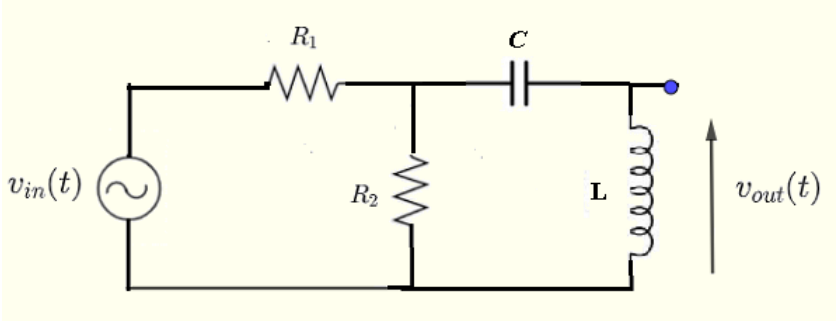
# SFWR ENG 3DX4 – Assignment 1

1. Consider the following circuit:




Let $R_1 = 40\ \Omega$, $R_2 = 20\ \Omega$, $L = 10\ mH$, and $C = 1\ \mu F$. The input is $v_{in}$ and the output is $v_{out}$. Give both the transfer function and a state space representation for the system.

2. A system has state space representation given by:

$$A = \begin{bmatrix} 0 & 1 & 1 \\ 0 & 0 & 1 \\ 8 & -2 & -3 \end{bmatrix},$$

$$B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix},$$

$$C = [3\ \ -3\ 0],$$

and $D = 0$.

   (a) Determine the transfer function for this system.

   (b) Give a different state space representation that yields the same transfer function.

   (c) Give the output response $c(t)$ when the input response $r(t)$ is a unit step function.

   (d) Is the output response stable?