Experimental General Physics for Engineers II

**Laboratory Report** PHYS 194 summer 2022

Section: L01\_\_\_\_\_

Experiment name: RC dc circuit

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| Table of results (1.25 pts) |  |
| Graph (1.25 pts) |  |
| Data analysis (2 pts) |  |
| Discussion (0.5 pt) |  |
| References |  |
| Others |  |
| **Report Grade (5 pts)** |  |

1. Table of results, charging the capacitor (Put correct units in the tables)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| (µ ampere) |  | (I in µ ampere) | (I in µ ampere) | (sec) | (sec) |
| 60 | ±1 | 4.094 | ±0.02 | 0 | ±0.01 |
| 50 | ±1 | 3.912 | ±0.02 | 14.34 | ±0.01 |
| 40 | ±1 | 3.689 | ±0.03 | 31.98 | ±0.01 |
| 30 | ±1 | 3.401 | ±0.03 | 55.67 | ±0.01 |
| 20 | ±1 | 2.996 | ±0.05 | 89.42 | ±0.01 |
| 10 | ±1 | 2.303 | ±0.1 | 149.92 | ±0.01 |

1. Graph of versus

Insert the graph here (don’t forget error bars)

1. Data analysis
   1. Theoretical value of time constant and its propagated error

𝜏= RC

R= 30 KΩ ± 300 Ω

C= 2200 µF ± 100 µF

𝜏 = (30x103) \* (2200\*10-6) = **66 sec**

U(𝜏)= sqrt ((d(RC)/d(R) \*U(R)) ^2 + (d(RC)/d(C) \*U(C)) ^2)

= sqrt (((2200\*10-6) \*300)2 + (30x103 \* 0.0001)2) = **± 3 sec**

* 1. Calculation of the propagated error on

Show how you calculate

U(I) is directly measured which is ±1

First row,

U(ln(I)) = sqrt((d(ln(I)/d(I) \* U(I))2) = sqrt ((U(I)/I)2) = sqrt ((1/60)2) = **±0.02** (I in µ ampere)

* 1. Slope of the graph intercept and their uncertainties\

**Slope** = -0.01194 (sec-1)

**U(Slope)** = ±0.000122 (sec-1)

**Intercept** = 4.078634 (I in µ ampere)

**U(Intercept)** = ±0.009312 (I in µ ampere)

* 1. Intercept of the graph and

Compare the value of the initial current you obtain from the graph intercept to the one you have used in the table.

Ln(I)= ln(I0) – (1/𝜏) \*t, and Intercept = ln(I0)

eIntercept=I0 =e4.079= 59.06 µ ampere

|Theoretical value-obtained value / Theoretical value | \* 100 = | 60-59.06 / 60 | \*100 = **1.56%**

* 1. The experimental value time constant and its propagated error

Ln(I)= ln(I0) – (1/𝜏) \*t, and Slope =– (1/𝜏)

𝜏 =– (1/ Slope) = -1/-0.01194 = 83.75 sec

U(𝜏) = sqrt ((d(-1/slope) \* U(slope) / d(slope))2)

= sqrt (((1/slope2 \*U(slope))2) = sqrt ((1/-0.012 \* 0.0001)2) = **±1 sec**

* 1. Compare between the experimental and theoretical values of

|theoretical value – obtained value / theoretical value | \*100= |66-83.75/66|\*100 = **29.5%**

1. Discussion

(Give a brief comment on whether your results are in agreement with what was expected or not and mention all the possible sources of error that you may have faced during the experiment).

Results are in agreement with what was expected. The final answer had an error of 29.5% due to some sources of error. These errors included are inaccuracy of human and reaction time while recording the time using the stopwatch. An error also would be on the value and the error of capacitance used. Overall, a successful experiment with an error of 29.5%

References