**ENGR 201 Help Session Jan 29, 2020**

- **Power & Energy**
  - 2 (a) 
    - \( P = \frac{dW}{dt} \Rightarrow W = \int_{t_0}^{t} P(t) \, dt \)

- **Higher & lower potentials**
  - Node voltage method

- **\( \Delta V \)**

- **Passive sign convention**
  - \( P = vi \geq 0 \)
    - absorbed power
    - \( P = vi \leq 0 \)
    - supplied power
  - Absorbed power = - Supplied power

- **dissipated, absorbed**

- **generated, supplied, developed**

2 (a) **power absorbed by the voltage-controlled current source**

\[ P = V_i = 2 \times (-2) = -4 \text{W} \]

\[ 2A \rightarrow -2A \]

Power supplied by the VCCS? \( 4 \text{W} \)

\[ v = 2v = iR \]

\[ -v_1 + v_2 = 0 \]

\[ v_1 = v_2 \]
b) Energy consumed by a 1000W room heater in 1 hour
\[ W = \int_{t_0}^{t} p(t) \, dt = P \,(A \cdot t) = 1000W \cdot (3600)s \]

\[ E(J) = 3600 \, 000 \, \text{J} \]

\[ Y - \Delta \]
\[ R_{ae} = R_1 + R_3 \]

\[ R_z = \frac{R_x \cdot R_y' + R_x \cdot R_z' + R_y \cdot R_z'}{R_z'} \]
\[ R_y = \frac{R_x \cdot R_y' + R_x \cdot R_z' + R_y \cdot R_z'}{R_y'} \]
\[ R_z = \frac{R_x \cdot R_y' + R_x \cdot R_z' + R_y \cdot R_z'}{R_x} \]

\[ \frac{9 \times 9}{27} = 3 \Omega \]
\[ R_y = \frac{R_a}{3} \]
Node voltage (nodal) analysis

\[ \text{KCL at node 1} \]
\[-I_5 + I_1 = 0 \]

\[ \text{KCL at node 2} \]
\[-I_1 + I_2 + I_a = 0 \]

\[ \text{KCL at node 3} \]
\[-I_a + I_3 + I_4 = 0 \]

\[ \text{KCL at node 4} \]
\[-I_5 - 2I_a = 0 \quad \text{or} \quad I_4 + 2I_a = 0 \]

\[ -I_5 + \frac{(V_1-V_2)}{R_1} = 0 \]

\[ -\frac{(V_1-V_2)}{R_1} + \frac{V_2}{R_2} + \frac{V_2-V_3}{R_3} = 0 \]

\[ -\frac{(V_2-V_3)}{R_3} + \frac{V_3}{R_4} + \frac{V_2-V_4}{R_5} = 0 \]

\[ -\frac{(V_2-V_3)}{R_5} - 2\left(\frac{V_2-V_3}{R_3}\right) = 0 \]