

# 1 Objective

The objective is to measure the time constant of an RC circuit in order to verify the calculated values [1].

# 2 Equipment Used

- Digital Multimeter
- DC Power Supply
- Resistor:  $20k\Omega$
- Capacitor:  $2,200\mu F$
- Alligator (Clips) Jumper

# 3 Experiment Setup

1. Construct the circuit in Figure 10-1[1].

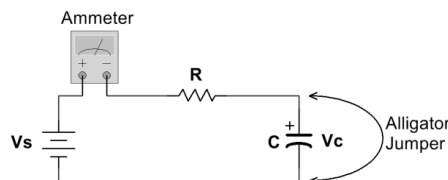


Figure 10-1 Series RC Circuit for Experimental Setup [1]

2. Measure the initial current [1].
3. Calculate the values of  $\tau$  and  $5\tau$  in which  $\tau$  is equal to  $R_{eq}$  times  $C_{eq}$  [1].
4. Collect data by timing the measurements of the current to ever 15 seconds and in order to measure the current remove the alligator clip from the circuit [1].
5. Take measurements every 15 seconds until  $5\tau$  and possibly further [1].
6. Repeat the previous 2 steps for trial 2 [1].
7. Take the average values of the two trials at each measured time [1].
8. Use the average current to calculate the voltage across the resistor [1].
9. Solve the voltage across the capacitor,  $V_c$ , which can be solved fro with the voltage accross the resistor  $V_c = (V_s - V_R)$  [1].

# 4 Results

$\tau = 44$  seconds Initial Current =  $1.745$  mA

$5\tau = 220$  seconds

Table 10-1: Data Table for RC Time Constant [1]

| Time<br>(min:sec) | Current (mA) |          |          | Resistor Volt-<br>age (V) | Capacitor<br>Voltage (V) |
|-------------------|--------------|----------|----------|---------------------------|--------------------------|
|                   | Trial 1      | Trial 2  | Average  |                           |                          |
| 0:00              | 1.745 mA     | 1.745 mA | 1.745 mA | 34.9 V                    | 0 V                      |
| 0:15              | 1.242 mA     | 1.24 mA  | 1.241 mA | 24.82 V                   | 10.08 V                  |
| 0:30              | .901 mA      | .900 mA  | .9005 mA | 18.01 V                   | 16.86 V                  |
| 0:45              | .662 mA      | .666 mA  | .664 mA  | 13.28 V                   | 21.62 V                  |
| 1:00              | .490 mA      | .500 mA  | .495 mA  | 9.9 V                     | 25 V                     |
| 1:15              | .365 mA      | .373 mA  | .369 mA  | 7.38 V                    | 27.52 V                  |
| 1:30              | .277 mA      | .274 mA  | .2755 mA | 5.51 V                    | 29.39 V                  |
| 1:45              | .212 mA      | .207 mA  | .2095 mA | 4.19 V                    | 30.71 V                  |
| 2:00              | .165 mA      | .158 mA  | .1615 mA | 3.23 V                    | 31.67 V                  |
| 2:15              | .125 mA      | .112 mA  | .1185 mA | 2.37 V                    | 32.53 V                  |
| 2:30              | .100 mA      | .092 mA  | .096 mA  | 1.92 V                    | 32.98 V                  |
| 2:45              | .076 mA      | .072 mA  | .074 mA  | 1.48 V                    | 33.42 V                  |
| 3:00              | .062 mA      | .057 mA  | .0595 mA | 1.19 V                    | 33.71 V                  |
| 3:15              | .050 mA      | .045 mA  | .0475 mA | .95 V                     | 33.95 V                  |
| 3:30              | .041 mA      | .036 mA  | .0385 mA | .77 V                     | 34.13 V                  |
| 3:45              | .034 mA      | .029 mA  | .0315 mA | .63 V                     | 34.27 V                  |
| 4:00              | .028 mA      | .024 mA  | .026 mA  | .52 V                     | 34.38 V                  |
| 4:15              | .023 mA      | .020 mA  | .0215 mA | .43 V                     | 34.47 V                  |
| 4:30              | .020 mA      | .016 mA  | .018 mA  | .36 V                     | 34.54 V                  |
| 4:45              | .017 mA      | .014 mA  | .0155 mA | .31 V                     | 34.59 V                  |
| 5:00              | .015 mA      | .012 mA  | .0135 mA | .27 V                     | 34.63 V                  |
| 5:15              | .013 mA      | .010 mA  | .0115 mA | .23 V                     | 34.67 V                  |
| 5:30              | .011 mA      | .009 mA  | .010 mA  | .2 V                      | 34.7 V                   |
| 5:45              | .010 mA      | .008 mA  | .009 mA  | .18 V                     | 34.72 V                  |
| 6:00              | .009 mA      | .007 mA  | .008 mA  | .16 V                     | 34.74 V                  |

## 5 Conclusion

## References

- [1] UNCC ECE Department. Time constant of an rc circuit, 2023. [Online; accessed 21 November 2023].