VE215 2025SU Assignment 4

Due Date: 23:59, June.26th, 2025
In order to get full marks, you shall write all the intermediate steps of calculation or proof, unless otherwise indicated. **Please box your answers.**

Exercise 4.1(15%)
For the following 1st order circuit, find the value of the output voltage V_0 for all t.

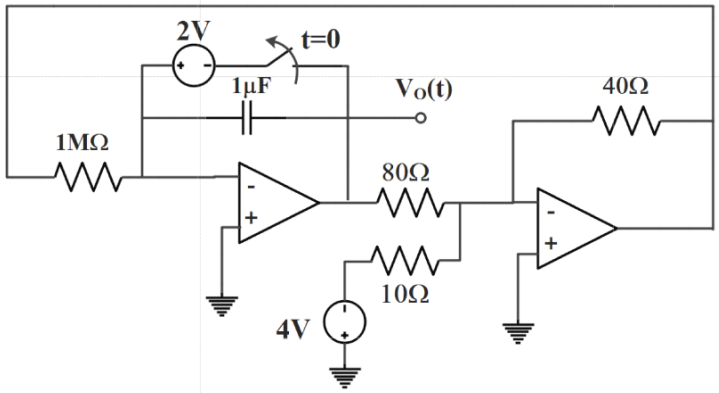

Figure 1: Exercise4.1

Exercise 4.2(25%)
In the circuit below, suppose both resistors have the same resistance of R and all the inductors have the same inductance of L. The power supply provides a voltage equal to R at $t < 0$ and suddenly turns off at $t = 0$.

(a) (15%)Suppose $R = L$, please calculate the mathematical expression of $I_x(t)$.

(b) (10%)Could we select the appropriate R and L to make the circuit working in under-damped condition? (R and L may not equal) Please prove your opinion.

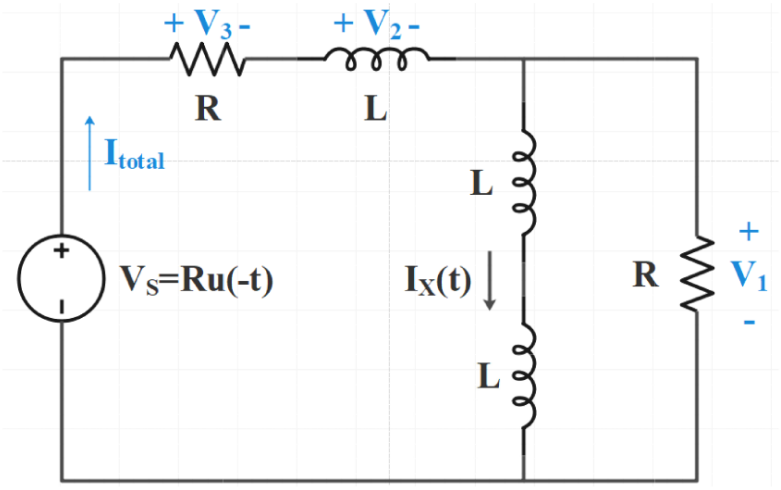

Figure 2: Exercise4.2

Exercise 4.3(25%)For the op-amp circuit shown below, the switch is connected to the branch connected with a 3Ω resister and a $24V$ independent voltage source at $t < 0$, and it is switched to the branch connected with a 8Ω resister and a $20V$ independent voltage source at $t \geq 0$.

(a) (10%)Find $v(t)$ for $t < 0$.

(b) (15%)Find $v(t)$ for $t > 0$.

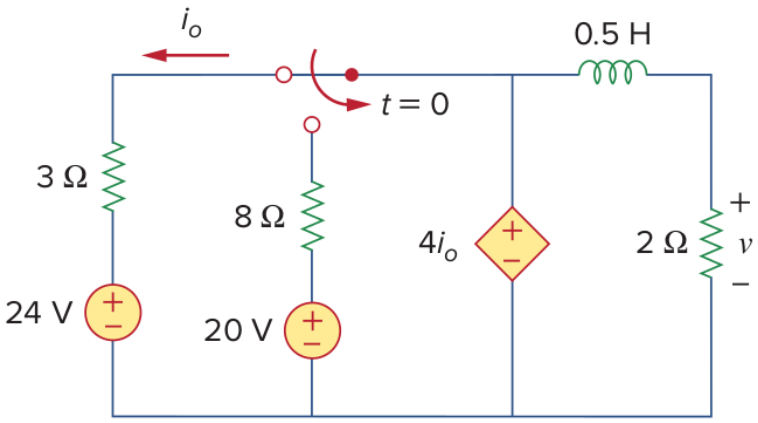

Figure 3: Exercise4.3

Exercise 4.4(15%)For the circuit shown below, please:

(a) (5%)Draw the equivalent cirrcuit at $t < 0$ and find $v(0^+)$ and $i(0^+)$

(b) (5%)Draw the equivalent cirrcuit at $t > 0$ and find $\frac{dv(0^+)}{dt}$ and $\frac{di(0^+)}{dt}$.

(c) (5%)Draw the equivalent cirrcuit at $t = \infty$ and find $v(\infty)$ and $i(\infty)$.

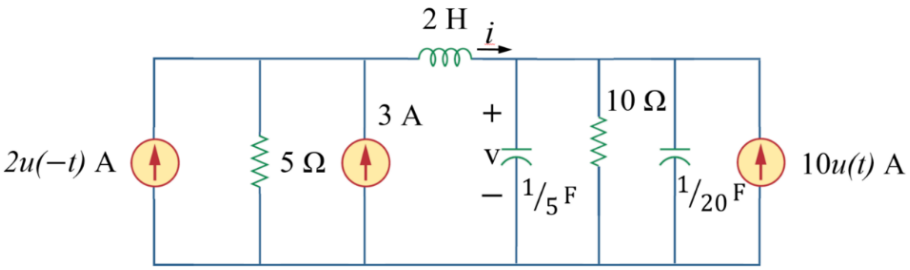

Figure 4: Exercise4.4

Exercise 4.5(20%)The input current source of the following circuit is $2(1-u(t))A$.

(a) (5%)Construct the dual of the circuit below.

(b) (15%)Find $i(t)$ for $t > 0$.

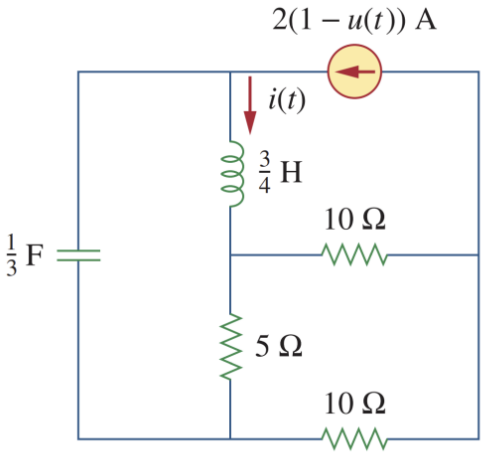

Figure 5: Exercise4.5