# Intermediate Laboratory: Homework 2

Due: 1 February 2024

Read chapter 3 and complete the following problems.

**1** Taylor, *Error Analysis, 2nd ed.*, 3.2, page 79. *(3.2 in 3rd ed.)*

**2** Taylor, *Error Analysis, 2nd ed.*, 3.6, page 80. *(3.8 in 3rd ed.)*

**3** Taylor, *Error Analysis, 2nd ed.*, 3.20, page 82. *(3.24 in 3rd ed.)*

**4** Taylor, *Error Analysis, 2nd ed.*, 3.22, page 83. *(3.26 in 3rd ed.)*

**5** Taylor, *Error Analysis, 2nd ed.*, 3.28, page 85. *(3.32 in 3rd ed.)*

**6 Battery properties**

The experiment done to determine the EMF and internal resistance of a battery plots $1/V$ versus $1/R$. The data yields

$$\text{intercept} = 0.6578 \pm 0.0011\,\text{V}^{-1}$$
$$\text{slope} = 0.296 \pm 0.006\,\Omega\ \text{V}^{-1}$$

a) Determine the EMF for the battery, including an uncertainty.

b) Determine the internal resistance for the battery, including an uncertainty.

**7 Parallel resistors**

The effective resistance of two resistors in parallel is given via

$$\frac{1}{R_{\text{eff}}} = \frac{1}{R_1} + \frac{1}{R_2}$$

where $R_1$ and $R_2$ are the resistances of the two resistors. Suppose that you are given two resistors whose stated resistances are $220\,\Omega \pm 5\%$ and $100\,\Omega \pm 8\%$. The aim of this exercise will be to compute that effective resistance of the combination plus its uncertainty.

a) Rearrange the rule for effective resistance to give

$$R_{\text{eff}} = \text{formula involving } R_1 \text{ and } R_2.$$

b) Determine the effective resistance of the combination and the error in this. Use these to state the effective resistance of the combination completely.