times 7 = 98$ w

Power delivered by $4V_x$ source $= 4V_x \times (I_1 - I_2) = -517.4$ w

Power delivered by V_x source $= \left((I_2 - I_3)5) + 4V_x\right) I_2 = 47.04$ w


R3
3
R1
2
R2
5
E1
E
GAIN = 4
G1
G
GAIN = 1
I1
7


R3
23.52W
2.800A
3
R1
192.1W
9.800A
2
-33.60V
R2
156.8W
5.600A
5
-14.00V
-5.600V
E1
-517.4W
E
GAIN = 4
G1
47.04W
G
GAIN = 1
I1
98.00W
7.000A
7
0V
0V



$$0.14V_x = 28I_2 \times 0.14$$

$$7 = 28I_1 - 17.08I_2$$

$$I_3 + I_2 = 0.7I_y$$

$$I_3 = -1.7I_2$$

$$7I_1 + 86.8I_2 = 7$$

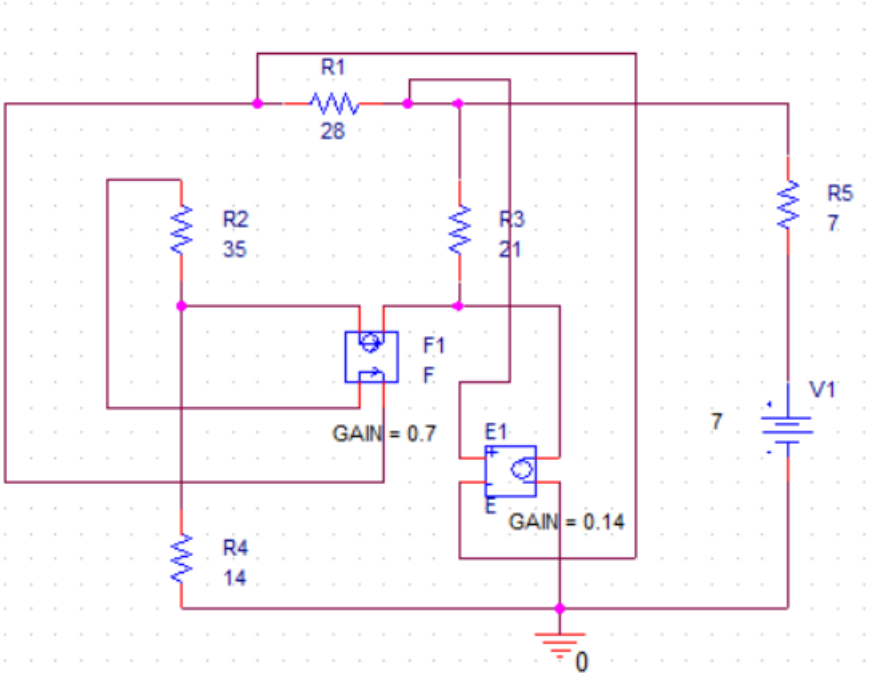
$$I_1 = 0.285\ A$$
$$I_2 = 0.0576A$$
$$I_3 = -0.09792A$$

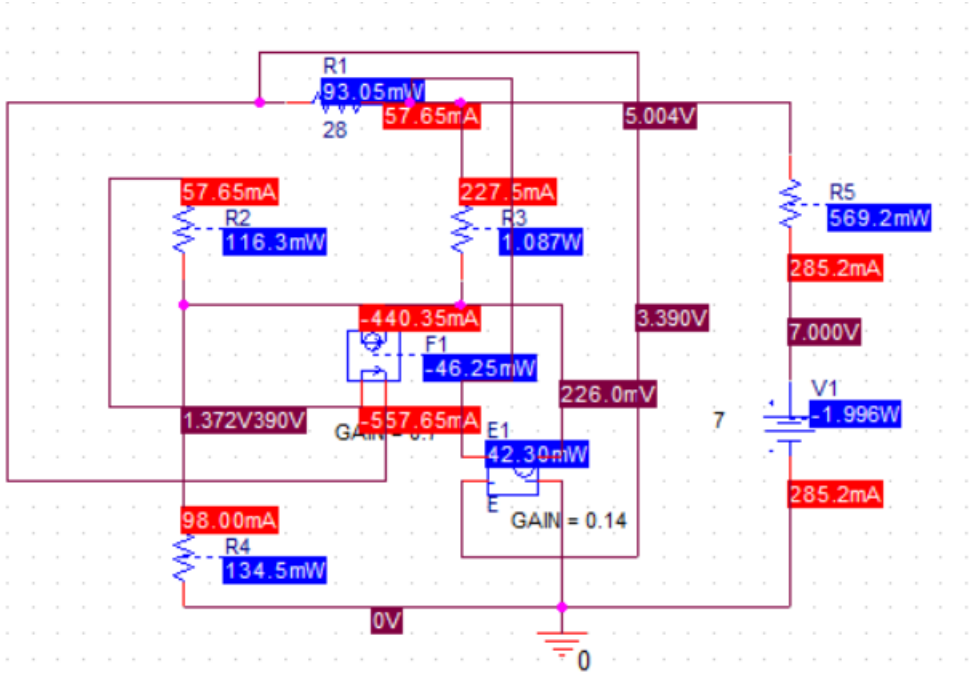
$$P_{7\Omega} = I_2^2 \times 7 = 569.2mW$$
$$P_{21} = (I_1 - I_2)^2 \times 21 = 1.087W$$
$$P_{28} = I_2^2 \times 28 = 93.05mW$$
$$P_{35} = I_2^2 \times 35 = 116.3mW$$
$$P_{14} = I_3^2 \times 14 = 134.5mW$$

$$P_{0.14V_x} = (I_1 - I_3) \times 0.14V_x = 42.30mW$$

$$P_{0.7I_y} = (I_2 + I_3)(-14I_3 - 0.14V_x) = -46.25mW$$

$$P_{7V} = 7 \times 0.285 = -1.996W$$


R1
28
R2
35
R3
21
R5
7
F1
F
GAIN = 0.7
E1
E
GAIN = 0.14
V1
7
R4
14
0


R1
93.05mW
57.65mA
28
5.004V
57.65mA
R2
116.3mW
227.5mA
R3
1.087W
R5
569.2mW
285.2mA
-440.35mA
3.390V
F1
-46.25mW
7.000V
226.0mV
V1
-1.996W
1.372V390V
-557.65mA
E1
42.30mW
7
285.2mA
98.00mA
R4
134.5mW
GAIN = 0.14
0V
0