Basic Electronic Circuits (IEC-103)

Lecture-10

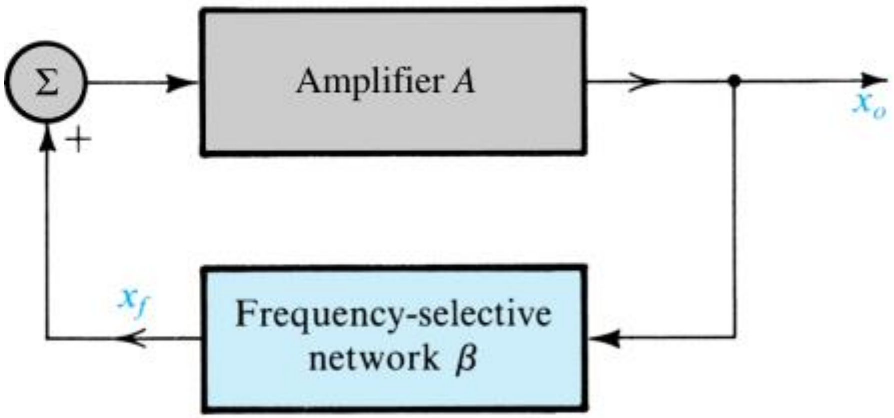
Sinusoidal Oscillators

Types of Oscillators

1. Feedback Oscillator
2. Relaxation Oscillators

- Feedback Oscillators
  - A fraction of output is feedback to the input with no net phase shift.
  - The loop gain must be maintained at 1 to maintain oscillations
  - Amplifier can be made of either discrete transistor or an op-amp.

Feedback Oscillators



Conditions for Oscillations

Two conditions must be satisfied for sustained oscillations

Conditions for Oscillations

Two conditions must be satisfied for sustained oscillations

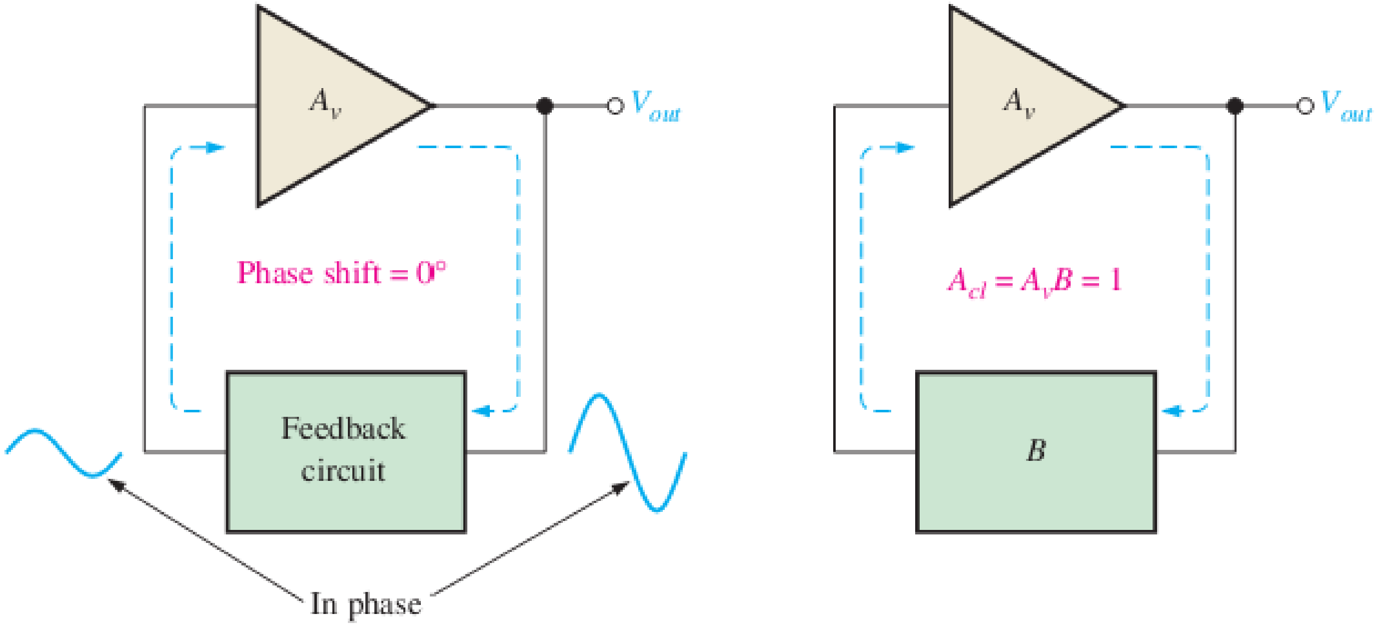
1. The phase shift around the feedback loop must be effectively 0^{o}.

Conditions for Oscillations

Two conditions must be satisfied for sustained oscillations

1. The phase shift around the feedback loop must be effectively 0^o.
2. The voltage gain $A\beta$ around the closed feedback loop (loop gain) must be equal to 1.

Conditions for Oscillations



(a) The phase shift around the loop is 0°.

(b) The closed loop gain is 1.

RC and LC Oscillators

RC **Oscillators: The frequency determining network contains only resistive and capacitive elements.**

- Wein bridge oscillator
- Phase-shift oscillator
- Twin-T oscillator

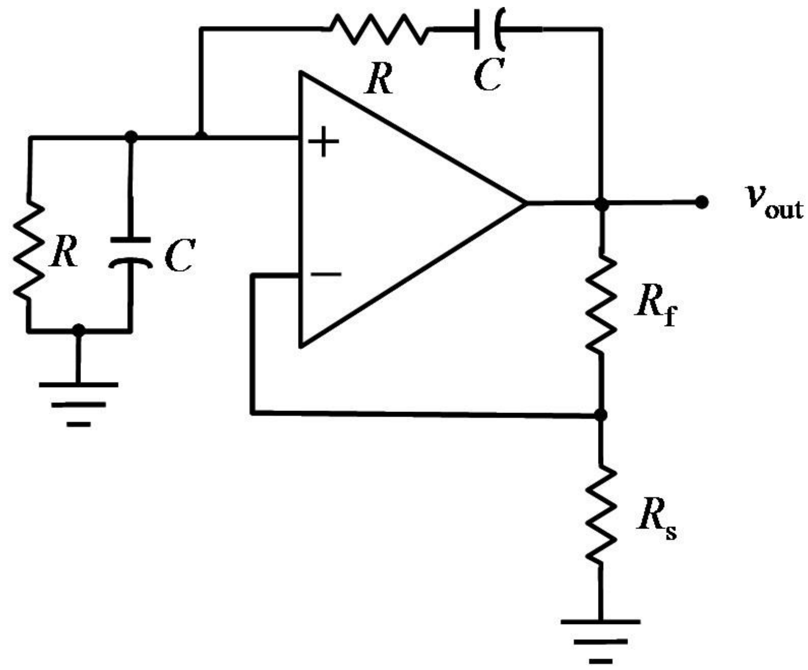
RC and LC Oscillators

LC **Oscillators: The frequency determining network contains inductive and capacitive elements.**

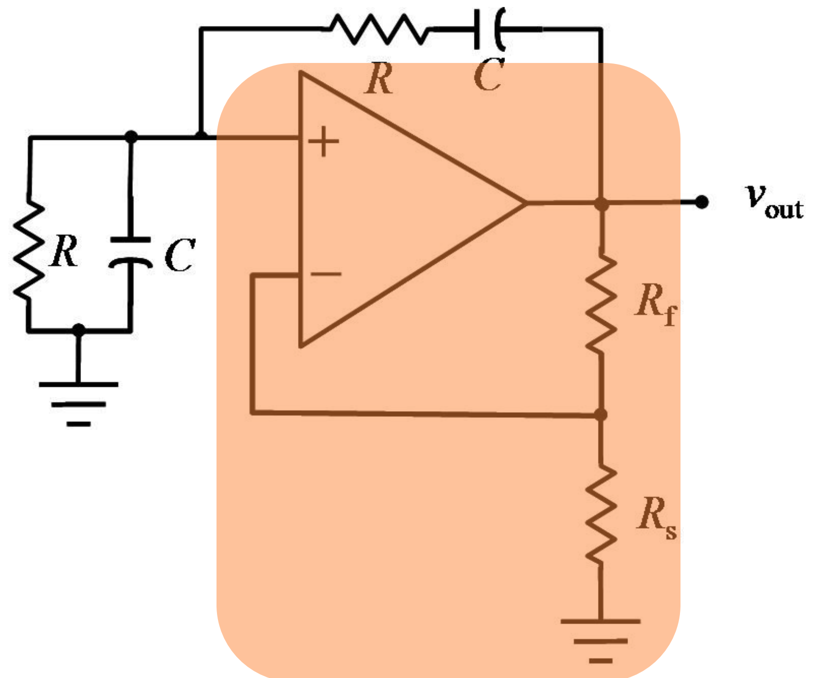
- **Hartly**
- **Colpitts**
- **Capp**
- **Pierce**

RC Oscillators

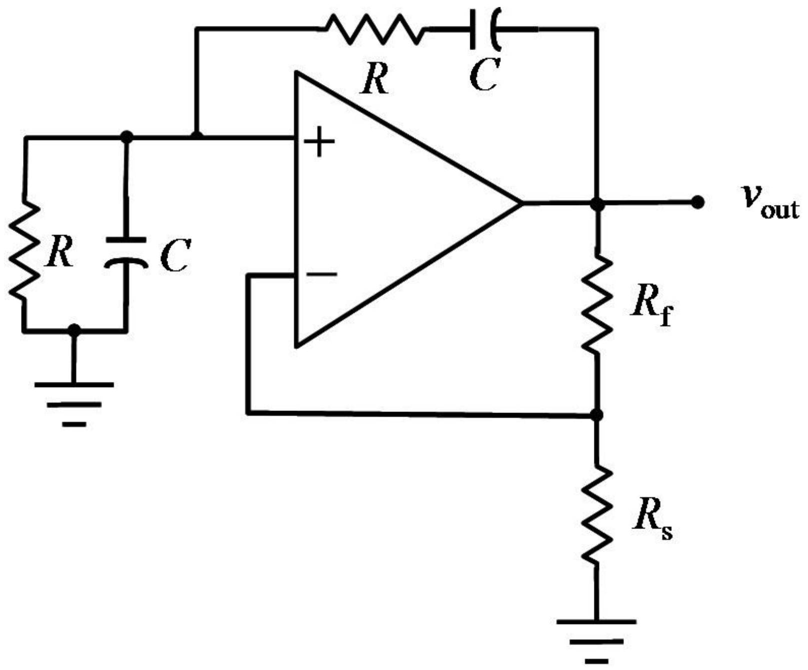
Wein Bridge Oscillator



Wein Bridge Oscillator

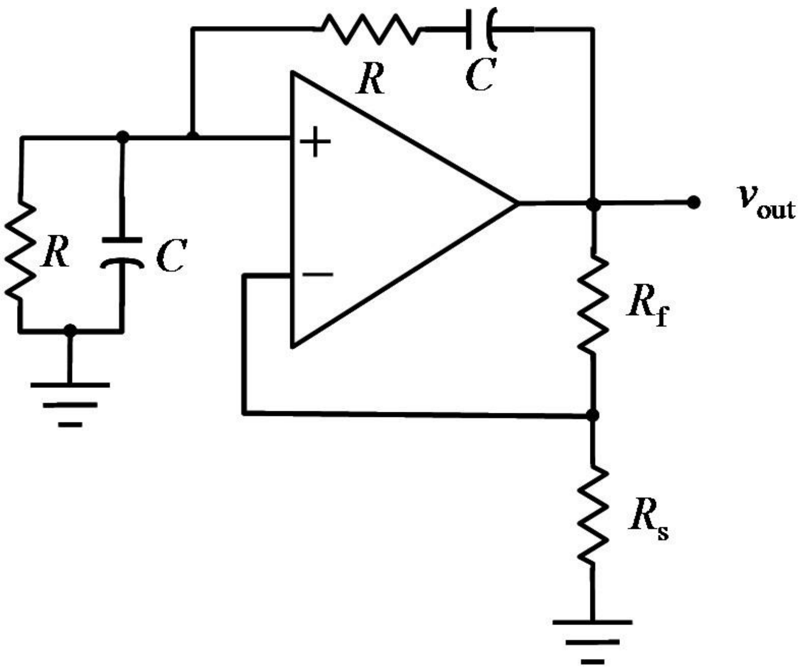


Wein Bridge Oscillator



$$R_F = 2R_s$$

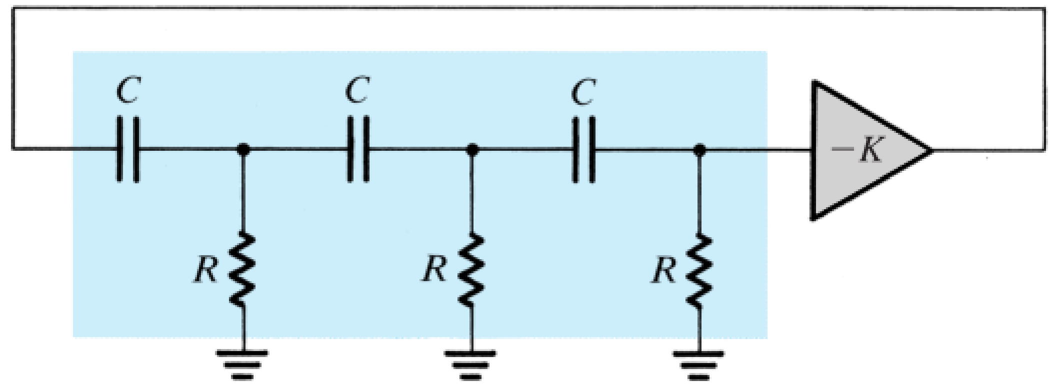
Wein Bridge Oscillator



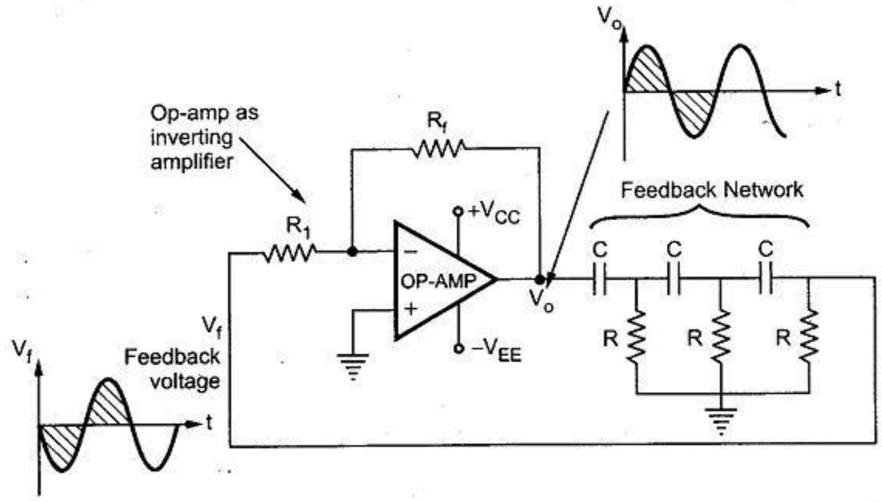
$$R_F = 2R_s$$

$$\omega = \frac{1}{RC}$$

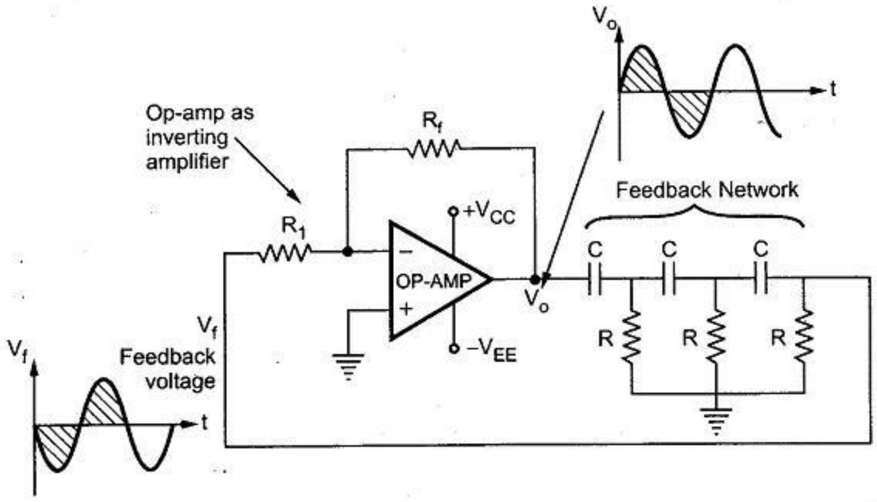
RC Phase Shift Oscillator



RC Phase Shift Oscillator

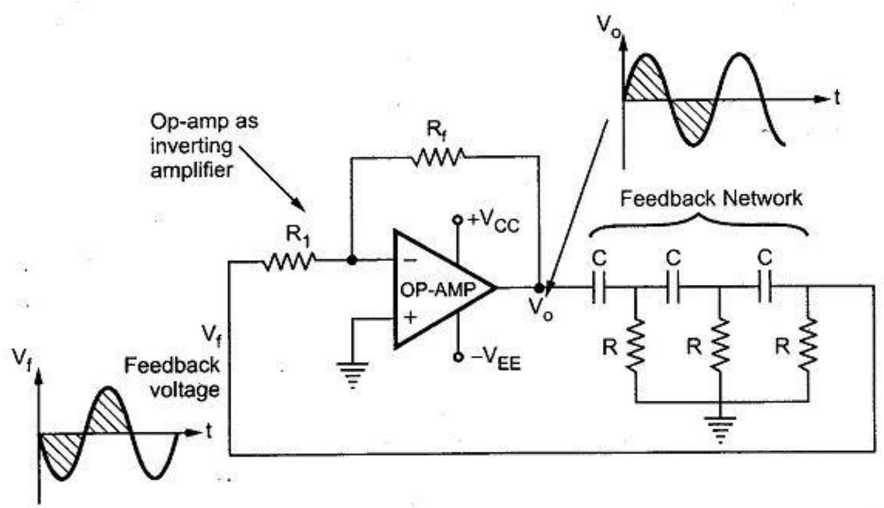


RC Phase Shift Oscillator



$$\frac{R_f}{R_1} = 29$$

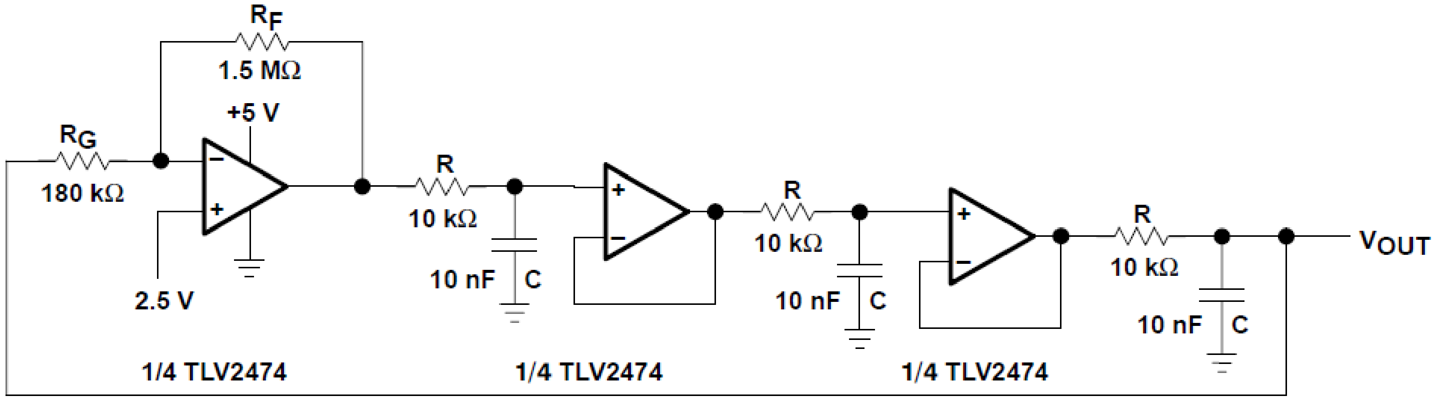
RC Phase Shift Oscillator



$$\frac{R_f}{R_1} = 29$$

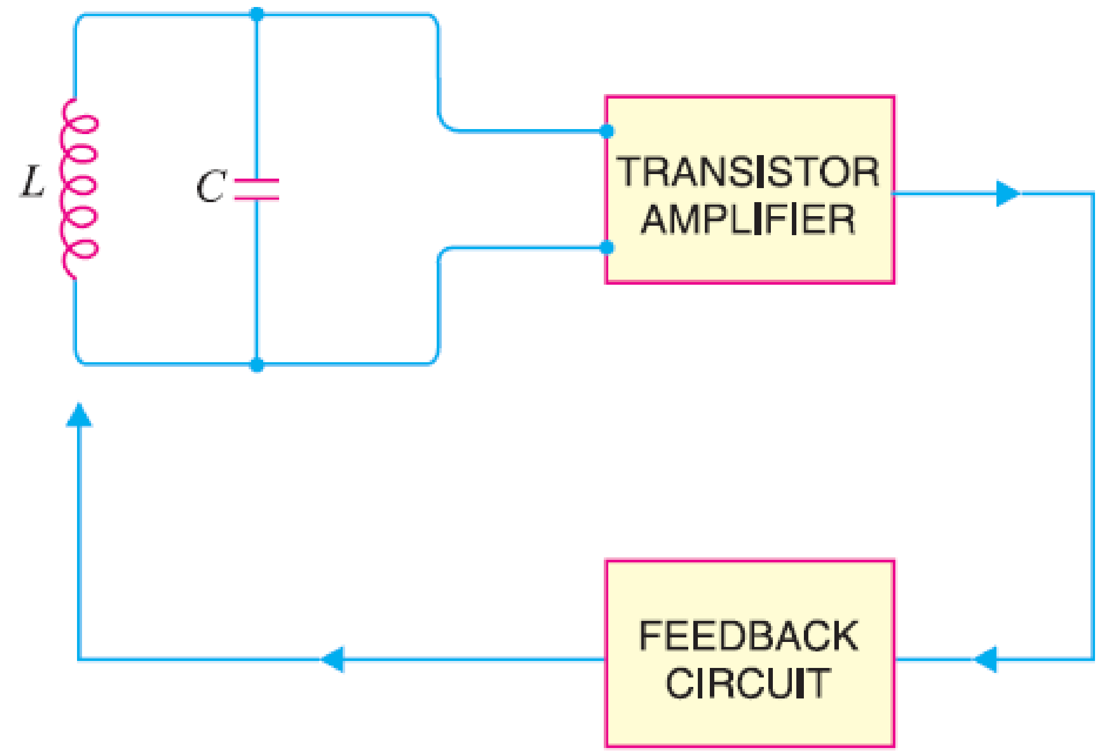
$$\omega = \frac{1}{\sqrt{6}RC}$$

Buffered Phase Shift Oscillator

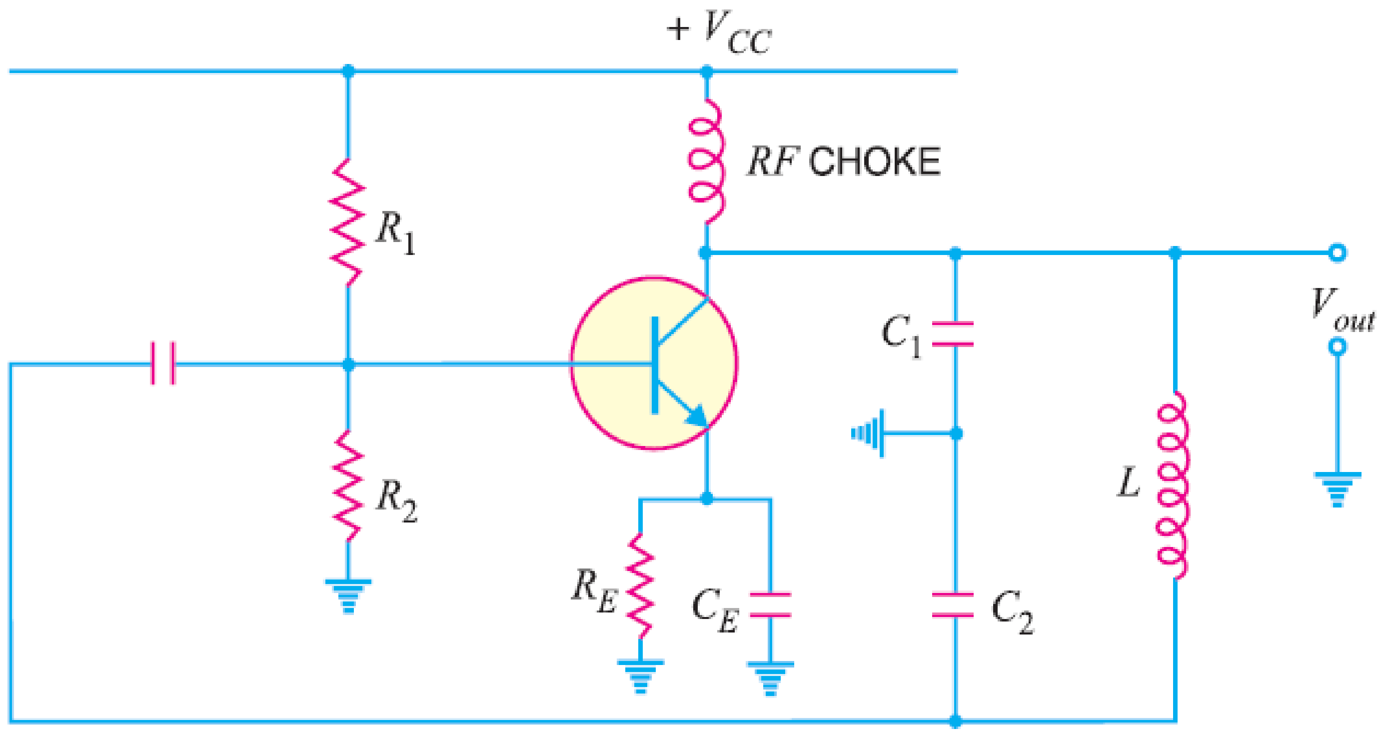


LC Oscillators

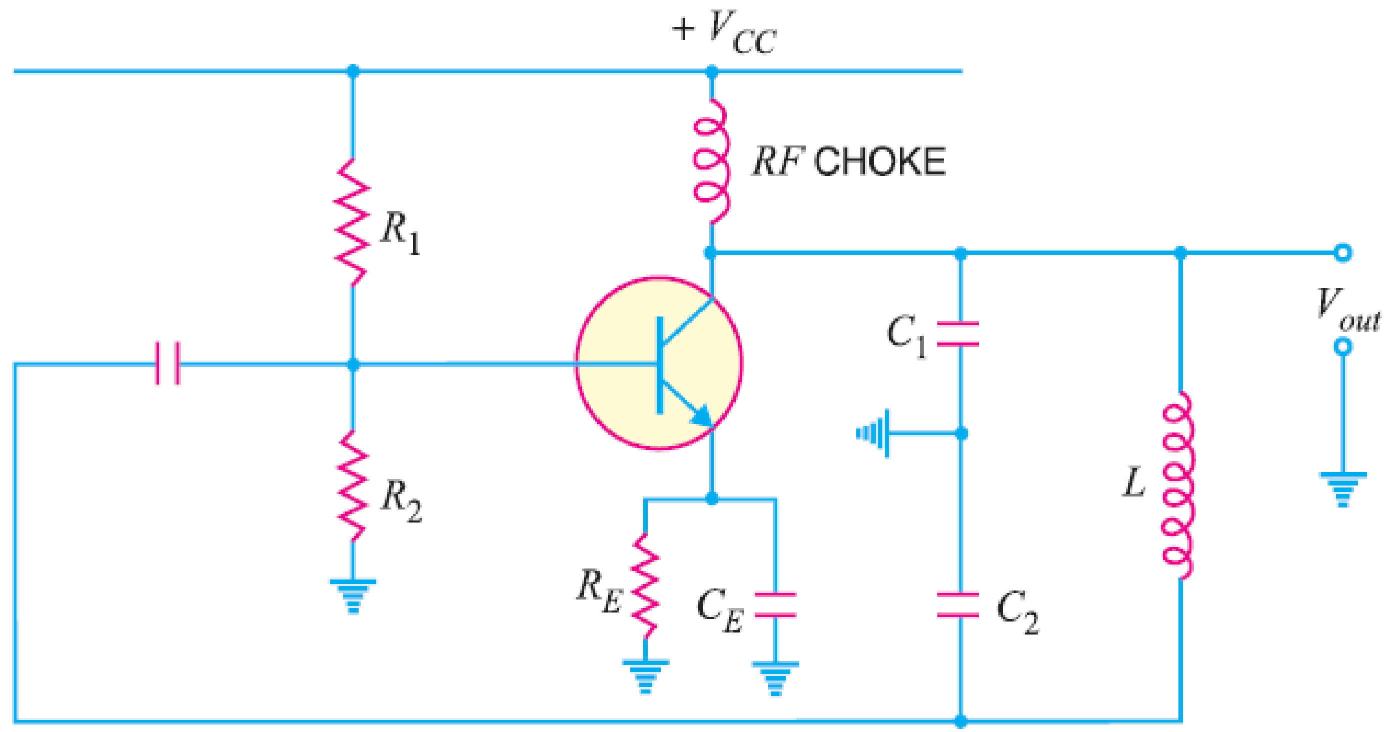
Transistor Oscillators



Colpitt's Oscillator

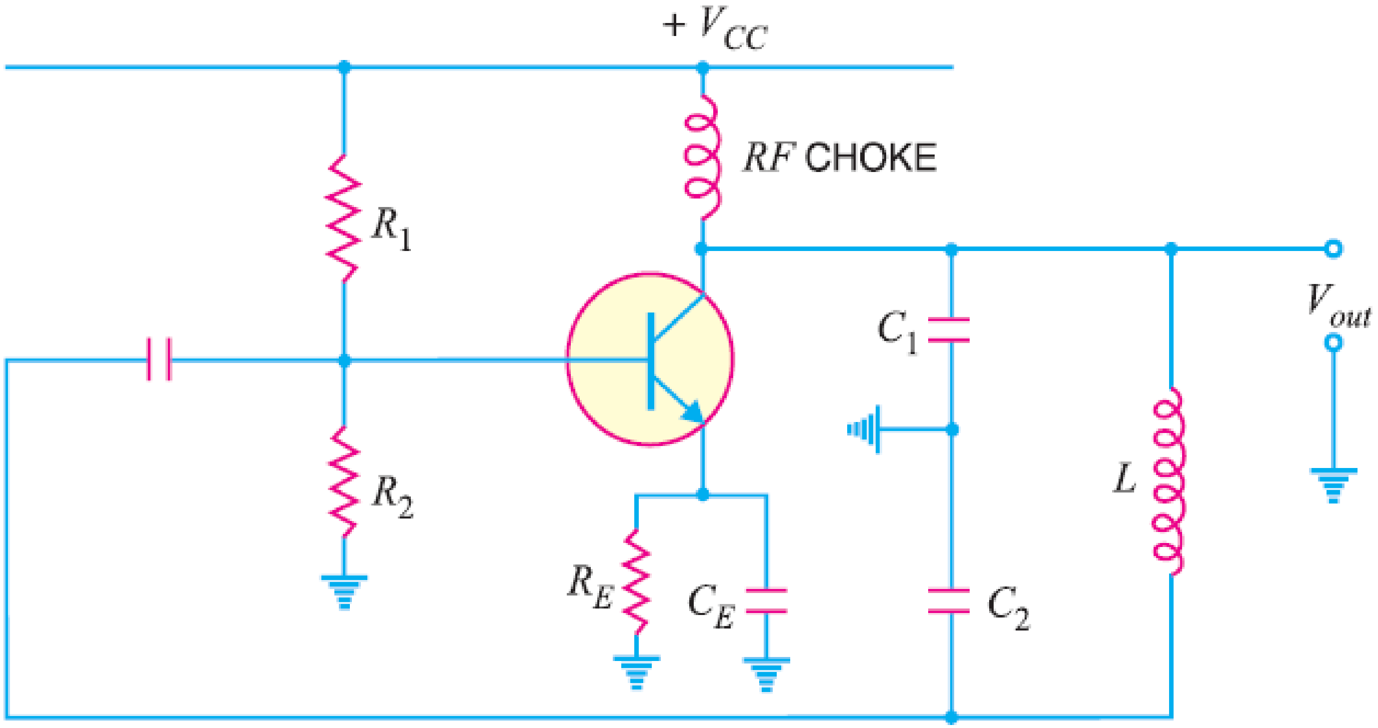


Colpitt's Oscillator



$$\omega = \frac{1}{\sqrt{LC_T}}$$

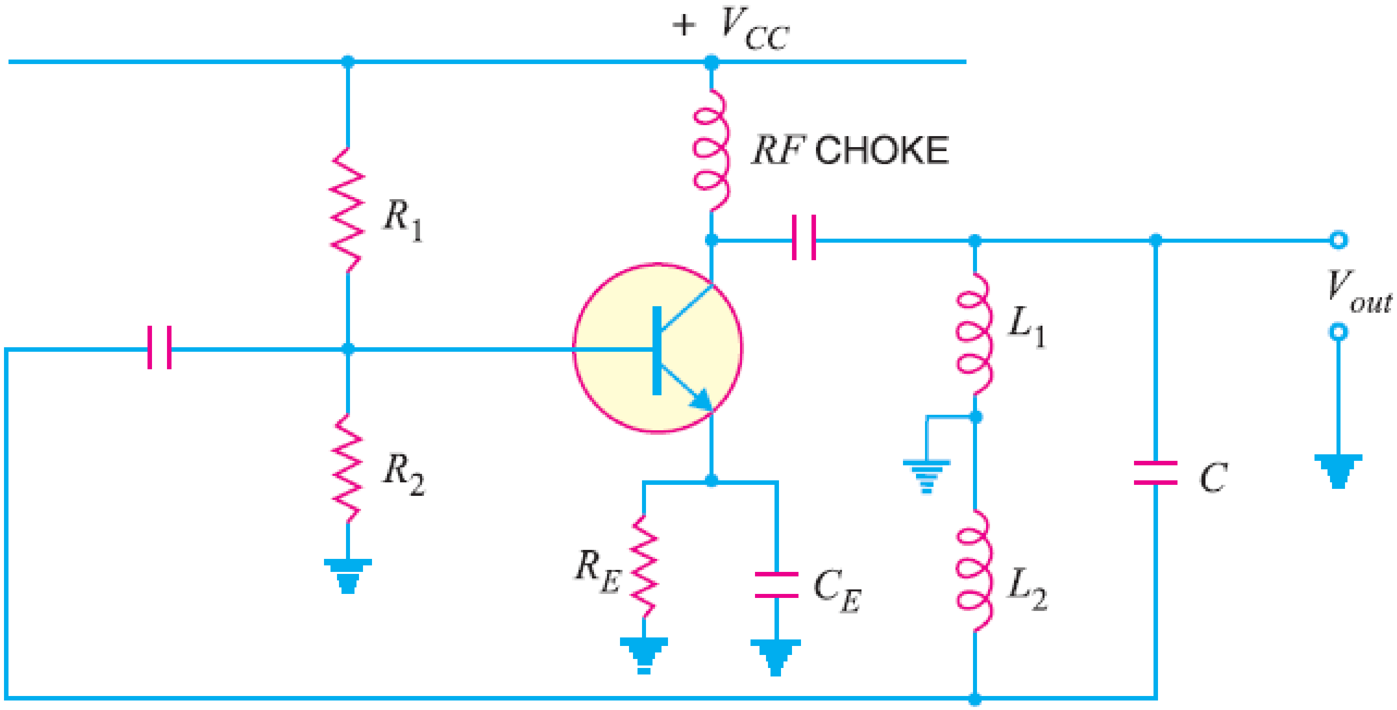
Colpitt's Oscillator



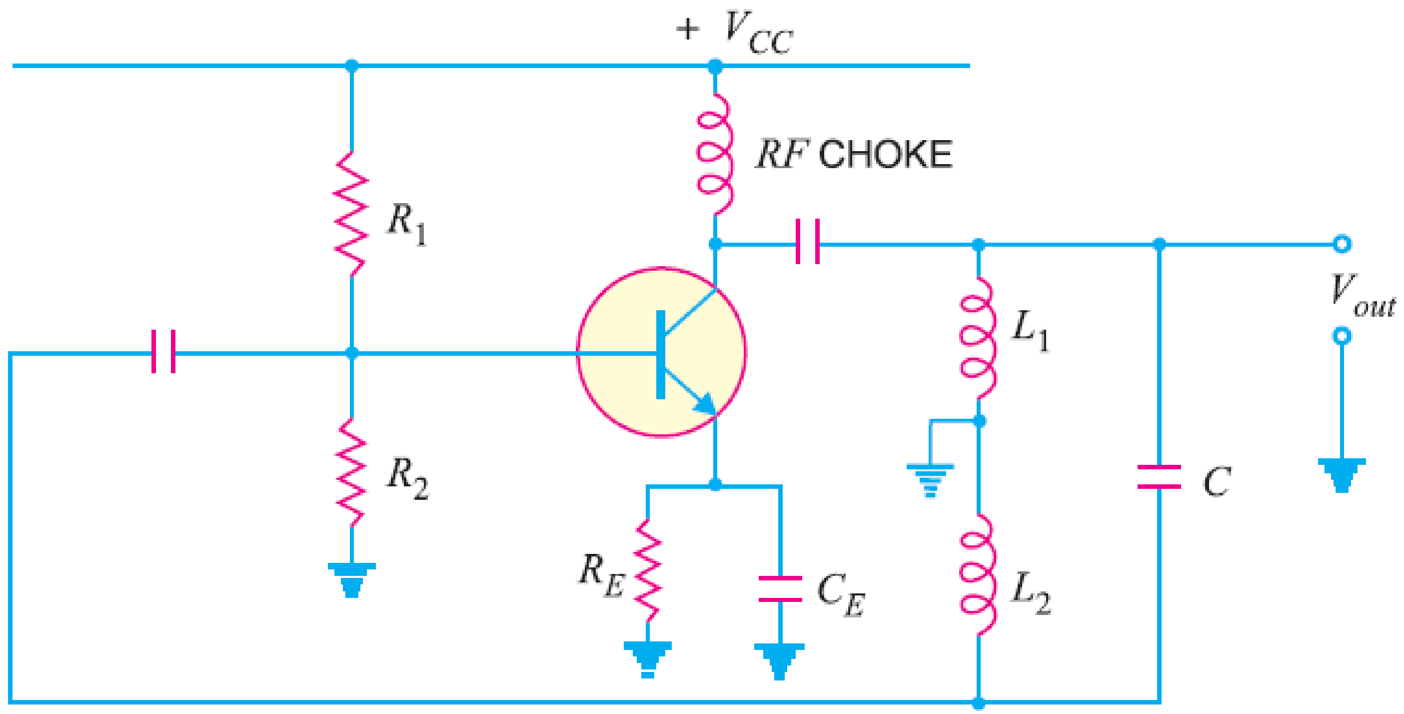
$$\omega = \frac{1}{\sqrt{LC_T}}$$

$$C_T = \frac{C_1 C_2}{C_1 + C_2}$$

Hartley Oscillator

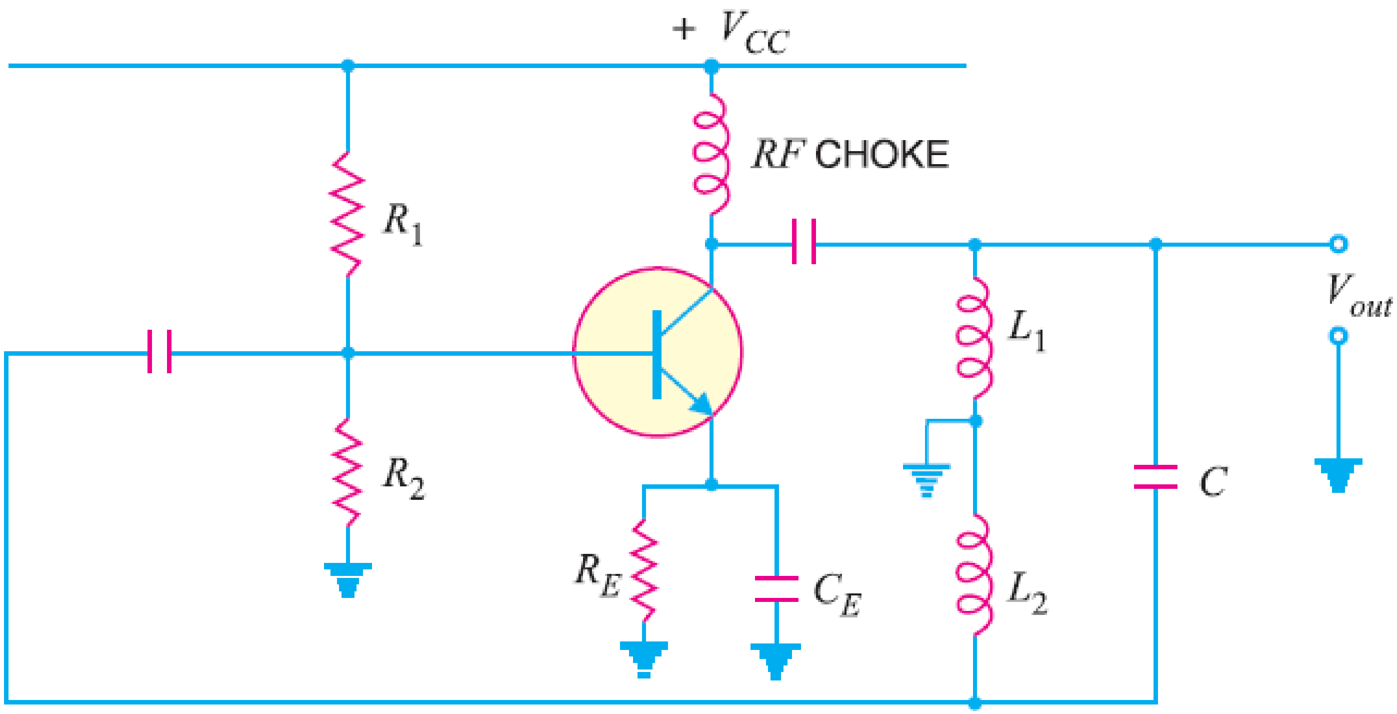


Hartley Oscillator



$$\omega = \frac{1}{\sqrt{L_T C}}$$

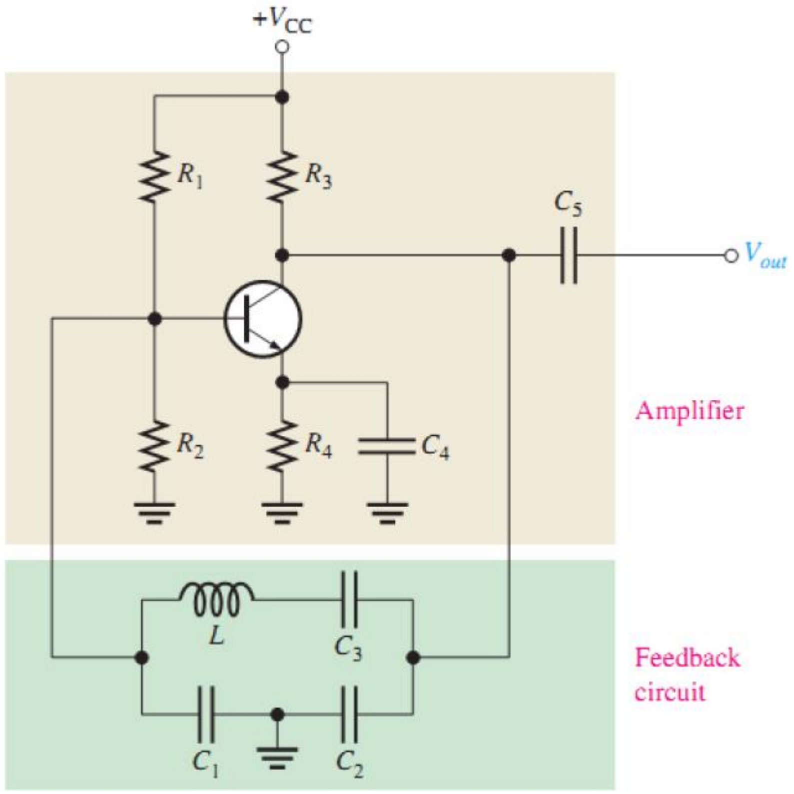
Hartley Oscillator



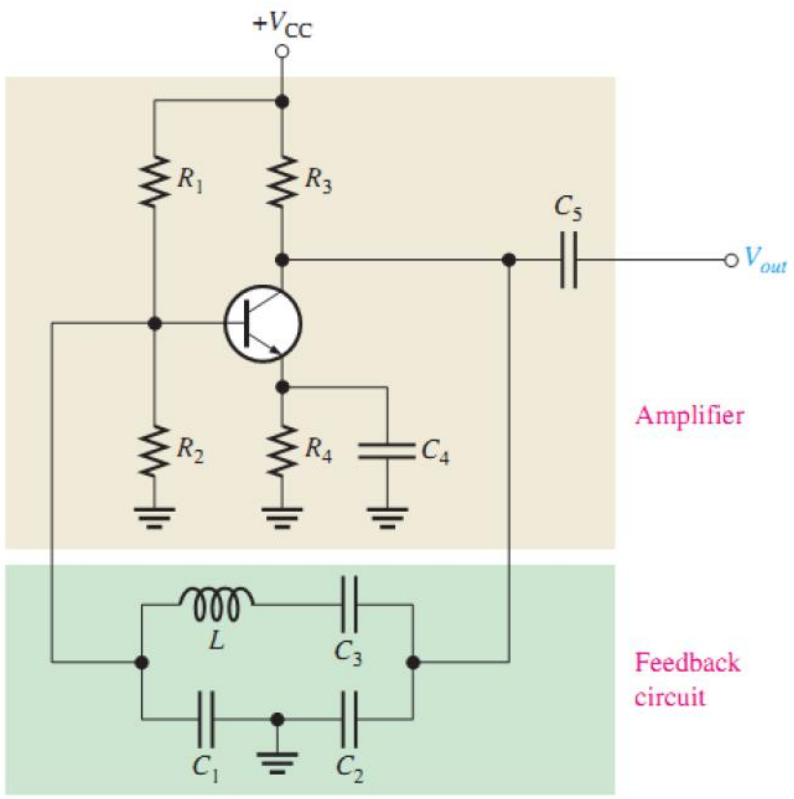
$$\omega = \frac{1}{\sqrt{L_T C}}$$

$$L_T = L_1 + L_2$$

Clapp Oscillator

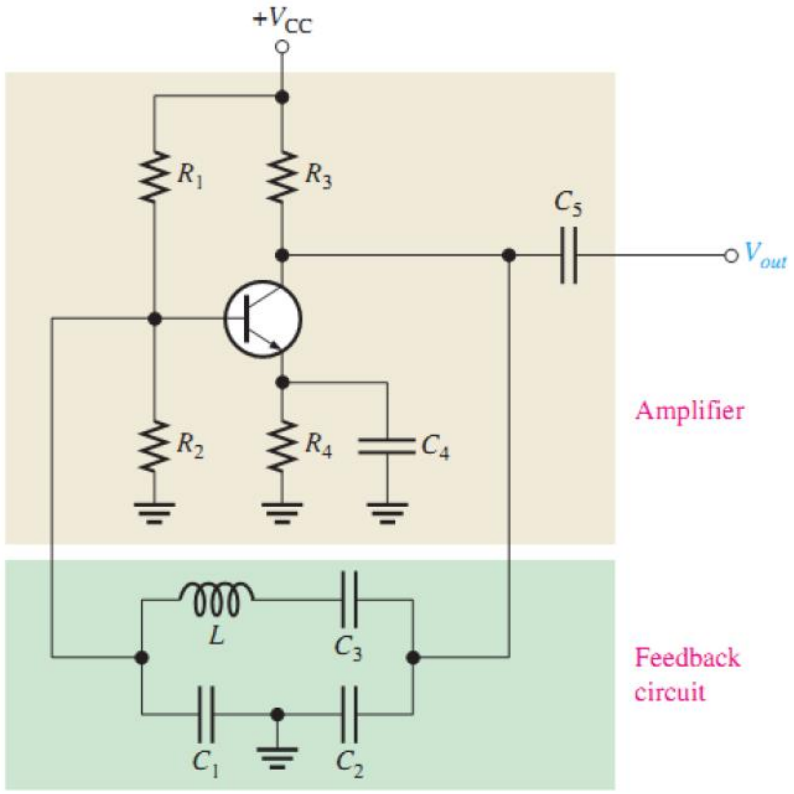


Clapp Oscillator



$$\omega = \frac{1}{\sqrt{LC_T}}$$

Clapp Oscillator



$$\omega = \frac{1}{\sqrt{LC_T}}$$

$$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$