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Department of Biomedical Engineering

Course Name: 23BMB101-Electron Devices and Circuits

I Year : II Semester

Unit V –Feedback Amplifiers and Oscillators

Topic : Wein Bridge Oscillator

INTRODUCTION

- Wien Bridge Oscillator is an oscillator which uses RC network so as to produce a sine wave at the output. These are basically the low-frequency oscillator that generates audio and sub audio frequency that ranges between 20 Hz to 20 KHz.
- This oscillator circuit uses the Wien bridge to provide feedback with the desired phase shift. It gives highly stable oscillation frequency and does not vary much with supply or temperature variation.
- It is basically a two-stage amplifier that consists of an RC bridge circuit or we can say Wien bridge circuit

Oscillators

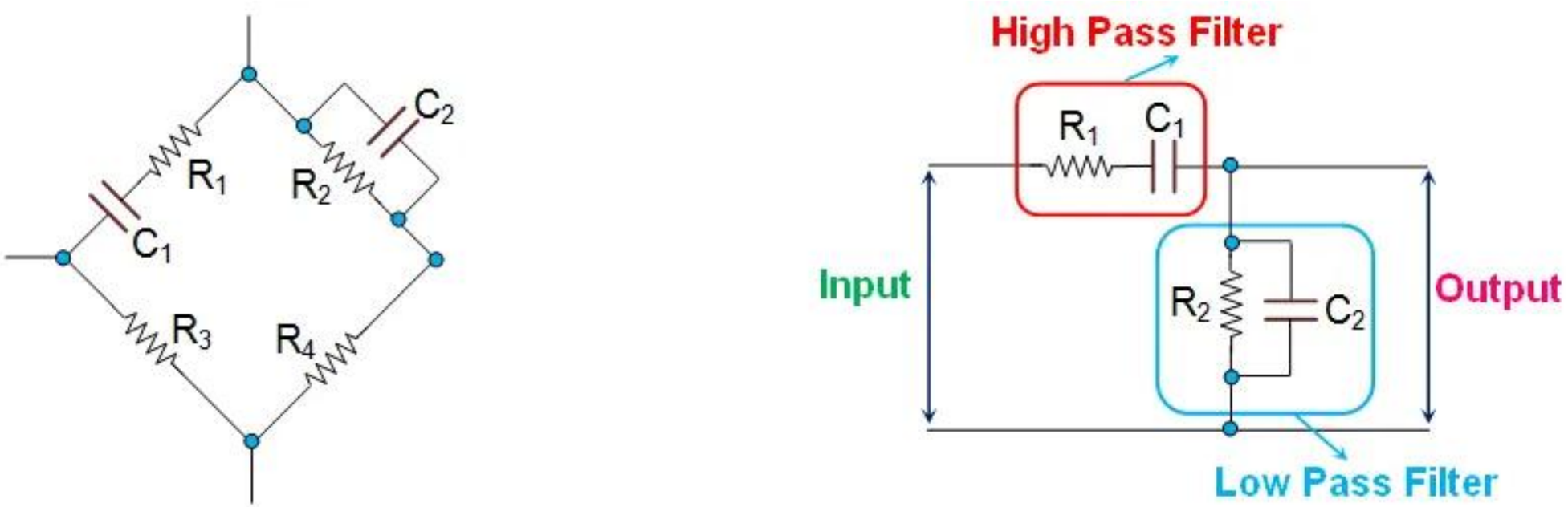
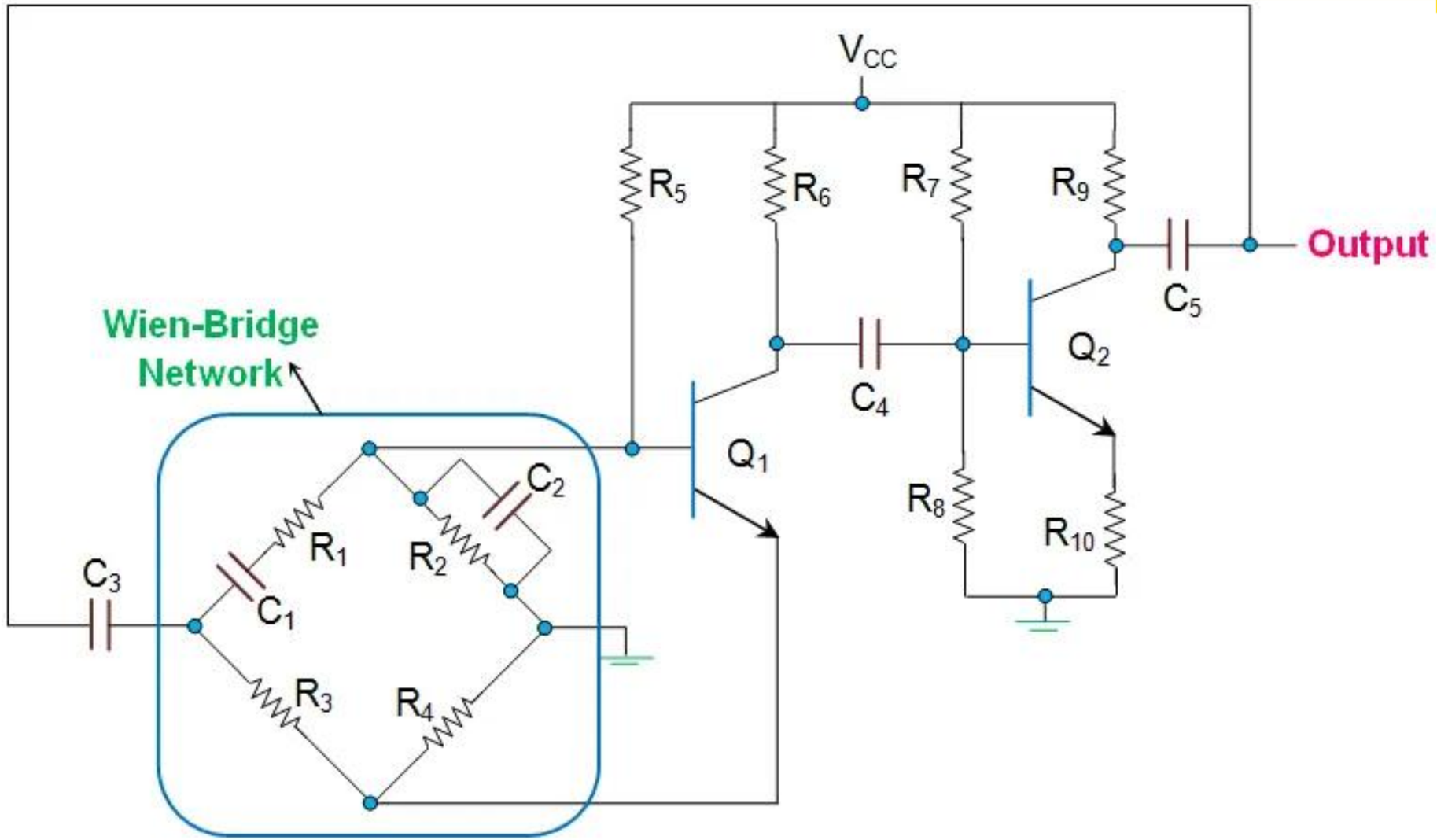


Figure 1 (a) Wien-Bridge Network (b) Two arms of the Wien-Bridge Network

Oscillator - Construction



Oscillators

$$R_3\left[\frac{R_2}{1+j\omega C_2 R_2}\right] = R_4\left[R_1 - \frac{j}{\omega C_1}\right]$$

$$R_2R_3 - R_4R_1 - \frac{C_2}{C_1}R_2R_4 = 0$$

$$or\ \frac{C_2}{C_1} = \frac{R_3}{R_4} - \frac{R_1}{R_2}$$

$$\frac{R_4}{\omega C_1} - \omega C_2R_2R_1R_4 = 0$$

$$\omega^2 = \frac{1}{C_1C_2R_1R_2}$$

$$\omega = \frac{1}{\sqrt{C_1C_2R_1R_2}}$$

$$f = \frac{1}{2\pi\sqrt{R_1R_2C_1C_2}}$$

If $C_1 = C_2 = C$ and $R_1 = R_2 = R$, then

$$f = \frac{1}{2\pi CR}$$

and $R_3 = 2R_4$

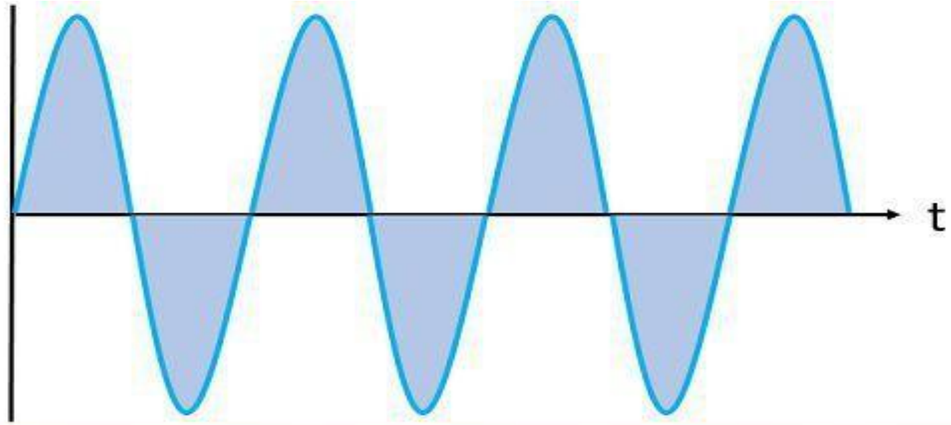
- The **frequency** at which the **oscillator provides maximum output** is known as **resonant frequency**.

Working of Wein Bridge Oscillator

- In these oscillators, the amplifier section will comprise of two-stage amplifier formed by the transistors, Q1 and Q2, wherein the output of Q2 is back-fed as an input to Q1 via Wien-Bridge network.
- The noise inherent in the circuit will cause a change in the base current of Q1 which will appear at its collector point after being amplified with a phase-shift of 180^{o}. This is fed as an input to Q2 via C4 and gets further amplified and appears with an additional phase-shift of 180^{o}.
- The circuit uses both positive feedback and negative feedback. The positive feedback is given through R1, C1, R2, C2 to transistor Q1 and the negative feedback is given through voltage divider R3-R4 to emitter section of transistor Q1.

Working of Wein Bridge Oscillator

- A part of the output of Q2 is again fed to the input of the bridge circuit. A part of the forwardly biased signal is supplied across R2 which produces positive feedback or we can say regenerative effect and the part which is applied to R4 produces negative feedback or degenerative effect.
- To have sustained oscillations, the effect of regeneration is made somewhat more than that of degeneration at the rated frequency.



Output waveform for a Wien bridge oscillator