SNS COLLEGE OF TECHNOLOGY

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COIMBATORE-35
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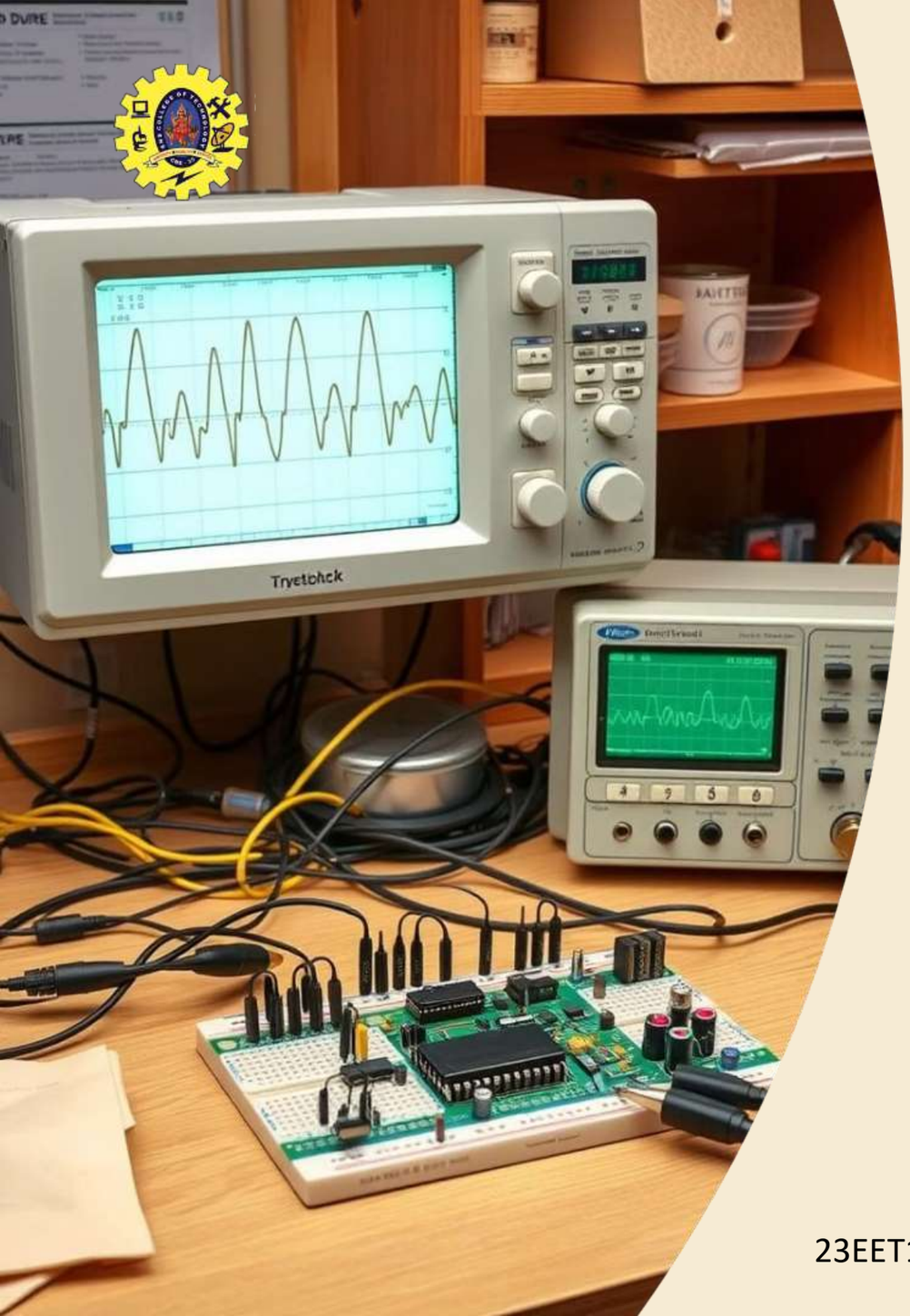
23EET104 / ANALOG ELECTRONICS CIRCUITS
I YEAR / II SEMESTER

UNIT-V: FEEDBACK AMPLIFIER AND OSCILLATOR

WEIN BRIDGE OSCILLATOR



Understanding the Wien Bridge Oscillator

The Wien Bridge Oscillator generates stable sinusoidal waves using an RC bridge circuit. It is widely used for low-distortion audio signals, leveraging positive feedback and op-amps.

by Senthil Kumar R.

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Main Components in the Wien Bridge Oscillator

Transistors as an Amplifier

Amplifies the signal and provides necessary gain for oscillations.

Resistors

R1, R2 form the bridge; Rf, Rg set amplifier gain.

Capacitors

C1, C2 create frequency-dependent phase shift in the feedback network.

Power Supply

Provides stable voltage for consistent op-amp operation.

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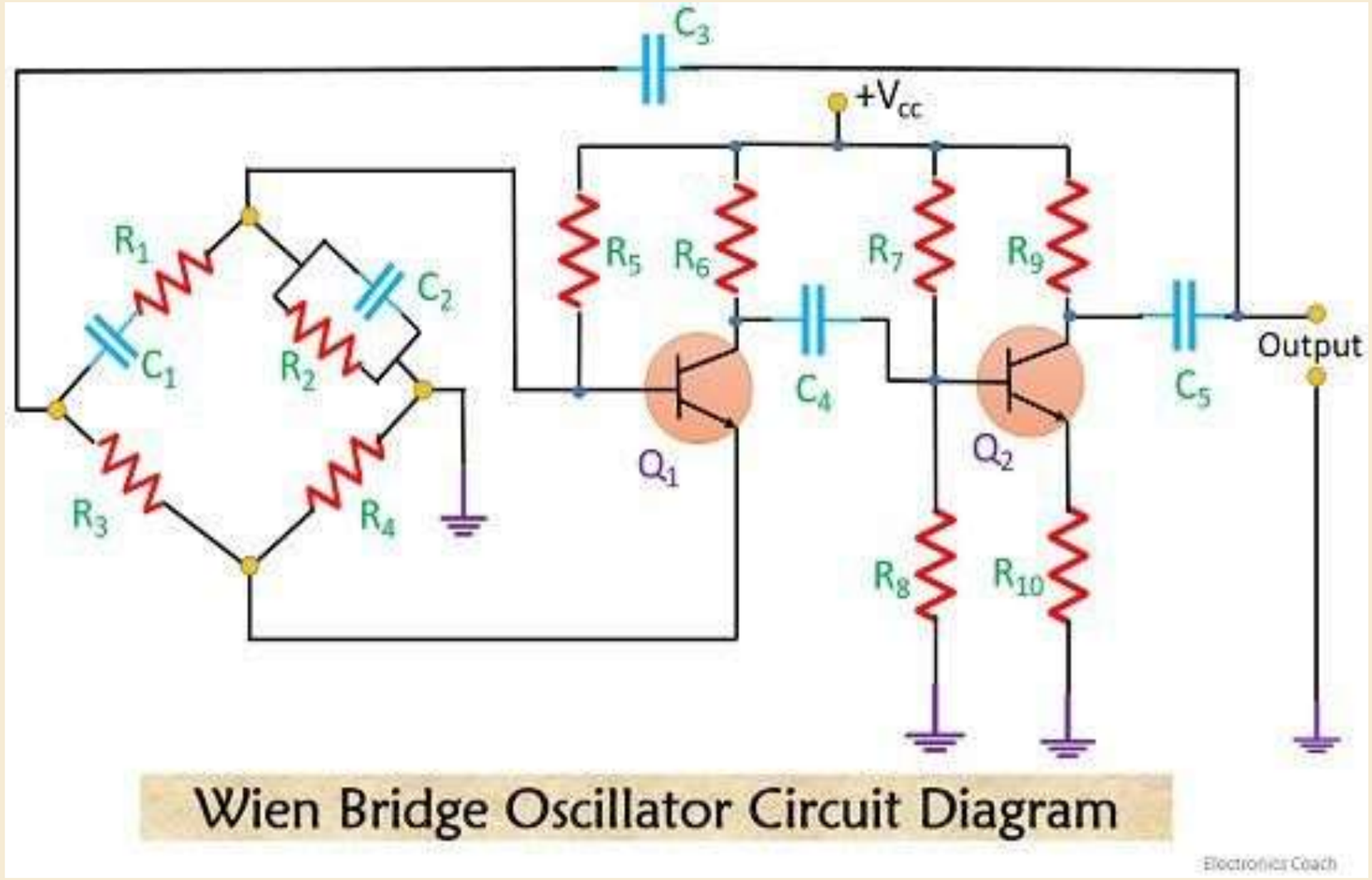
Wien Bridge Oscillator Circuit

Key Components

- Operational Amplifier (Op-Amp)
- Resistors R1, R2
- Capacitors C1, C2
- Feedback resistor Rf and gain resistor Rg

Signal Flow

The RC bridge provides frequency-selective positive feedback. The output is a sinusoidal waveform sustained by the op-amp gain.



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Working Principle of the Wien Bridge Oscillator

- The Wien Bridge Oscillator uses a feedback network to generate a sinusoidal output.
- It's characterized by a bridge circuit with a series and parallel RC network, which provides a phase shift that, at the resonant frequency, allows positive feedback for oscillation.
- The circuit also includes a gain-controlling element (like a lamp or transistor) to maintain a stable oscillation amplitude.

1

Positive Feedback

RC network (R1,C1 and R2,C2) creates zero phase shift at resonance frequency.

2

Gain Condition

Amplifier gain must be ≥ 3 to maintain oscillations.

3

Amplitude Stabilization

Automatic Gain Control adjusts gain to prevent distortion.

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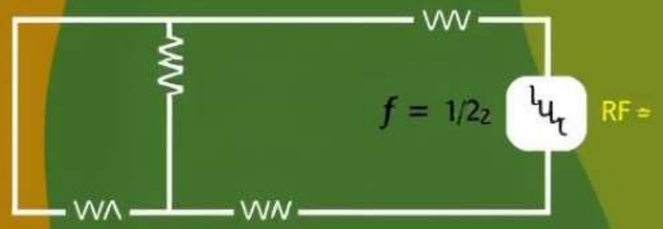

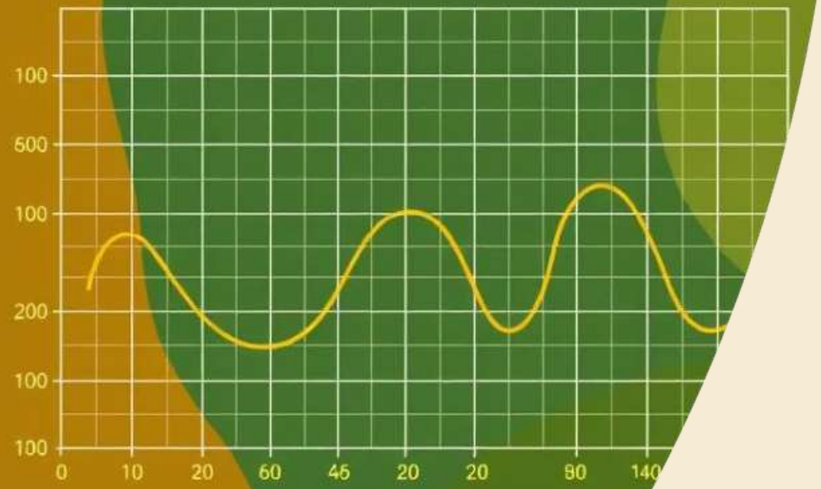

Frequency of Oscillation Formula

Formula

$f = 1 / (2\pi RC)$ where $R = R_1 = R_2$, and $C = C_1 = C_2$

Frequency Control

Accurate oscillation depends on matching R and C components precisely.

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Barkhausen Criteria for Oscillation

Total Phase Shift = 0°

Ensures in-phase feedback for sustained oscillations.

Feedback Voltage = 1/3 Output

At resonance, feedback network outputs exactly one-third voltage.

Loop Gain $|A\beta| \geq 1$

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Automatic Gain Control Methods

Thermistor or Lamp

Provides slow but stable gain control via resistance change.

Diode Limiter

Offers faster control to stabilize amplitude quickly.

Both techniques keep loop gain close to unity, preserving waveform quality.

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Advantages and Disadvantages

Advantages

- Produces very low distortion sine waves
- Good frequency stability
- Easy tuning by adjusting resistors or capacitors

Disadvantages

- Requires gain control for stable operation
- More complex than RC phase-shift oscillators

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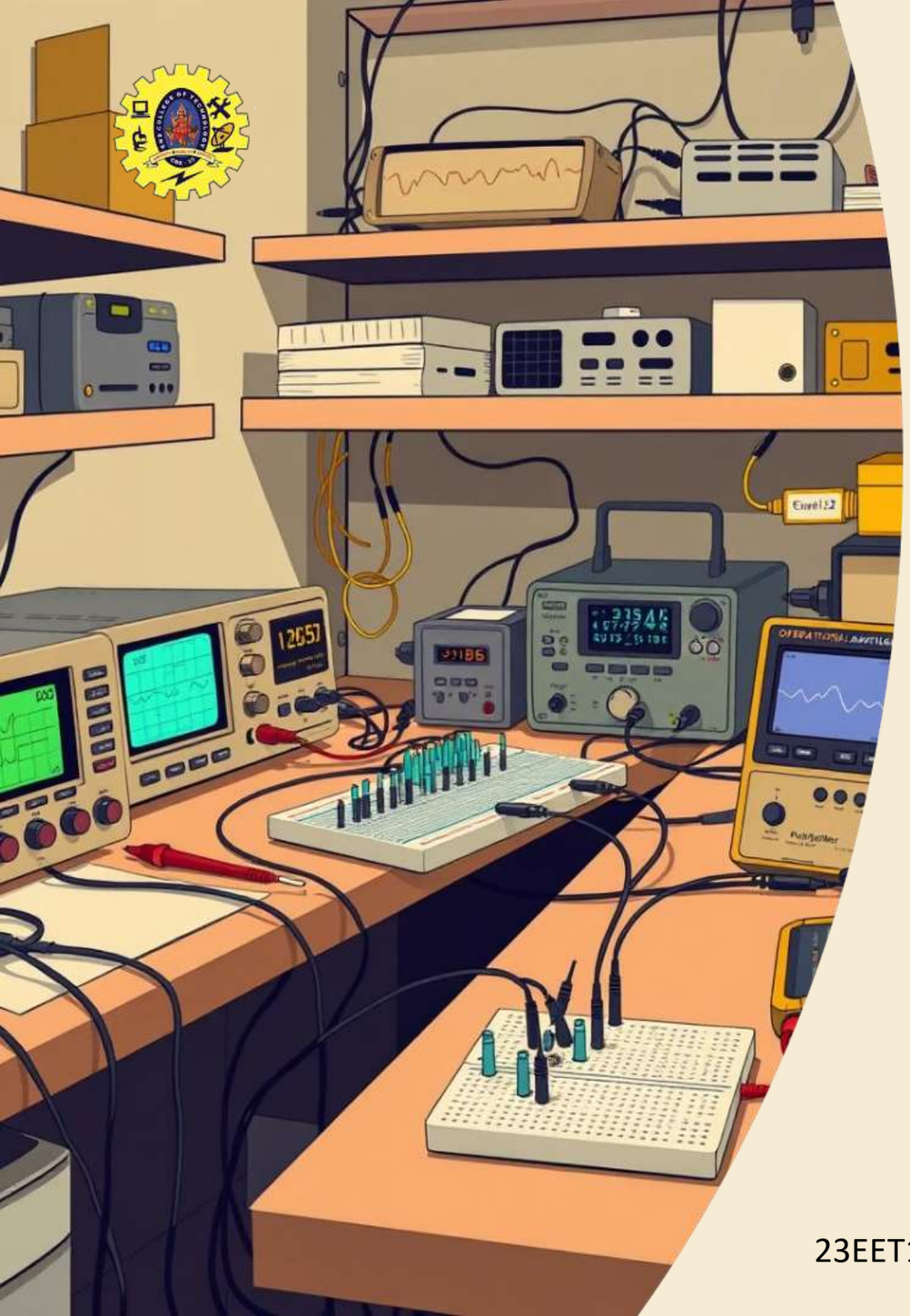
Applications of Wien Bridge Oscillator

Audio Signal Generators

Function Generators

Communication Systems

Audio Test Equipment



Summary and Conclusion

Reliable Sinusoidal Output

Wien Bridge Oscillator produces stable low-distortion sine waves.

Frequency Control

Uses phase-selective positive feedback for accurate frequencies.

Wide Usage

Common in labs and audio systems for signal generation.

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