Experiment 1.1

Objective
In this exercise we should learn how a resistor works and what its purpose is; how a resistor influences the voltage and the current, and the other way around.

Results and procedure
To find out what resistance a resistor has we looked at its colour coding, and calculated the resistance from there (brown, green, orange, gold = $15k\Omega$ with 5% tolerance) After identifying the resistor, it is smart to check if it actually works or not. This can be done by measuring the resistance with a multimeter.

- Measurement on a $15k\Omega$ resistor shows: $14.98k\Omega$

Conc. Looking at the colour coding we could see that the resistor has a tolerance of 5%. Hence, the measured value is perfectly acceptable. In order to see how the resistor influences the current we set the voltage to 5V. To measure the voltage in the circuit, the multimeter was connected in parallel. To measure the current we put the multimeter in series. On the side, we made calculations to later be able to compare our measurement to the datasheet. The representation of the calculations and the measurements on voltage of 5V can be seen in (table 1).

"Step 2" was repeated, but this time for 11 different voltages ranging from -15 to 15V:

Conclusion

Experiment 1.2

Objective
The objective of this experiment is to learn how to build small circuits with resistors and to get familiar with analysing circuits using "device" and "connection" equations.

Results
Following resistors are given by:

$$R_1 = 15k\Omega \quad R_2 = 22k\Omega \quad R_3 = 33k\Omega \quad R_4 = 10k\Omega$$

a) $R = R_1 + R_2 + R_3 = 15 + 22 + 33 = 70k\Omega$

b) $R = R_1 \parallel R_2 + R_3 = \frac{R_1R_2+R_3(R_1+R_2)}{R_1+R_2} = \frac{330+33\times37}{37} = \frac{330+1221}{37} \cong 41.92k\Omega$

c) $R = (R_1 \parallel R_2) + R_3 = \frac{R_1(R_2+R_3)}{R_1+R_2+R_3} = \frac{15(22+33)}{15+22+33} = \frac{165}{14} \cong 11.8k\Omega$

d) $R = R_1 \parallel R_2 + R_3 \parallel R_4 = \frac{R_1R_2}{R_1+R_2} + \frac{R_3R_4}{R_3+R_4} = \frac{330}{37} + \frac{330}{43} \cong 8.92 + 7.67 \cong 16.59k\Omega$

e) $R = (R_1 + R_2) \parallel (R_3 + R_4) = \frac{(R_1+R_2)(R_3+R_4)}{R_1+R_2+(R_3+R_4} = \frac{37\times43}{80} \cong 19.89k\Omega$

Conclusion

Experiment 1.3

Objective
The objective of this experiment is to get more familiar with KVL and KCL.

Results and procedure
Following values are given:

$$V_a = 5V \quad V_b = 10V \quad R_1 = 22k\Omega \quad R_2 = 33k\Omega \quad R_3 = 10k\Omega$$

Calculations were made using KCL to find all the independant equasions for the current:

$$i_1 = \frac{5 \times 33 \times 10^3 + 5 \times 10^3 - 10 \times 10^3}{22 \times 10^6 \times 33 + 33 \times 10 \times 10^6 + 22 \times 10 \times 10^6} = \frac{-115}{1276 \times 10^3} \cong -0.09mA$$
$$i_2 = \frac{(5 \times 10 + 10 \times 22) \times 10^3}{1276 \times 10^6} \cong 0.2mA$$
$$i_3 = \frac{(10 \times +10 \times 22 - 5 \times 33) \times 10^3}{1276 \times 10^6} = \frac{385}{1276 \times 10^3} \cong 0.3mA$$

Using KVL following voltages were determined:

$$V_1 = I \times R = -0.09 \times 22 = -1.98V$$
$$V_2 = 0.2 \times 33 = 6.6V$$
$$V_3 = 0.3 \times 10 = 3V$$

Conclusion

Experiment 1.4

Objective
The objective of this experiment is to use use superposition to analyse the circuit.

Results
Following values are given:

$$V = 5V(With\,max\,current\,60mA) \quad I = 60mA(With\,max\,voltage\,3V) \tag{1}$$

$$R_1 = 180\Omega \quad R_2 = 18\Omega \quad R_3 = 270\Omega \tag{2}$$

The voltage that falls on R_3 is calculated using superposition.

$$e = \frac{R_2}{R_1 + R_2}V + \frac{R_1 R_2}{R_1 + R_2}I = 1.43V \tag{3}$$

Conclusion

Experiment 2.1

Objective

Results and procedure

Conclusion

Experiment 2.2

Objective

Results and procedure

Conclusion

Experiment 2.3

Objective

Results and procedure

Conclusion

Experiment 3.1

Objective

Results and procedure

Conclusion

Experiment 3.2

Objective

Results and procedure

Conclusion

Experiment 3.3

Objective

Results and procedure

Conclusion

Experiment 4.1

Objective

Results and procedure

Conclusion

Experiment 4.2

Objective

Results and procedure

Conclusion

Experiment 4.3

Objective

Results and procedure

Conclusion