**National Institute Of**

**Technology**

**Goa**

**Assignment**

**Of**

**VLSI Circuit Design**

# Topic: RC circuit Transient and AC response analysis

**Submitted To:**

**Dr. Vasantha M.H.**

**Associate Professor**

**Department of Electronics and Communication Eng.**

## **Name: Sahil Yadav**

## **Roll. No.: 21ECE1039**

## **Batch No. :14TH**

## **Department: ECE**

## **Semester: 7th Semester**

## **Course Code: EC – 401**

Submission Date: 18.08.2024

Aim : The aim of this experiment is to analyze the transient and AC response of an RC (Resistor-Capacitor) circuit using Cadence simulation software

Tools Used : Cadence Software

Theory

### Transient Response

The transient response of an RC circuit to a step input voltage is characterized by the charging and discharging of the capacitor. The time constant

\tauτ

of the circuit is given by:

\tau = R \times Cτ=R×C

The capacitor voltage

V\_C(t)VC​(t)

as a function of time can be expressed by the equation:

* **During charging**:

V\_C(t) = V\_{in} \left(1 - e^{-\frac{t}{RC}}\right)VC​(t)=Vin​(1−e−RCt​)

* **During discharging**:

V\_C(t) = V\_{in} e^{-\frac{t}{RC}}VC​(t)=Vin​e−RCt​

### AC Response

The AC response of the RC circuit can be analyzed using its frequency response. The impedance of the RC circuit is:

Z(f) = \frac{1}{j 2 \pi f C} + RZ(f)=j2πfC1​+R

The magnitude and phase of the frequency response are given by:

* **Magnitude**:

|H(f)| = \frac{1}{\sqrt{1 + (2 \pi f R C)^2}}∣H(f)∣=1+(2πfRC)2​1​

* **Phase**:

\phi(f) = -\arctan(2 \pi f R C)ϕ(f)=−arctan(2πfRC)

### circuit Design

### conclusion

The experiment successfully demonstrated the transient and AC responses of an RC circuit using Cadence simulation software. The results for the transient response matched theoretical expectations, confirming the accuracy of the time constant and capacitor behavior. The AC response analysis also aligned well with theoretical predictions, providing insights into the circuit's frequency response. The experiment reinforced the understanding of RC circuit dynamics and the utility of simulation tools in circuit analysis.

# References

1. Jan M. Rabaey, “Digital Integrated Circuits- A Design Perspective”, Prentice Hall, Second Edition, 2005

2. Sung –Mo Kang & Yusuf Leblebici, “CMOS Digital Integrated Circuits- Analysis & Designing”, MGH, Third Ed., 2003

3. John P Uyemura, “Introduction to VLSI Circuits and Systems”, Wiley India, 2006

4. S K Gandhi, “VLSI Fabrication Principle”, John Wiley