ENGG104 Tutorial 4 Class Questions

Team Name: _____

Question 1

Which resistors are in series and which are in parallel?

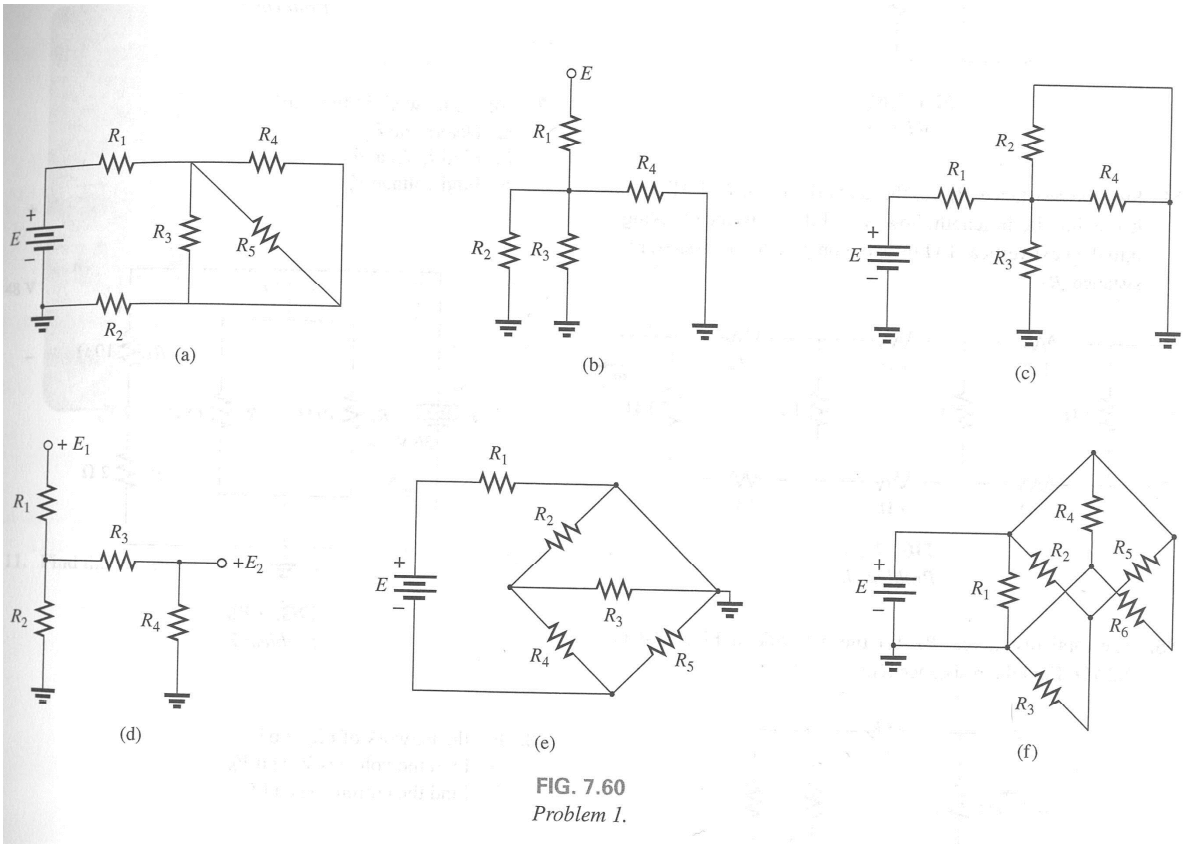

FIG. 7.60
Problem 1.

1. a. R_1, R_2,. and E are in series; R_3, R_4 and R_5 are in parallel
   b. E and R_1 are in series; R_2, R_3 and R_4 are in parallel.
   c. E and R_1 are in series; R_2, R_3 and R_4 are in parallel.
   d. E_1 and R_1 are in series; E_2 and R_4 in parallel.
   e. E and R_1 are in series, R_2 and R_3 are in parallel.
   f. E, R_1, R_4 and R_6 are in parallel; R_2 and R_5 are in parallel.

Question 2 [Past exam question]

For the network in Fig. 7.71:

a. Find currents I_s, I_2, and I_6.

b. Find voltages V_1 and V_5.

c. Find the power delivered to the 3 kΩ resistor.

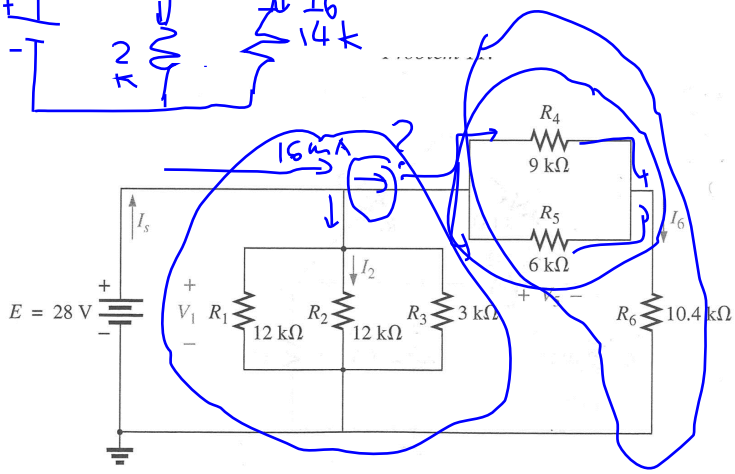

FIG. 7.71

a. $R_T = (R_1 \parallel R_2 \parallel R_3) \parallel (R_6 + R_4 \parallel R_5)$

$= (12\ \text{k}\Omega \parallel 12\ \text{k}\Omega \parallel 3\ \text{k}\Omega) \parallel (10.4\ \text{k}\Omega + 9\ \text{k}\Omega \parallel 6\ \text{k}\Omega)$

$= (6\ \text{k}\Omega \parallel 3\ \text{k}\Omega) \parallel (10.4\ \text{k}\Omega + 3.6\ \text{k}\Omega)$

$= 2\ \text{k}\Omega \parallel 14\ \text{k}\Omega = 1.75\ \text{k}\Omega$

$$I_s = \frac{E}{R_T} = \frac{28\ \text{V}}{1.75\ \text{k}\Omega} = \mathbf{16\ mA}, \quad I_2 = \frac{E}{R_2} = \frac{28\ \text{V}}{12\ \text{k}\Omega} = \mathbf{2.33\ mA}$$

$R' = R_1 \parallel R_2 \parallel R_3 = 2\ \text{k}\Omega$

$R'' = R_6 + R_4 \parallel R_5 = 14\ \text{k}\Omega$

$$I_6 = \frac{R'(I_s)}{R' + R''} = \frac{2\ \text{k}\Omega(16\ \text{mA})}{2\ \text{k}\Omega + 14\text{k}\Omega} = \mathbf{2\ mA}$$

b. $V_1 = E = \mathbf{28\ V}$

$R' = R_4 \parallel R_5 = 6\ \text{k}\Omega \parallel 9\ \text{k}\Omega = 3.6\ \text{k}\Omega$

$V_5 = I_6 R' = (2\ \text{mA})(3.6\ \text{k}\Omega) = \mathbf{7.2\ V}$

c. $P = \dfrac{V_{R_3}^2}{R_3} = \dfrac{(28\ \text{V})^2}{3\ \text{k}\Omega} = \mathbf{261.33\ mW}$

Question 3

8. Convert the current sources in Fig. 8.104 to voltage sources.

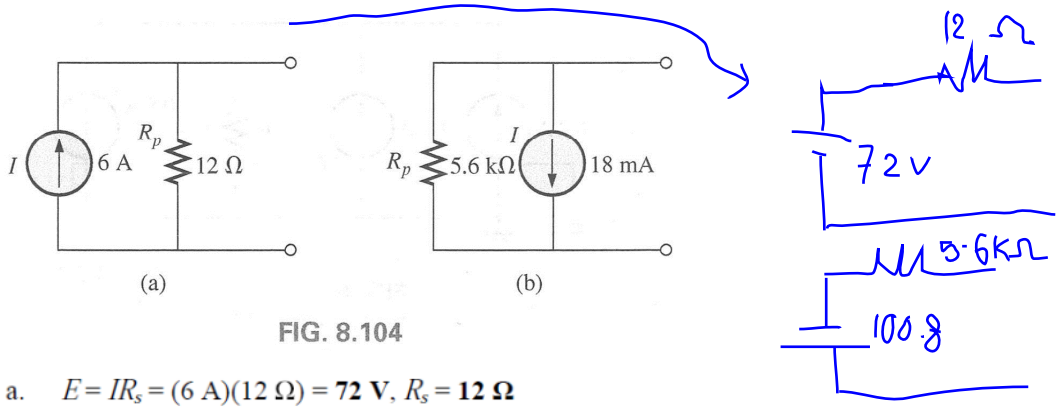

FIG. 8.104

a. $E = IR_s = (6\text{ A})(12\ \Omega) = \mathbf{72\ V}$, $R_s = \mathbf{12\ \Omega}$

b. $E = IR_s = (18\text{ mA})(5.6\text{ k}\Omega) = \mathbf{100.8\ V}$, $R_s = \mathbf{5.6\ k\Omega}$

Question 4 [typical exam question]

6. For the network in Fig. 8.102:

a. Find the currents I_1 and I_s.

b. Find the voltages V_s and V_3.

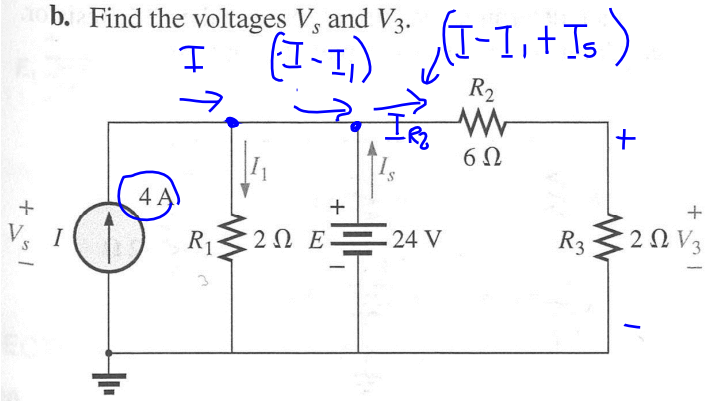

FIG. 8.102
Problem 6.

a. $I_1 = \dfrac{E}{R_1} = \dfrac{24\text{ V}}{2\ \Omega} = \mathbf{12\ A}$, $I_{R_2} = \dfrac{E}{R_2 + R_3} = \dfrac{24\text{ V}}{6\ \Omega + 2\ \Omega} = \dfrac{24\ \Omega}{8\ \Omega} = 3\text{ A}$

KCL: $I + I_s - I_1 - I_{R_2} = 0$

$I_s = I_1 + I_{R_2} - I = 12\text{ A} + 3\text{ A} - 4\text{ A} = \mathbf{11\ A}$

b. $V_s = E = 24\text{ V}$

VDR: $V_3 = \dfrac{R_3 E}{R_2 + R_3} = \dfrac{2\ \Omega(24\text{ V})}{6\ \Omega + 2\ \Omega} = \dfrac{48\text{ V}}{8\ \Omega} = \mathbf{6\ V}$

Question 5 [Typical exam question]

42. **a.** Write the nodal equations using the general approach for the network of Fig. 8.126.

b. Find the nodal voltages using determinants.

c. What is the total power supplied by the current sources?

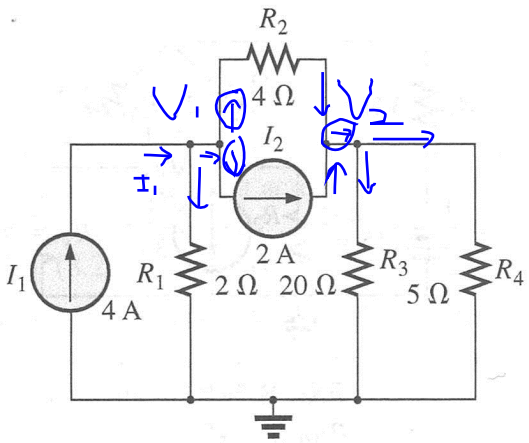

FIG. 8.126

a. V_1 V_2

At V_1: $\Sigma I_i = \Sigma I_o$

$$4\text{ A} = \left(\frac{V_1}{2\ \Omega}\right) + \left(\frac{V_1 - V_2}{4\ \Omega}\right) + (2\text{ A})$$

Ar V_2: $\Sigma I_i = \Sigma I_o$

$$(2\text{ A}) + \left(\frac{V_1 - V_2}{4\ \Omega}\right) = \left(\frac{V_2}{20\ \Omega}\right) + \left(\frac{V_2}{5\ \Omega}\right)$$

or $$V_1\left[\frac{1}{2} + \frac{1}{4}\right] - V_2\left[\frac{1}{4}\right] = 2$$

$$-V_1\left[\frac{1}{4}\right] + V_2\left[\frac{1}{4} + \frac{1}{20} + \frac{1}{5}\right] = 2$$

b. $V_1 = \mathbf{4.8\ V}$, $V_2 = \mathbf{6.4\ V}$

c. I_1: $P = V_1 I_1 = (4.8\text{ V})(4\text{ A}) = \mathbf{19.2\ W}$

I_2: $P = |(V_1 - V_2) I_2| = |(4.8\text{ V} - 6.4\text{ V})(2\text{ A})| = \mathbf{3.2\ W}$

$P = IV$

$P = \frac{V^2}{R}$

$P = I^2 R$