



SNS COLLEGE OF TECHNOLOGY

Kurumbapalayam (Po), Coimbatore – 641 107

An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE NAME : 19ECB201-ANALOG ELECTRONIC CIRCUITS

II YEAR /III SEMESTER

Unit 4- OSCILLATORS & MULTIVIBRATOR CIRCUITS

Topic 4 : RC Phase Shift and Wein Bridge Oscillators

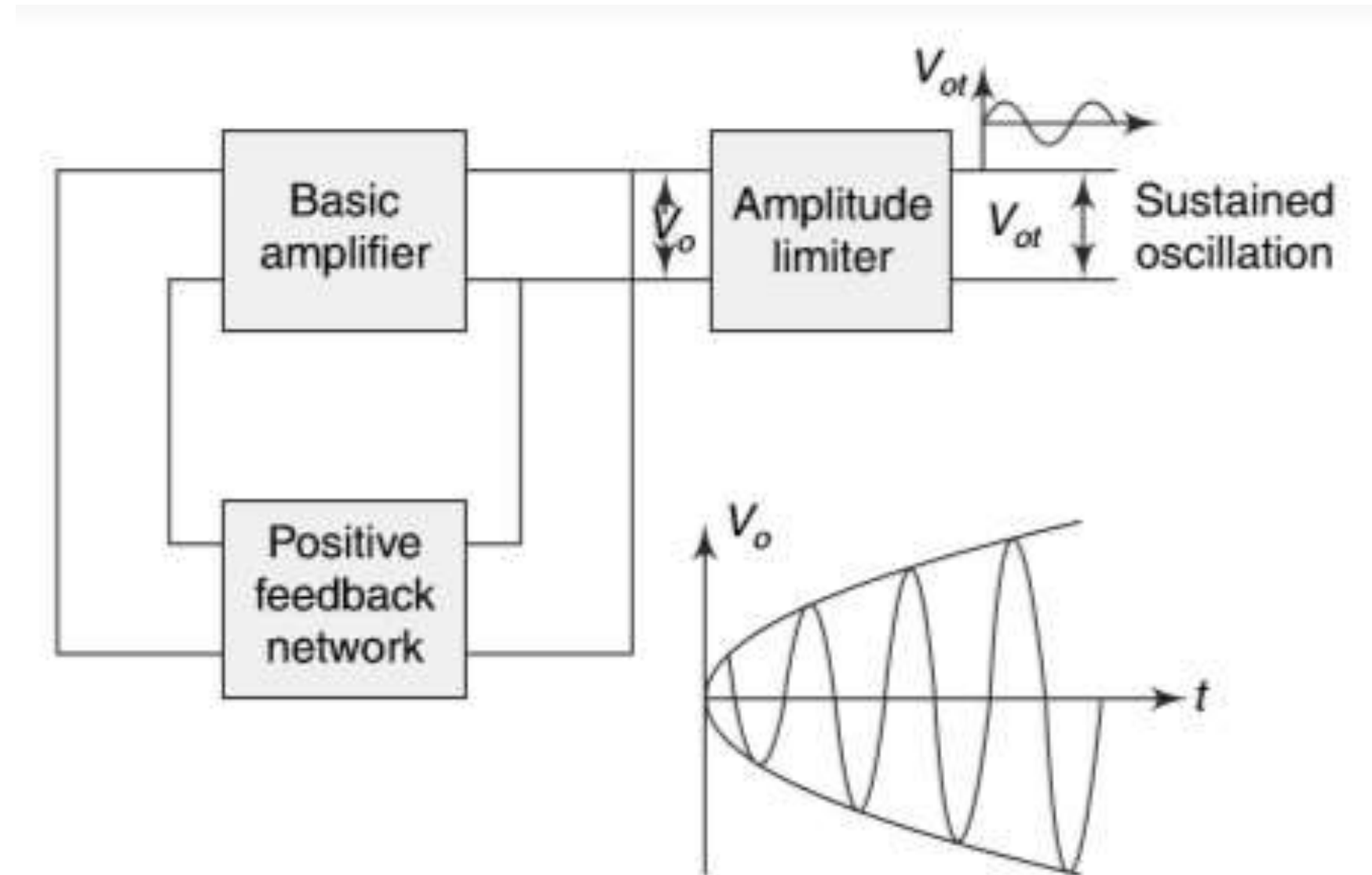




Application of Oscillators



- Communication Systems
- Control signals

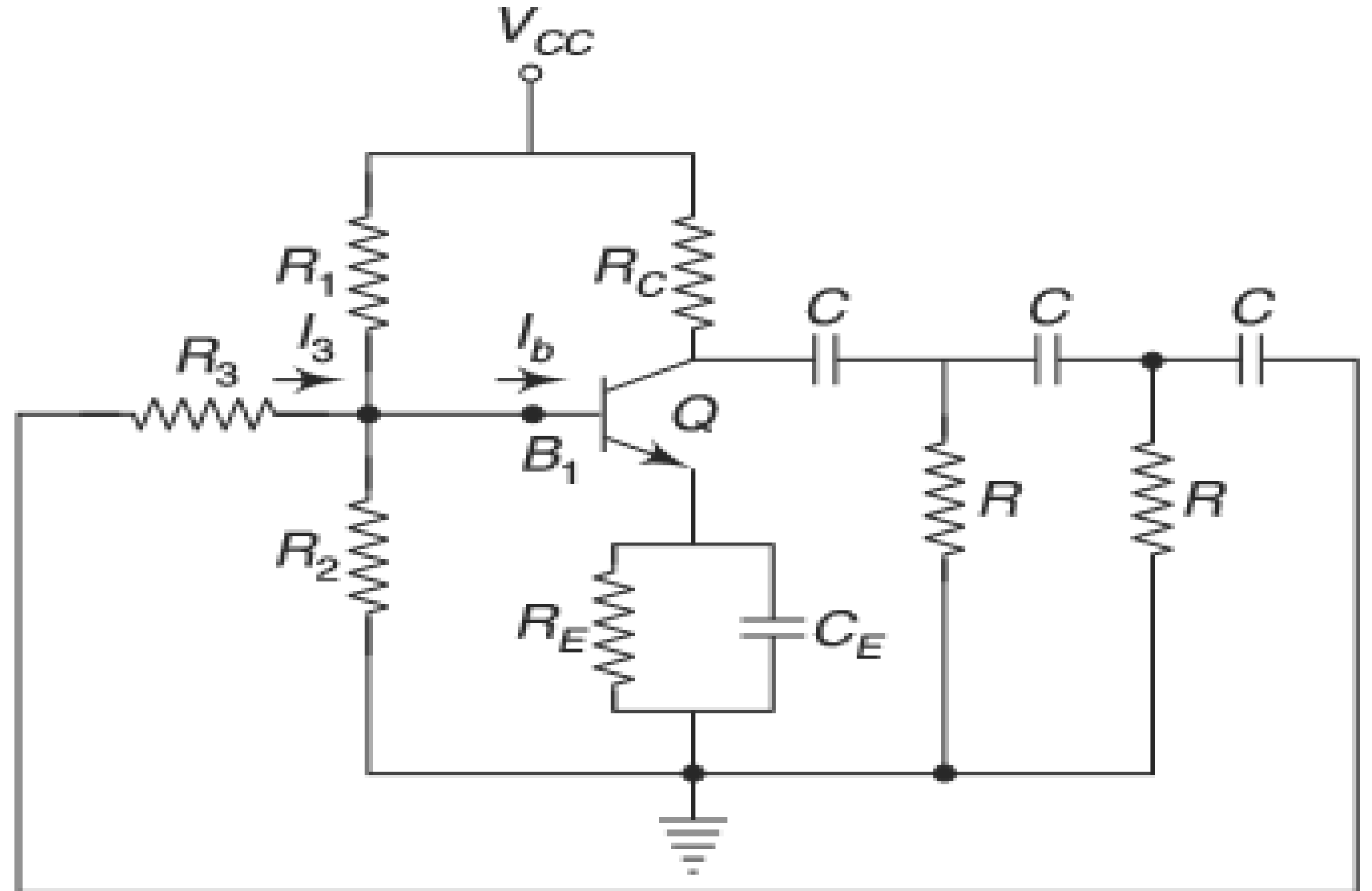




RC Phase Shift Oscillator Circuit

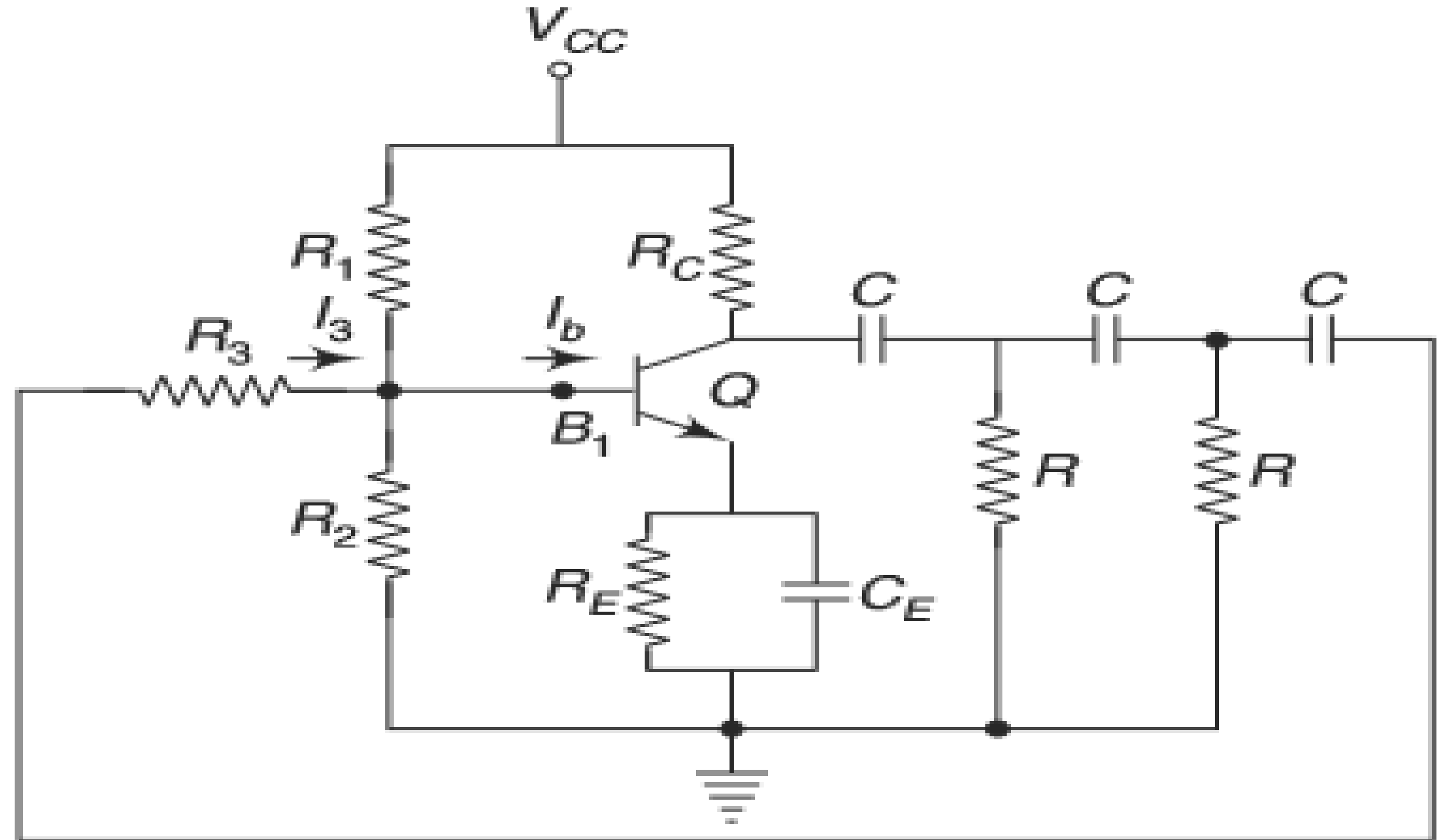


- NPN transistor
- Conditions for oscillations
- Positive Feedback





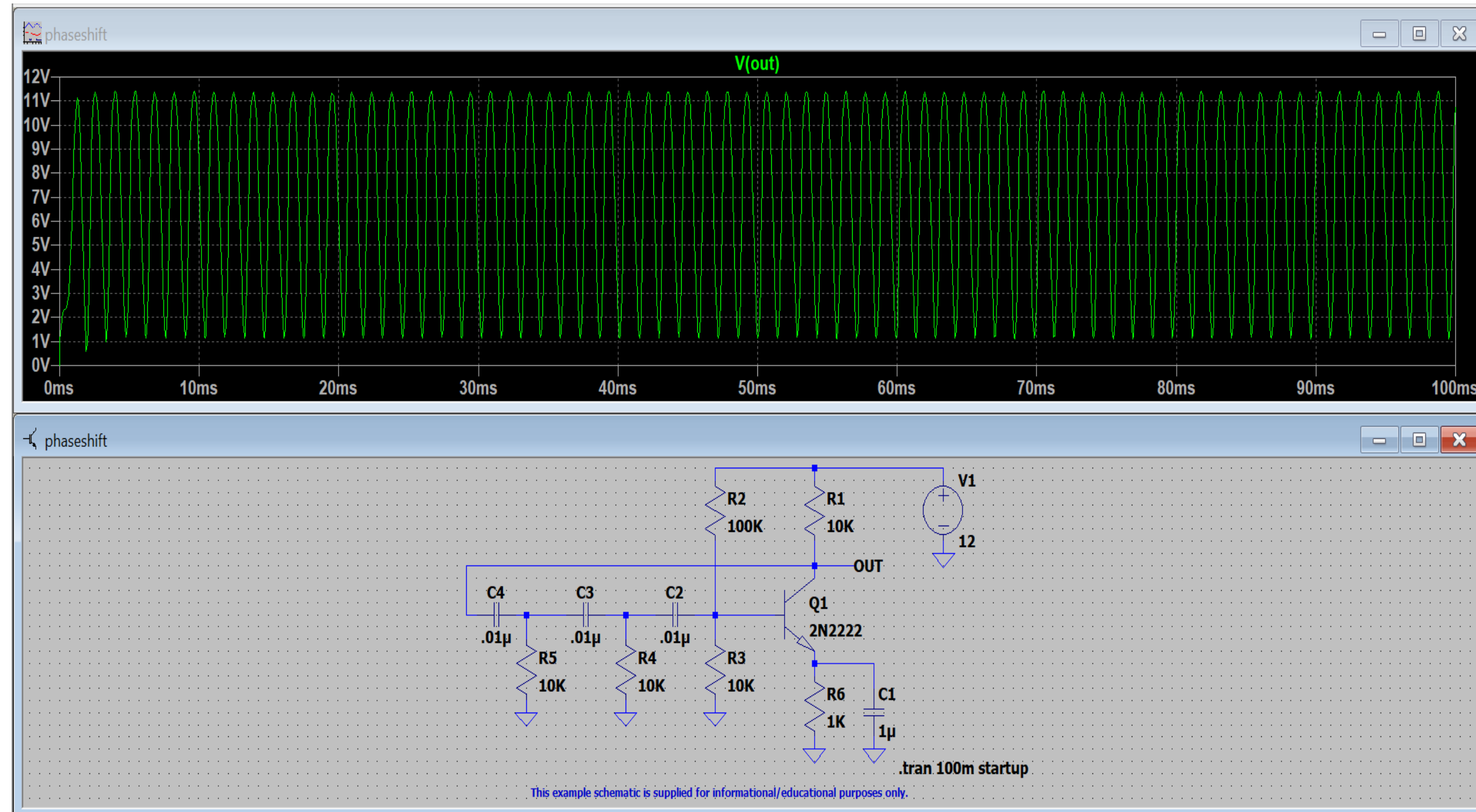
Mechanism of Start of Oscillation





Stabilization of Amplitude

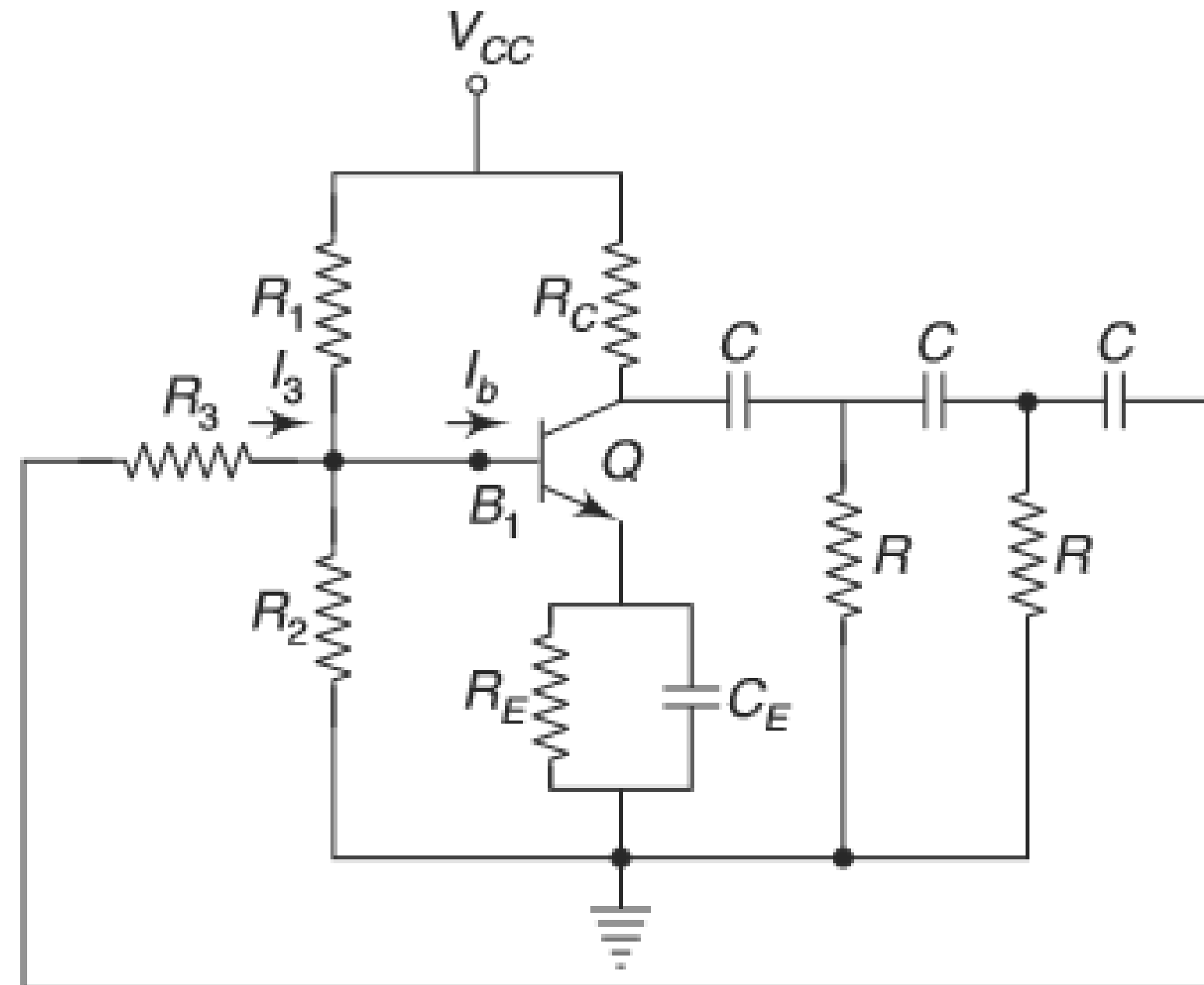
Amplitude Limiting





Frequency of Oscillation

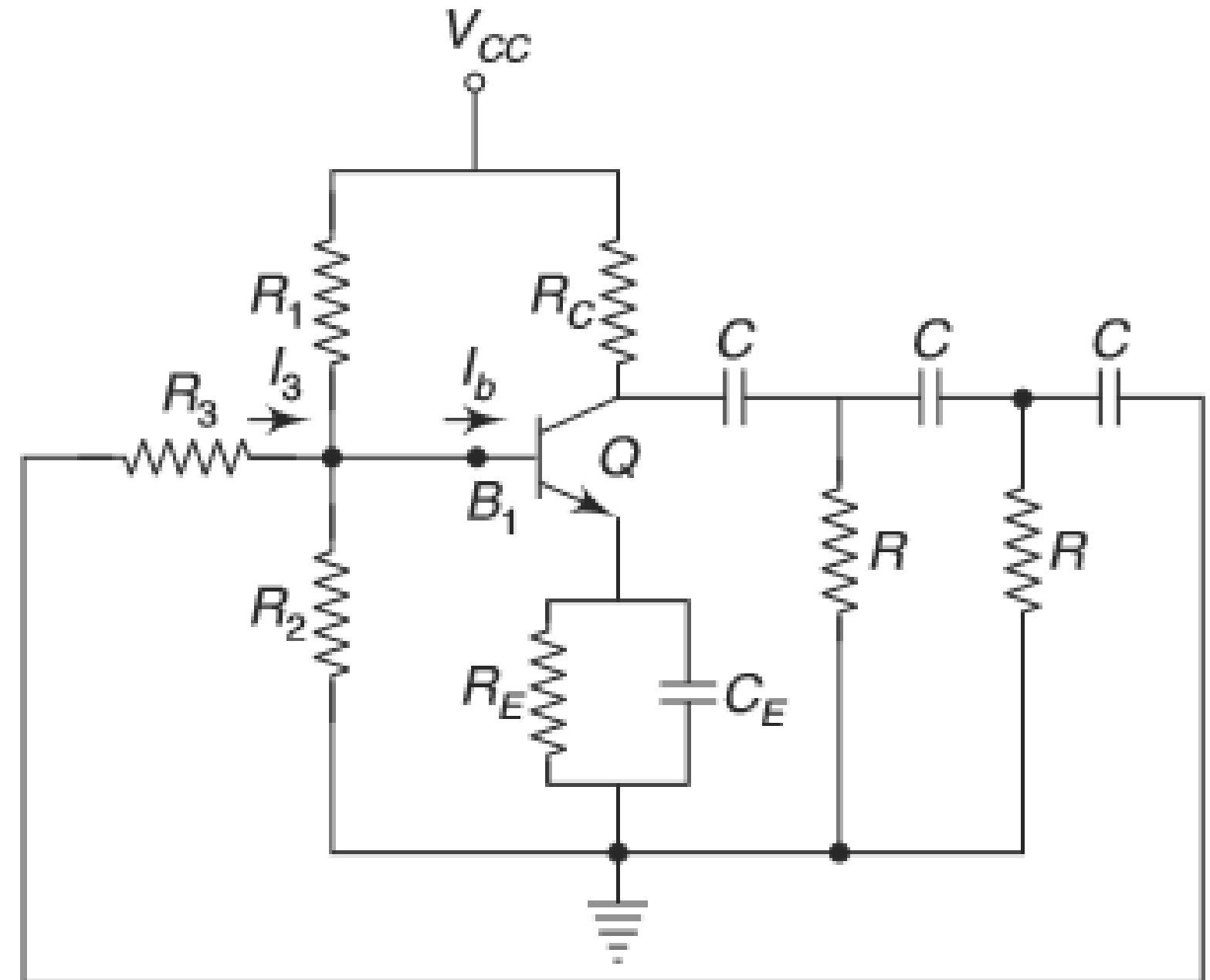
$$f_o = \frac{1}{2\pi RC\sqrt{6}}$$





Role of RC Network

Phase shift of each RC stage is 60 degree

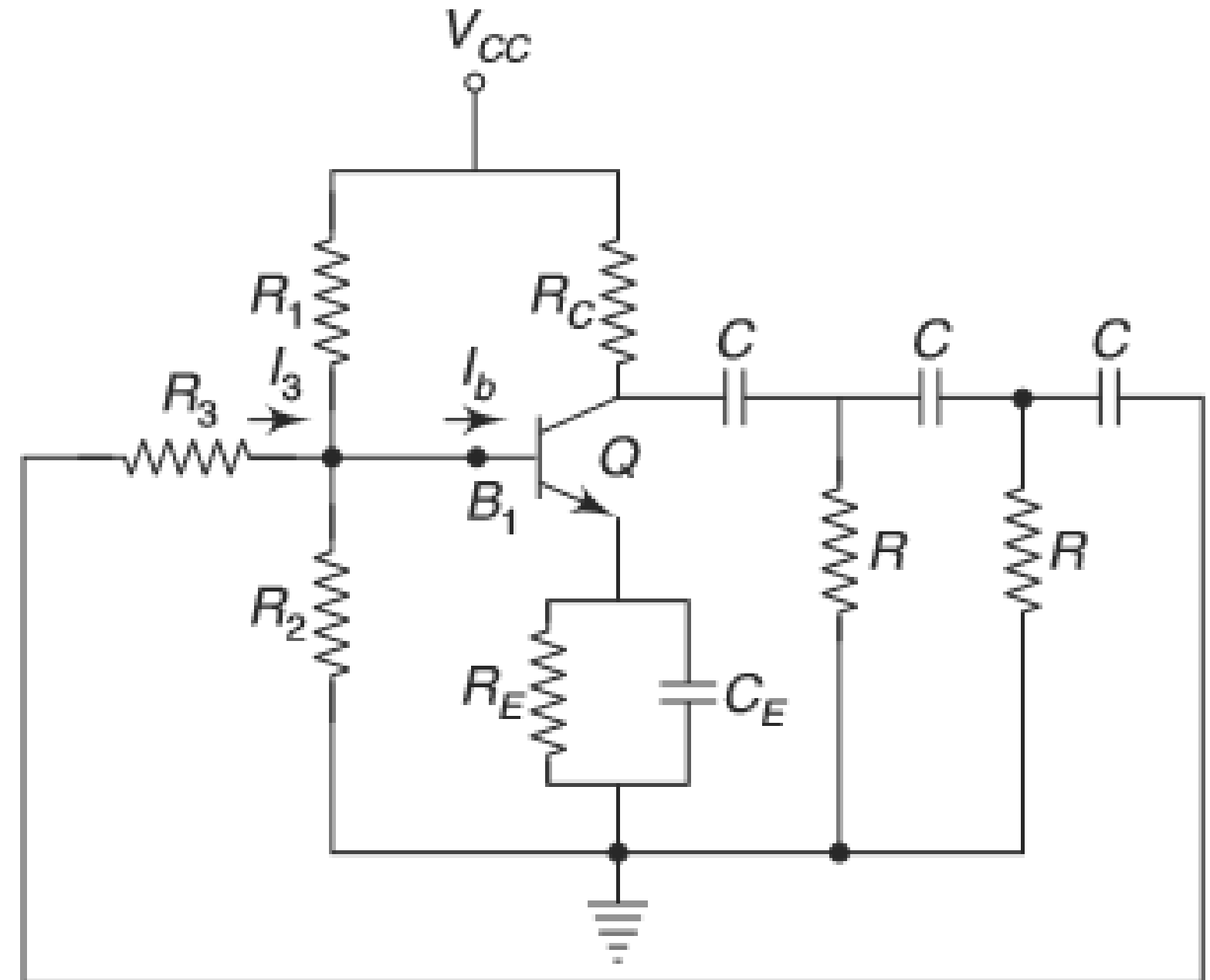




Amplitude Limiting by RC Stages

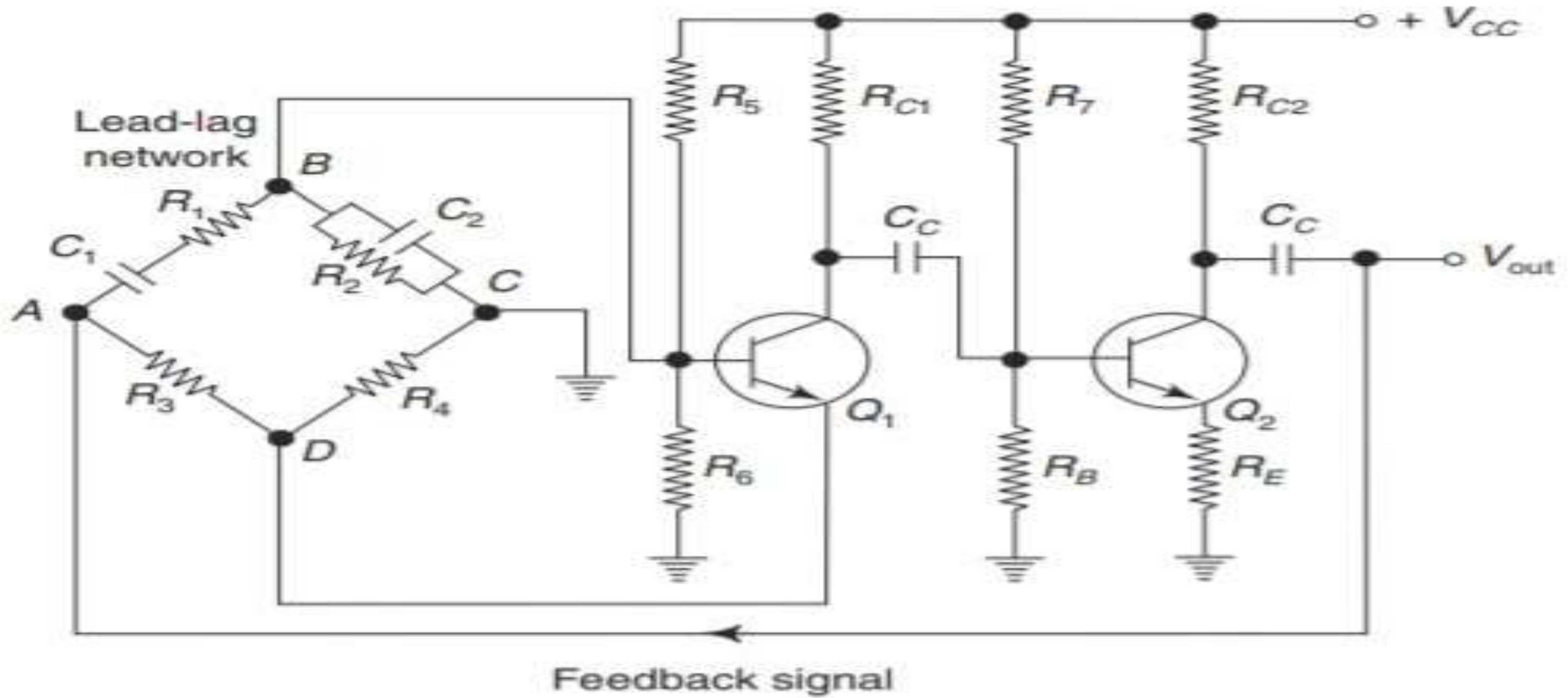


Signal compressed by RC stages





Wein Bridge Oscillator

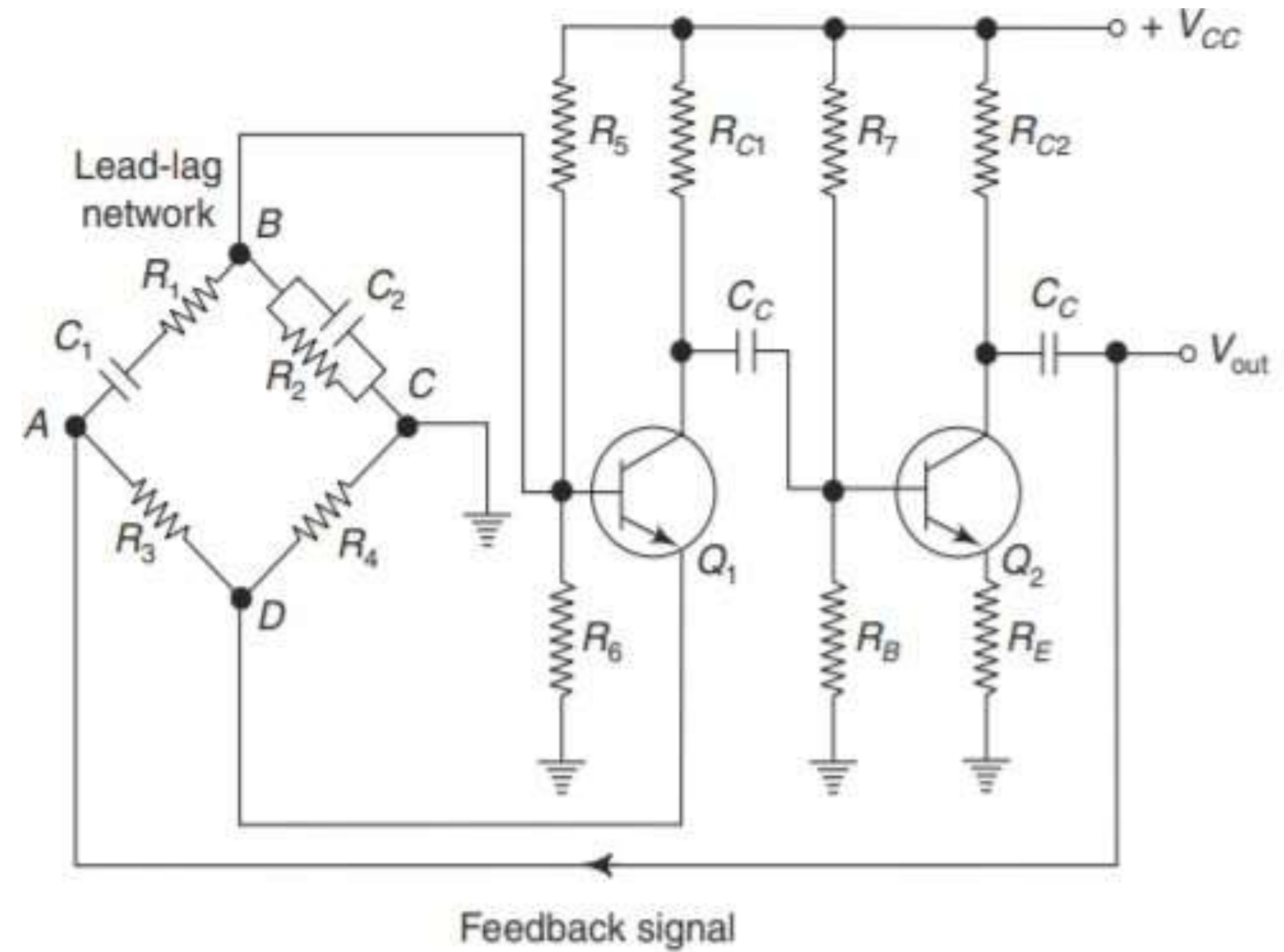




Wein Bridge Oscillator

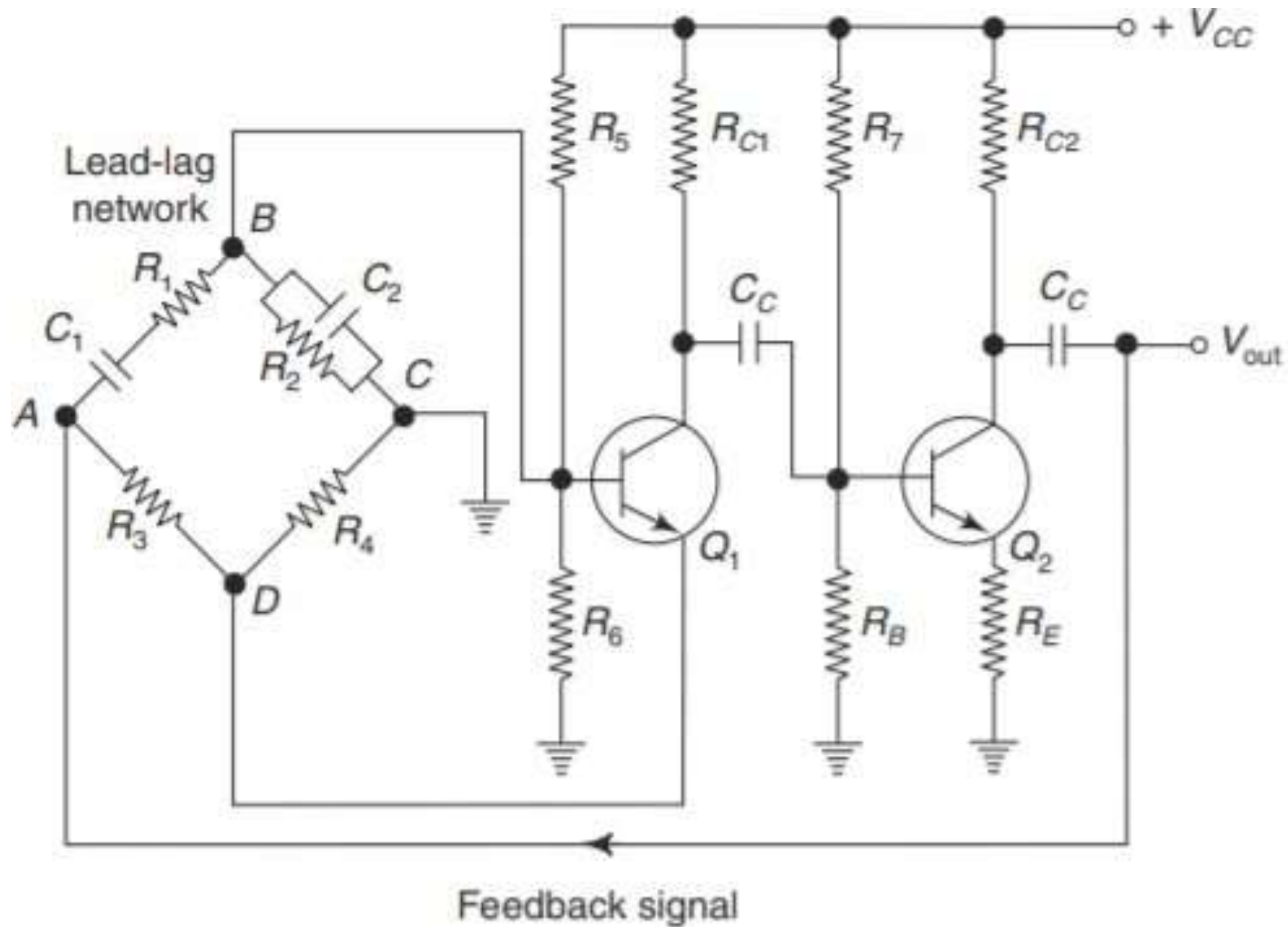


- The feedback network consists of a lead-lag network ($R_1 - C_1$ and $R_2 - C_2$) and a voltage divider ($R_3 - R_4$).





Wein Bridge Oscillator



- The lead-lag network provides a positive feedback to the input of the first stage and the voltage divider provides a negative feedback to the emitter of Q1.



Frequency of Oscillation



$$f_o = \frac{1}{2\pi\sqrt{R_1 R_2 C_1 C_2}}$$

$$= \frac{1}{2\pi RC}, \text{ if } R_1 = R_2 = R \text{ and } C_1 = C_2 = C.$$



Problem-I



In an RC phase shift oscillator, if $R_1 = R_2 = R_3 = 200 \text{ k}\Omega$ and $C_1 = C_2 = C_3 = 100 \text{ pF}$. Find the frequency of oscillations.

The frequency of an RC phase shift oscillator is given by

$$\begin{aligned} f_o &= \frac{1}{2\pi RC\sqrt{6}} \\ &= \frac{1}{2\pi \times 200 \times 10^3 \times 100 \times 10^{-12} \sqrt{6}} \\ &= 3.248 \text{ kHz} \end{aligned}$$



Problem-II



In a Wien-bridge oscillator, if the value of R is $100 \text{ k}\Omega$, and frequency of oscillation is 10 kHz , find the value of capacitor C .

Solution The operating frequency of a Wien-bridge oscillator is given by

$$f_o = \frac{1}{2\pi RC}$$

Therefore,

$$C = \frac{1}{2\pi R f_o}$$
$$= \frac{1}{2\pi \times 100 \times 10^3 \times 10 \times 10^3} = 159 \text{ pF}$$



Assessment 1



Determine the frequency of oscillations when a RC phase-shift oscillator has $R = 10 \text{ k}\Omega$, $C = 0.01 \text{ }\mu\text{F}$ and $R_C = 2.2 \text{ k}\Omega$. Also, find the minimum current gain needed for this purpose.





References



Electronic Devices and Circuits By Salivahanan

Thank You