ECE 222

Voltage (inductor):	$v = L\frac{di}{dt}$
Current over time:	$i(t) = \frac{1}{L}\int_{t0}^{t} v(t)dt + i(t_0)$
Current (capacitor):	$i = C\frac{dv}{dt}$
Voltage over time:	$v(t) = \frac{1}{C}\int_{t0}^{t} i(t)dt + v(t_0)$
Energy:	$W(t) = \frac{1}{2}Cv^2(t) = \frac{1}{2}Li^2(t)$
Capacitance (Series):	$C_{eq} = (\frac{1}{C_1} + \frac{1}{C_2})^{-1}$
Capacitance (Parallel):	$C_{eq} = C_1 + C_2$
Capacitance:	$C = \frac{\epsilon A}{d}$
Dielectric Constant:	$\epsilon = 8.85 \times 10^{-12} F/m$
Stored Charge:	$q = Cv$
Inductance (Series):	$L_{eq} = L_1 + L_2$
Inductance (Parallel):	$L_{eq} = \left(\frac{1}{L_1} + \frac{1}{L_2}\right)^{-1}$

General Transient Solution: $x(t) = x_f + [\, x_0 - x_f] \, e^{-t/\tau}$

- For RC network:
  $x(t) = v_C(t)$, the capacitor voltage
  ⇨ $x_0 = v_C(0)$ (initial voltage value) and
  $x_f = v_C(\infty)$ (final voltage value)
  Time constant: $\tau = RC$
  The initial condition response only is given by: $v_C(t) = v_C(0)e^{-t/\tau}$

- For RL network:
  $x(t) = i_L(t)$, the inductor current
  ⇨ $x_0 = i_L(0)$ (initial current value) and
  $x_f = i_L(\infty)$ (final current value)
  Time constant: $\tau = \frac{L}{R}$
  The initial condition response only is given by: $i_L(t) = i_L(0)\, e^{-t/\tau}$