VE215 2025SU Assignment 1

Due Date: 23:59, May.29th, 2025

In order to get full marks, you shall write all the intermediate steps of calculation or proof, unless otherwise indicated.

Exercise 1.1 (15%) The voltage v(unit:V) across a device and the current i (unit:A) through it are

$$v(t) = 10 \cos \frac{\pi t}{2} + 10 \quad i(t) = \begin{cases} 0 & t < 0 \\ -10t^2 + 20t & 0 \leq t < 1 \\ 10e^{-t+1} & 1 \leq t < \ln 2 + 1 \\ 5 & t \geq \ln 2 + 1 \end{cases}$$

(a)(5%) Calculate the total charge in the device at t = 1.5 s.

(b)(5%) Calculate the power delivered to the element at $t = 1.5$ s.

(c)(5%) Calculate the energy delivered to the device between 3 and 5 s.

Exercise 1.2 (25%) In the circuit below, all resistors have a resistance of R.
(a) (12%)Determine the number of branches, nodes, loops, and meshes. Write your answers directly.
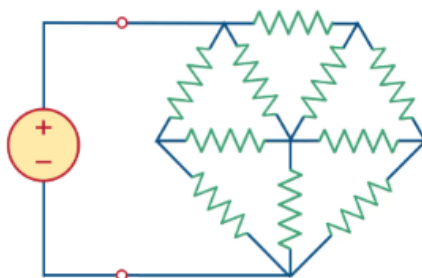(b) (13%)Calculate the equivalent resistance between the terminals.

Figure 1: Exercise 1.2

Exercise 1.3(25%) Solve the following questions with the given methods.
(a) (10%) Calculate the unknown current I_x using mesh analysis.
(b) (15%) Calculate the unknown voltage V_x using nodal analysis.

Figure 2: Exercise 1.3

Exercise 1.4(20%)Solve the following questions with the given methods.

(a)(10%)Using nodal analysis **by inspection**, find V_1, V_2, V_3 and V_0 in the following circuit.
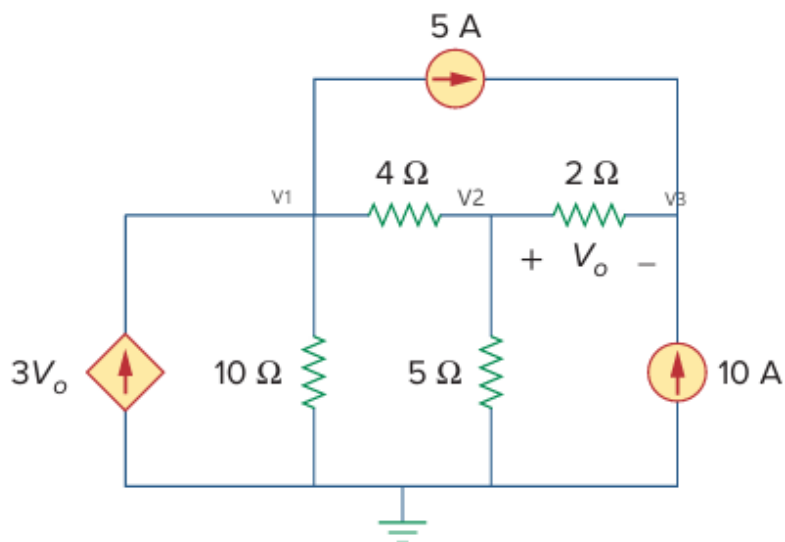

Figure 3: Exercise1.4(a)

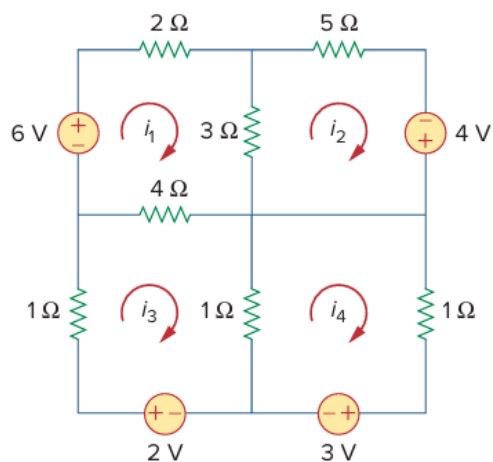(b)(10%)Using mesh analysis **by inspection** to solve the mesh currents in the following circuit.

Figure 4: Exercise1.4(b)

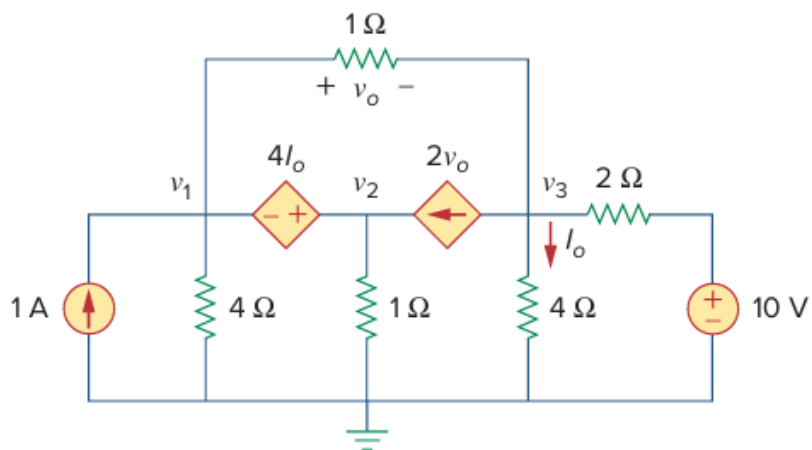**Exercise 1.5**(15%)For the circuit below, find the node voltages v_1, v_2, v_3.

Figure 5: Exercise 1.5