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

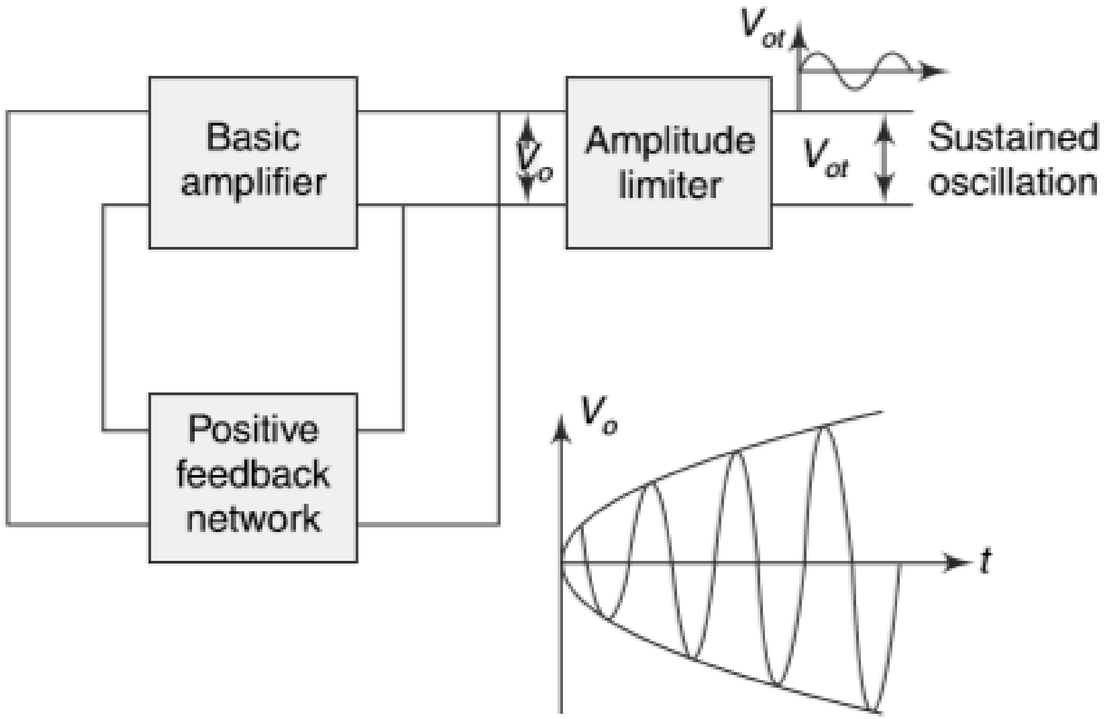
II YEAR /III SEMESTER

Unit 4- OSCILLATORS & MULTIVIBRATOR CIRCUITS

Topic 3 : Colpitts Oscillator

Need for Oscillators

- Communication Systems
- Control signals



Colpitts Oscillator Circuit

- NPN transistor
- Conditions for oscillations
- Positive Feedback

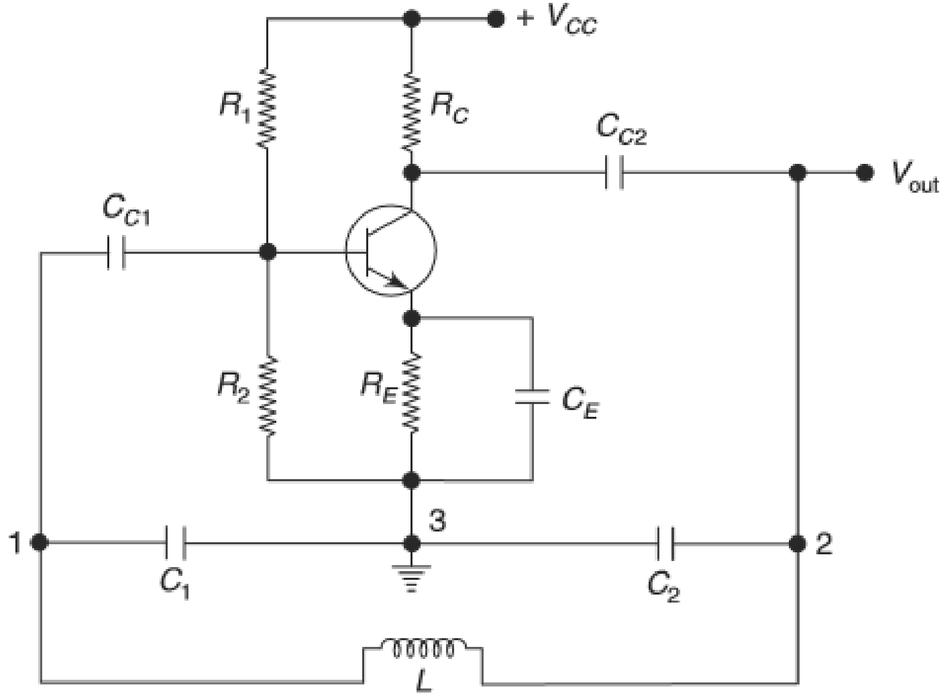


Fig. 15.5 *Colpitts oscillator*

Mechanism of Start of Oscillation

Empathy

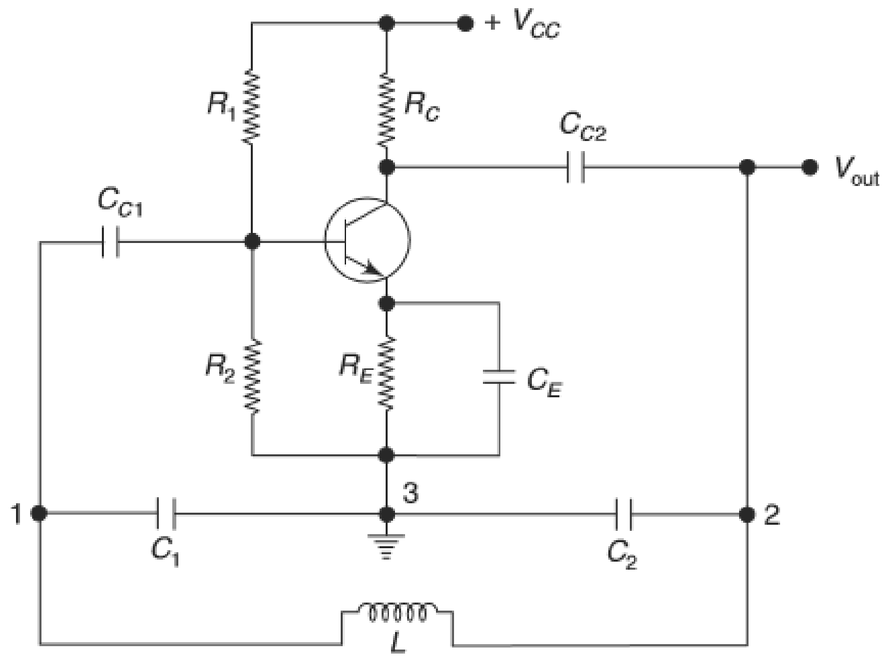
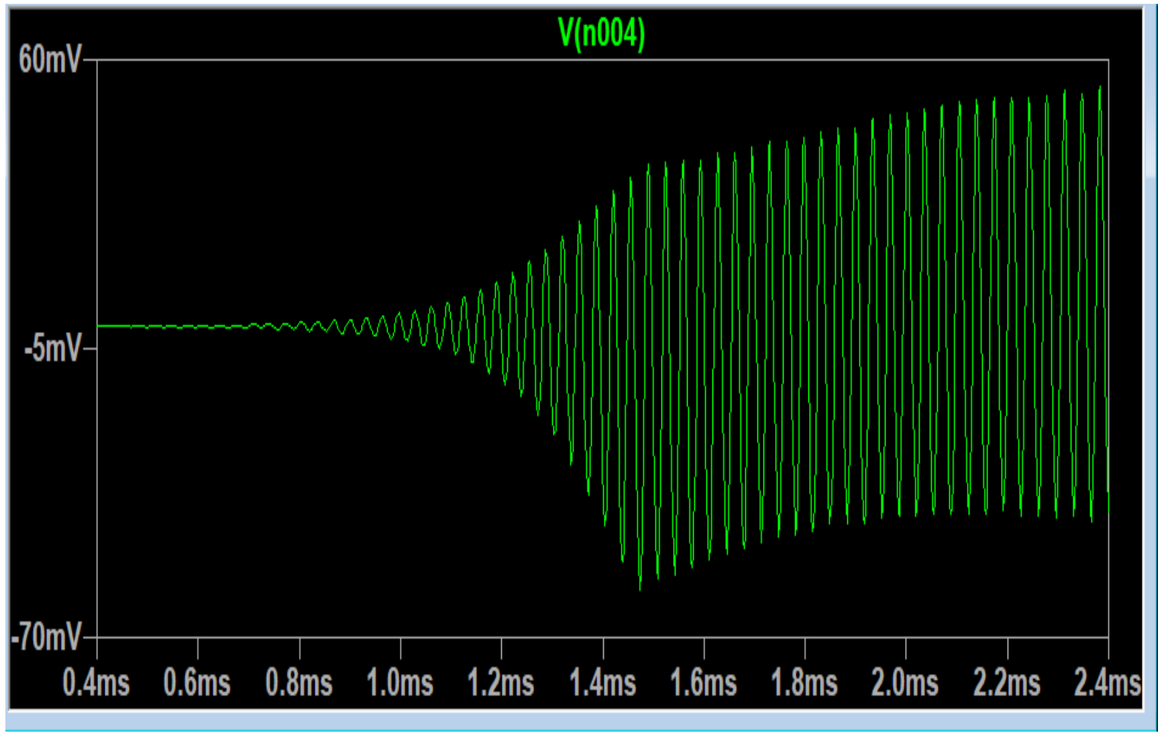


Fig. 15.5 *Colpitts oscillator*

Stabilization of Amplitude

Amplitude Limiting



Frequency of Oscillation

$$Z_1 = \frac{1}{j\omega C_1} = -\frac{j}{\omega C_1}$$

$$Z_2 = \frac{1}{j\omega C_2} = -\frac{j}{\omega C_2}$$

$$Z_3 = j\omega L$$

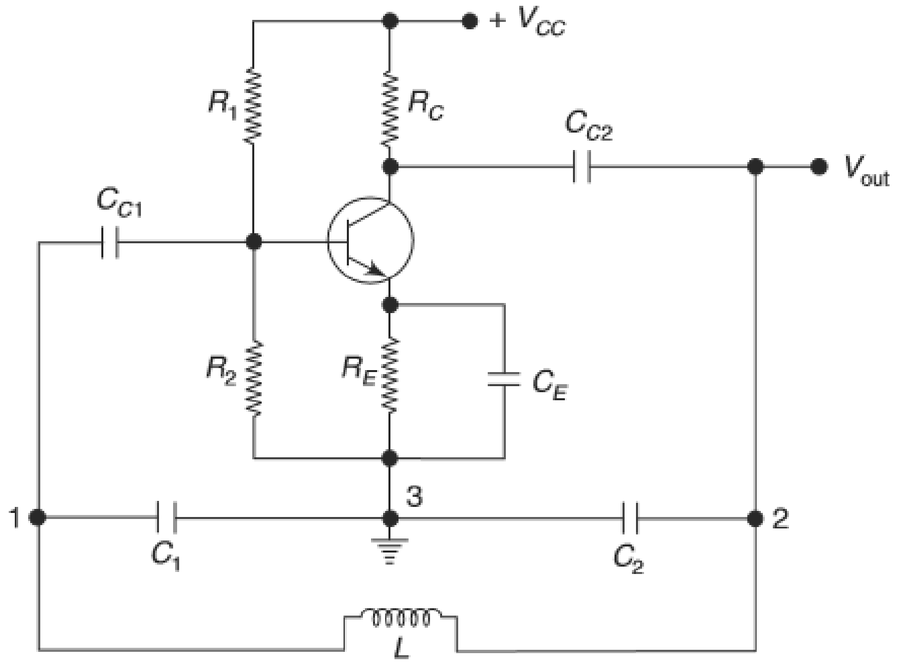


Fig. 15.5 *Colpitts oscillator*

Frequency of Oscillation

General Equation of Oscillation

$$h_{ie}(Z_1 + Z_2 + Z_3) + Z_1Z_2(1 + h_{fe}) + Z_1Z_3 = 0$$

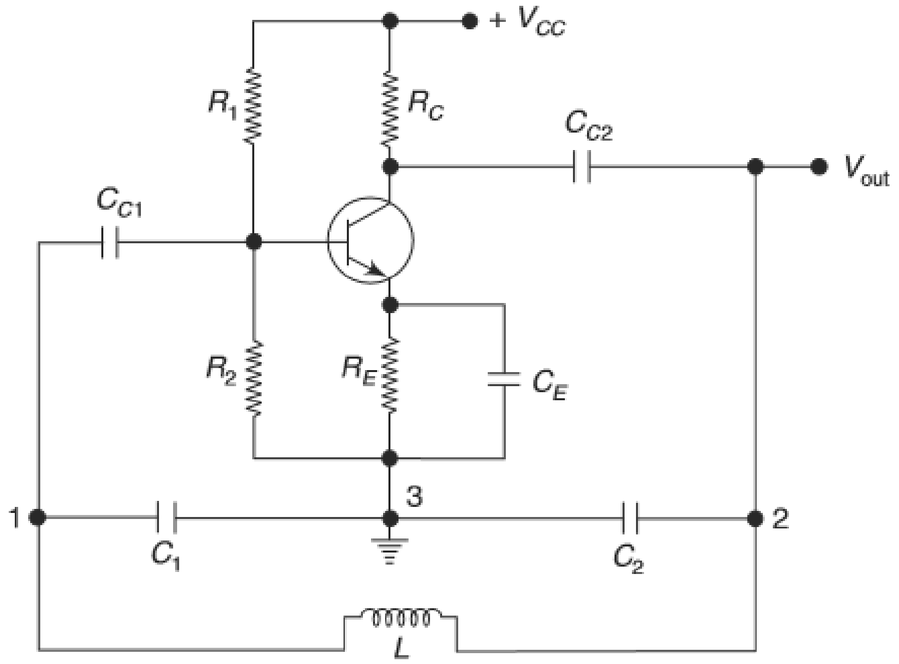


Fig. 15.5 *Colpitts oscillator*

Frequency of Oscillation

$$-jh_{ie}\left(\frac{1}{\omega C_1}+\frac{1}{\omega C_2}-\omega L\right)+\left(\frac{1+h_{fe}}{\omega^2 C_1 C_2}-\frac{L}{C_1}\right)=0$$

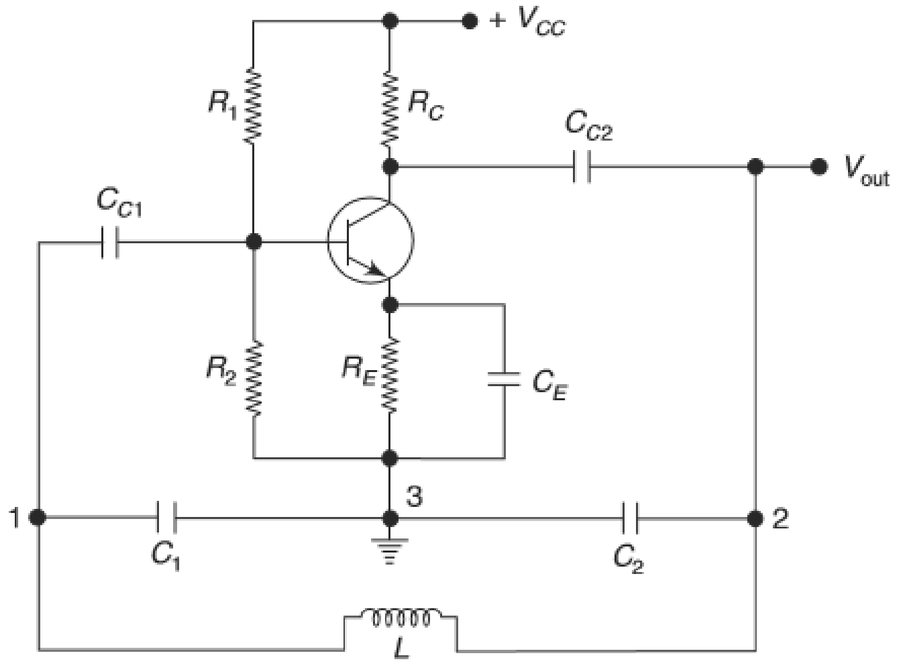


Fig. 15.5 *Colpitts oscillator*

Frequency of Oscillation

$$f_o = \frac{\omega_o}{2\pi}$$

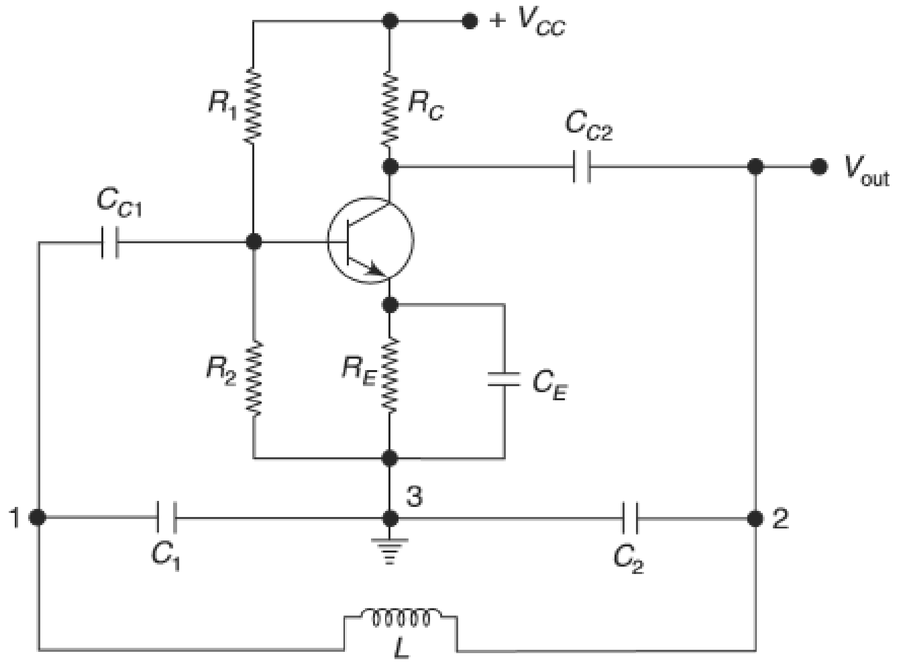


Fig. 15.5 *Colpitts oscillator*

Frequency of Oscillation

For calculating the frequency of oscillation

Equate the imaginary part of the basic equation to zero

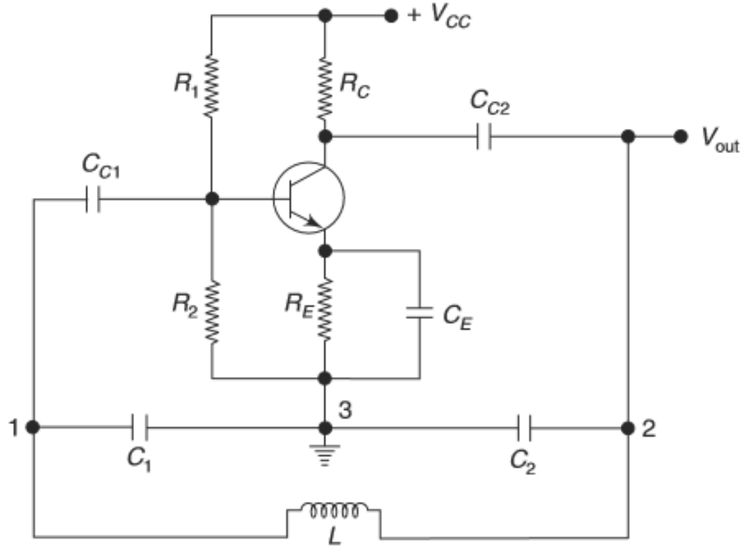


Fig. 15.5 *Colpitts oscillator*

Frequency of Oscillation

$$f_o = \frac{\omega_o}{2\pi} = \frac{1}{2\pi}\sqrt{\frac{C_1 + C_2}{LC_1C_2}}$$

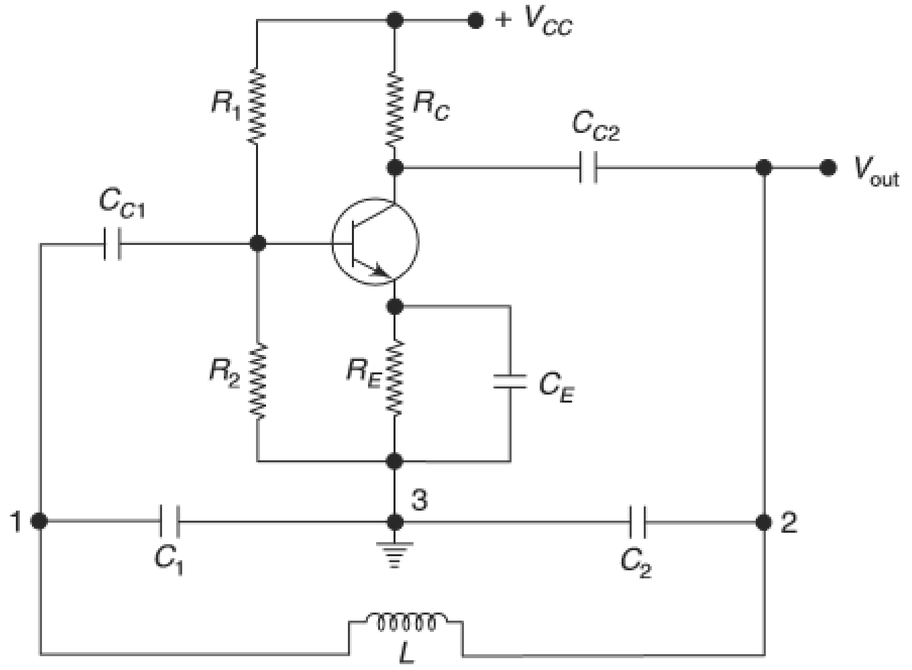


Fig. 15.5 *Colpitts oscillator*

Conditions for Maintenance of Oscillation

For obtaining the conditions for maintenance of oscillation equate the real part of the basic equation to zero

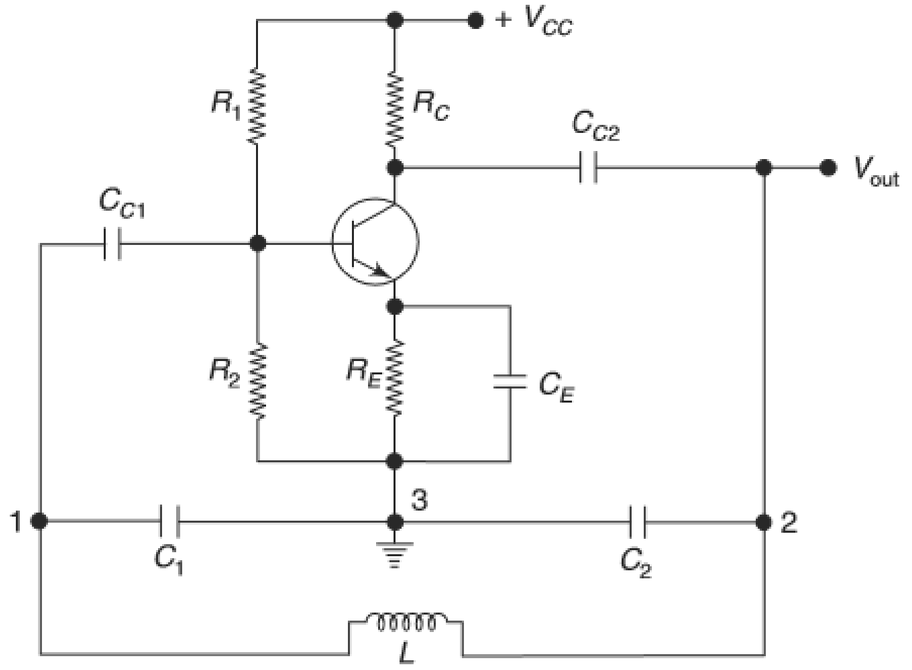


Fig. 15.5 *Colpitts oscillator*

Conditions for Maintenance of Oscillation

$$h_{fe} = \frac{C_2}{C_1}$$

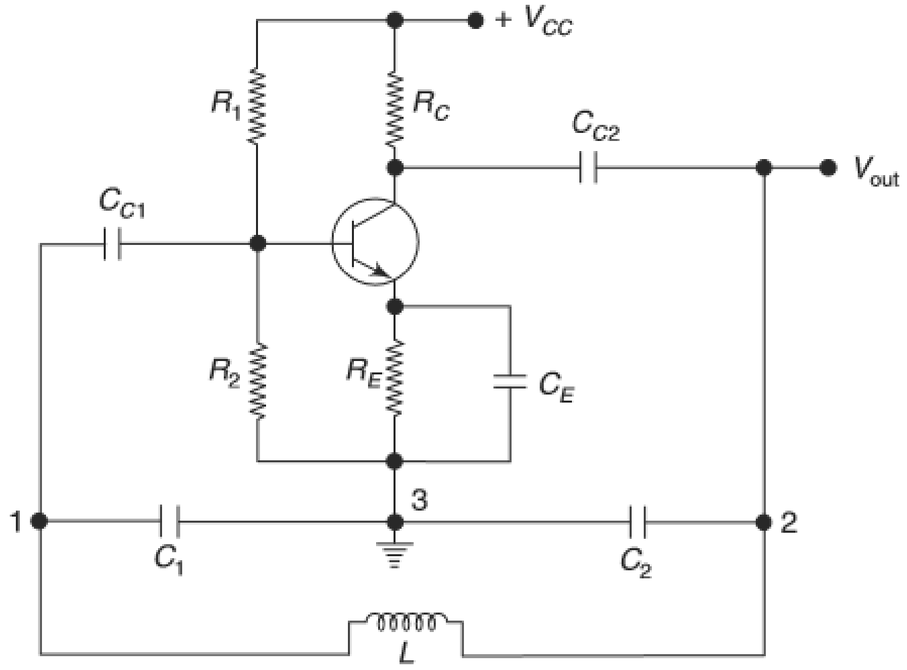


Fig. 15.5 *Colpitts oscillator*

Assessment 1

In the Colpitts oscillator, C1=0.02 micro Farads and C2=0.02 micro Farads. If the frequency of oscillation is 10 KHz, find the value of the inductor?

References

Electronic Devices and Circuits By Salivahanan

Thank You