Laboratory Report

Laboratory Exercise No.:	11	**Date Performed:**	04-12-25
Laboratory Exercise Title:	Oscillator Circuits		
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Part I Theory

Oscillator circuits are electronic circuits that produce a constant, repeating waveform without the need for an external signal. The waveform may be sinusoidal, square, or triangular in nature, depending on design and application. Oscillators are a critical element in numerous electronic devices and serve to produce timing pulses, carrier waves in communications systems, and clock pulses in digital circuits. Oscillators differ from amplifiers in that they utilize positive feedback to continue to supply a self-generated output.

There is a multitude of particular oscillator designs for different frequency ranges and applications. Traditionally, Colpitts, Hartley, and Clapp oscillators are common LC-based circuits used in radio-frequency (RF) applications because they are stable and easy to use. Wein bridge oscillators, RC-based networks, are often used in audio-frequency ranges to produce low-distortion sine waves. Crystal oscillators are also available in many forms, but quartz is the most popular, due to the stable mechanical resonance of quartz, which is the basic mechanism behind its exceptional frequency precision. People have come to rely on quartz oscillators in everything from wristwatches to microprocessors. Digital systems most often rely on ring oscillators or astable multivibrators that produce square waves for clocks or timing purposes. Thus, oscillator circuits are fundamental to electronics, providing the heartbeat of virtually all applications of electronics, from simple timers to more complex systems like communication systems.

Part IIa Construction of a Phase-Shift Oscillator

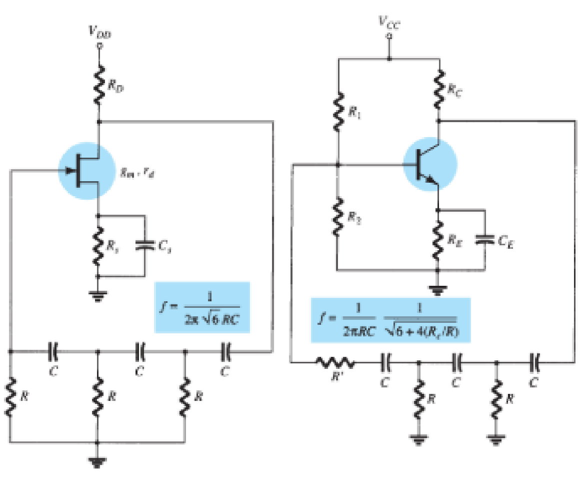

Fig 2a.1. (a) FET Version (b) BJT Version

For this experiment, we used the FET version of the Phase-shift Oscillator.

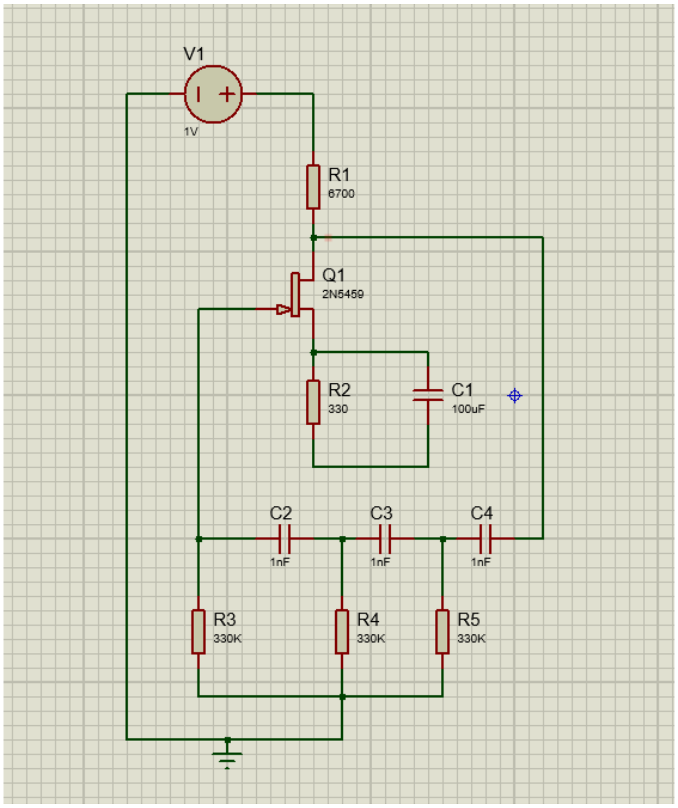

Fig 2a.2 . Proteus Version of FET Phase-Shift Oscillator

Data:

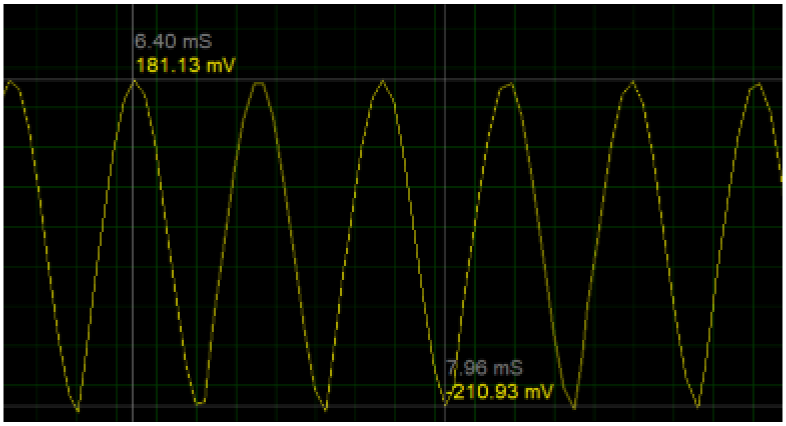

Figure 2a.3 Phase-shift Oscillator Wave

Time Per division(s)	0.125ms
Voltage per division(V)	1V
Frequency (Hz)	2k

Table 2a.1 Phase-shitd Oscillator Wave

Part IIb Crystal Oscillator

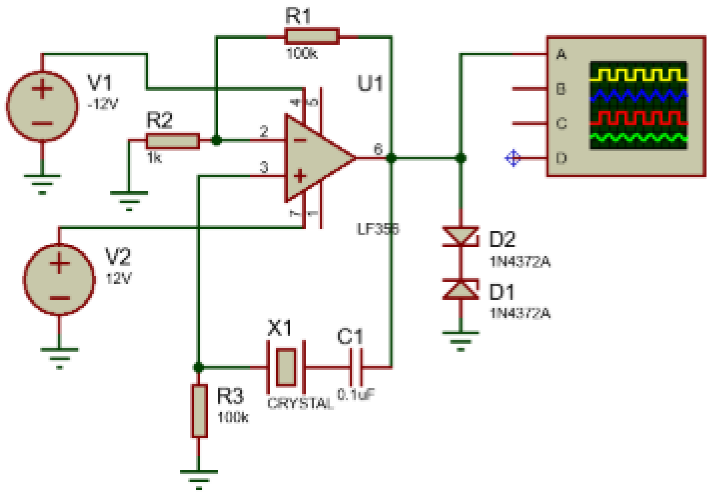

Fig 2b.1 Crystal Oscillator op-amp Version

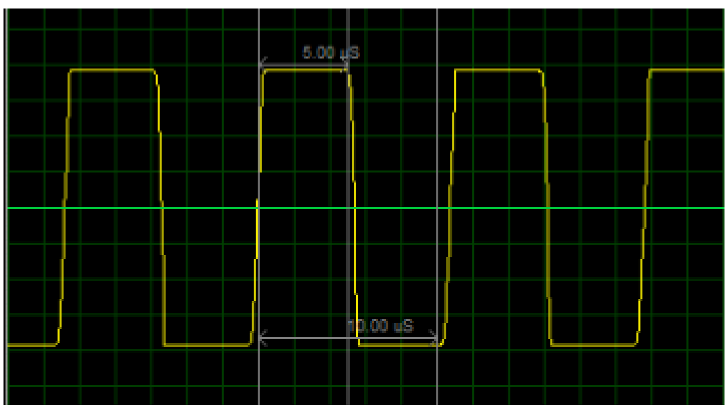

Fig 2b.2 Crystal Oscillator Wave

Time Per division(s)	10uS
Voltage per division (V)	1V
Frequency (Hz)	1k

Table 2b.1 Crystal Data

Part III. Analysis

1. **Observe the signal plot in Table 1. What type of waveform the oscillator generated?**
   - It generated a sin wave
2. **From the signal plot in Table 1, what is the phase shift of the signal?**
   - Using the time per division value and the period of 0.0005 derived from 1/f, one can determine the signal's phase-shift, which comes out to be roughly 90 degrees.
3. **Observe the signal plot in Table 2. What type of waveform the oscillator generated?**
   - It generated a square wave

4. **Based on the output signal of the crystal oscillator, calculate the duty cycle (percentage of the period where the output is high).**
    - To calculate the duty cycle, the formula Duty Cycle(%)=((Pulse Width)/Period)×100 is to be used. The Pulse Width is 5μs while the Period is 10μs so the Duty Cycle is 50%.

References

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[3] T. Floyd, *Electronic Devices*, 10th ed. Boston, MA, USA: Pearson, 2018.

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