LAB REPORT 1

Introduction to DSO, Breadboard and RC Circuit

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M24EC2.102: Electronics Workshop-1

Team ID: 23

Due: 29th September 2024

Objective:

To measure the actual time constant of a given RC circuit using a Digital Storage Oscilloscope.

Equipment Needed:

- Breadboard
- Resistors (Various values)
- Capacitors(Various values)
- Digital Storage Oscilloscope (DSO)

Procedure:

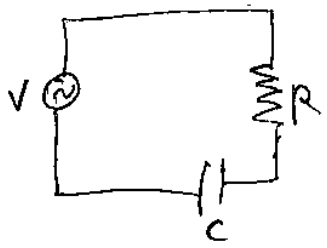
1. Connect the RC circuit on the breadboard as shown in the Ciruit Diagram given below.
2. Apply a square wave using the wave generator option in the DSO.
3. Observe the waveform across the capacitor on the DSO screen.
4. For each combination of R and C:
    a. Calculate the theoretical time constant (τ) using: $\tau = R * C$
    b. Measure the practical time constant from the DSO waveform and the cursors tool.
    c. Calculate the theoretical cutoff frequency (fc) using: $fc = 1 / (2\pi * R * C)$
5. Record your results in an observation table.
6. Repeat steps 4-5 for three different combinations of R and C values.

Observation and Circuit Diagram:

Observation Table

S.No.	R (in Ohms)	C (in μF)	Time Constant (Theoretical)	Time Constant (Practical)	Cutoff Frequency (Theoretical)
1.	380 Ω	0.01 μF (103)	3.8×10^{-6} s	4.3 μs	41.88
2.	4.65 KΩ	0.1 μF (104)	4.65×10^{-4} s	3.72 ms	342.3
3.	1.5 KΩ	0.01 μF (102)	1.0×10^{-5} s	1 ms	2814

Circuit diagram



Calculations:

- **For first combination of R and C:**

$$\tau = R * C$$

$$\tau = (380\ \Omega) * (0.01\mu F)$$

$$\tau = 3.80\ \mu s$$

- **For second combination of R and C:**

$$\tau = R * C$$

$$\tau = (4.65\ K\Omega) * (0.1\mu F)$$

$$\tau = 465\ \mu s$$

- **For third combination of R and C:**

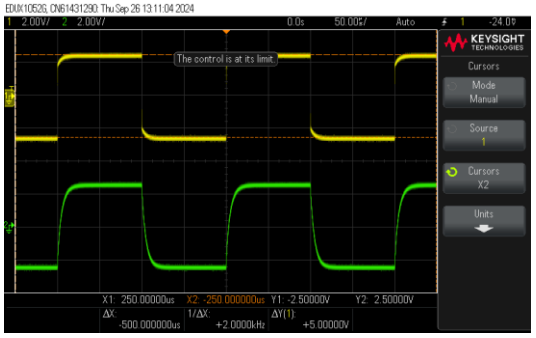
$$\tau = R * C$$

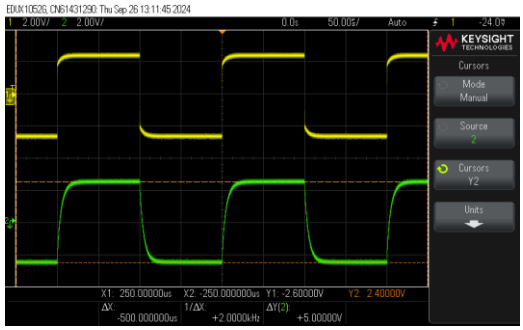
$$\tau = (1\ K\Omega) * (0.01\mu F)$$

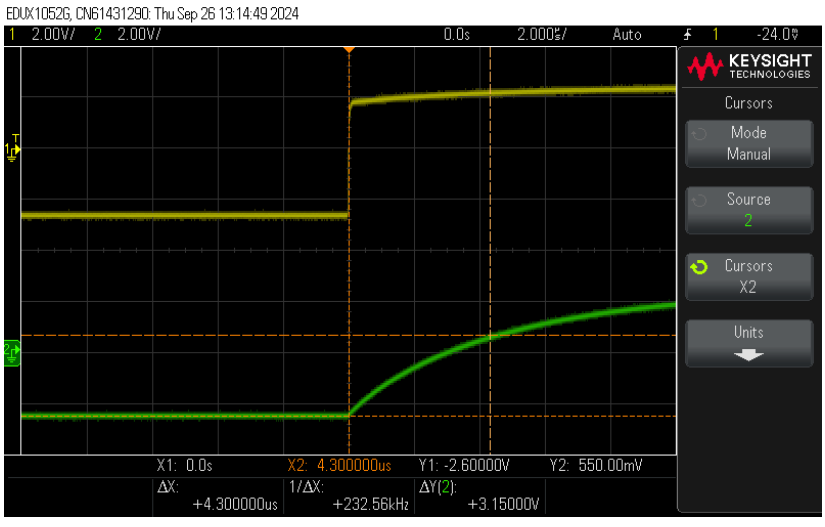
$$\tau = 465\ \mu s$$

<u>Images of Experiment Performed:</u>

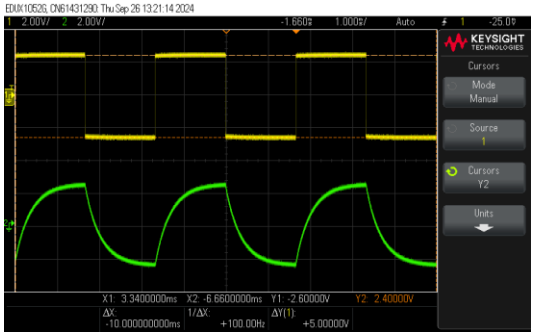
- **For the First Pair of R and C values:**

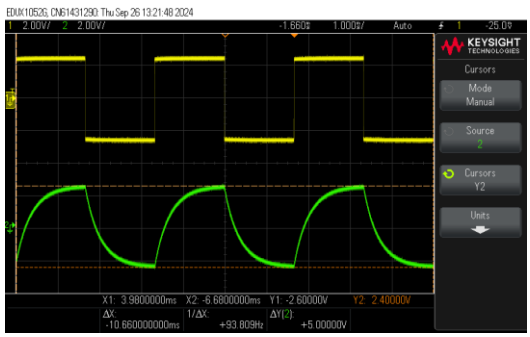


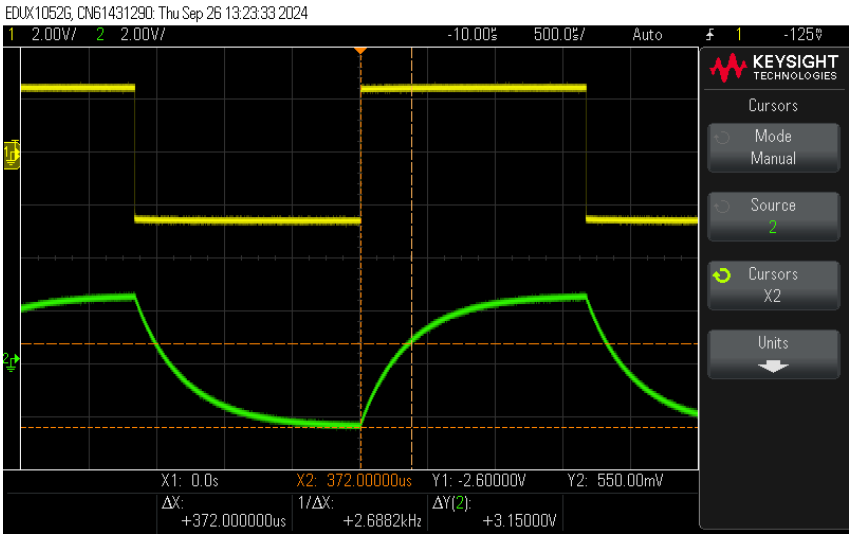




- **For the second Pair of R and C values:**







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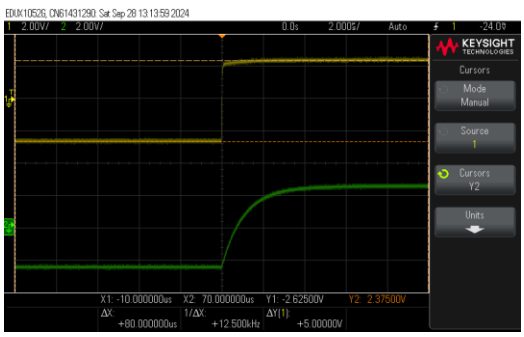
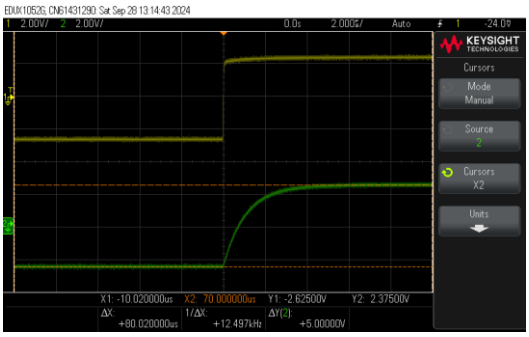
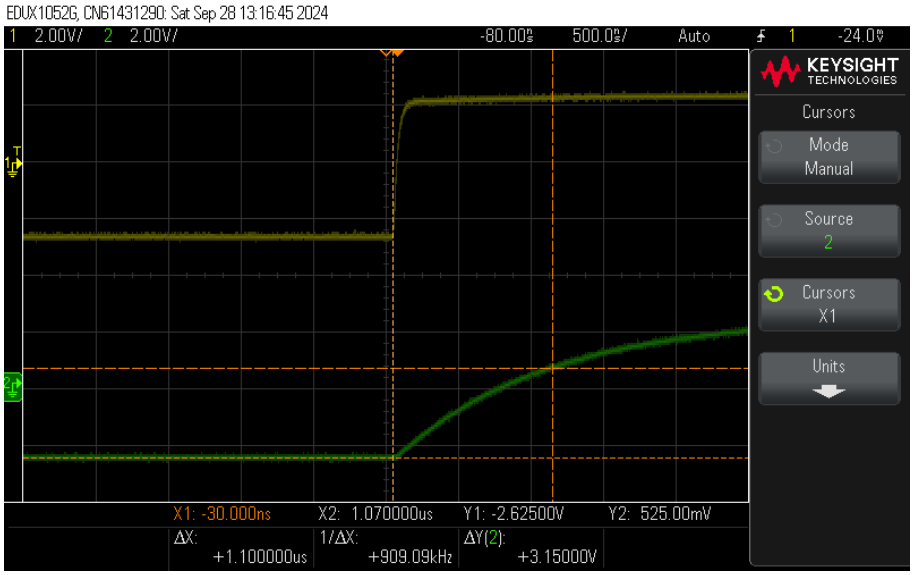
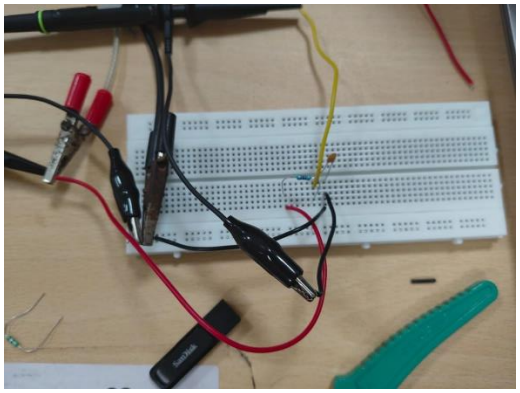
- **For the third Pair of R and C values:**









An RC circuit Implemented on the breadboard

Sources of Error:

- Resistor Tolerance: Resistors can have a slightly different value based on their Tolerance.
- Breadboard connections: Connections might be loose which might induce an error in the actual value of time constant.
- Precision of Cursor tool: Using cursors to measure the time constant introduces some human error due to their limited precision.

Conclusion:

Thus the time constants for different RC circuits have been verified experimentally.