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Experiment 8

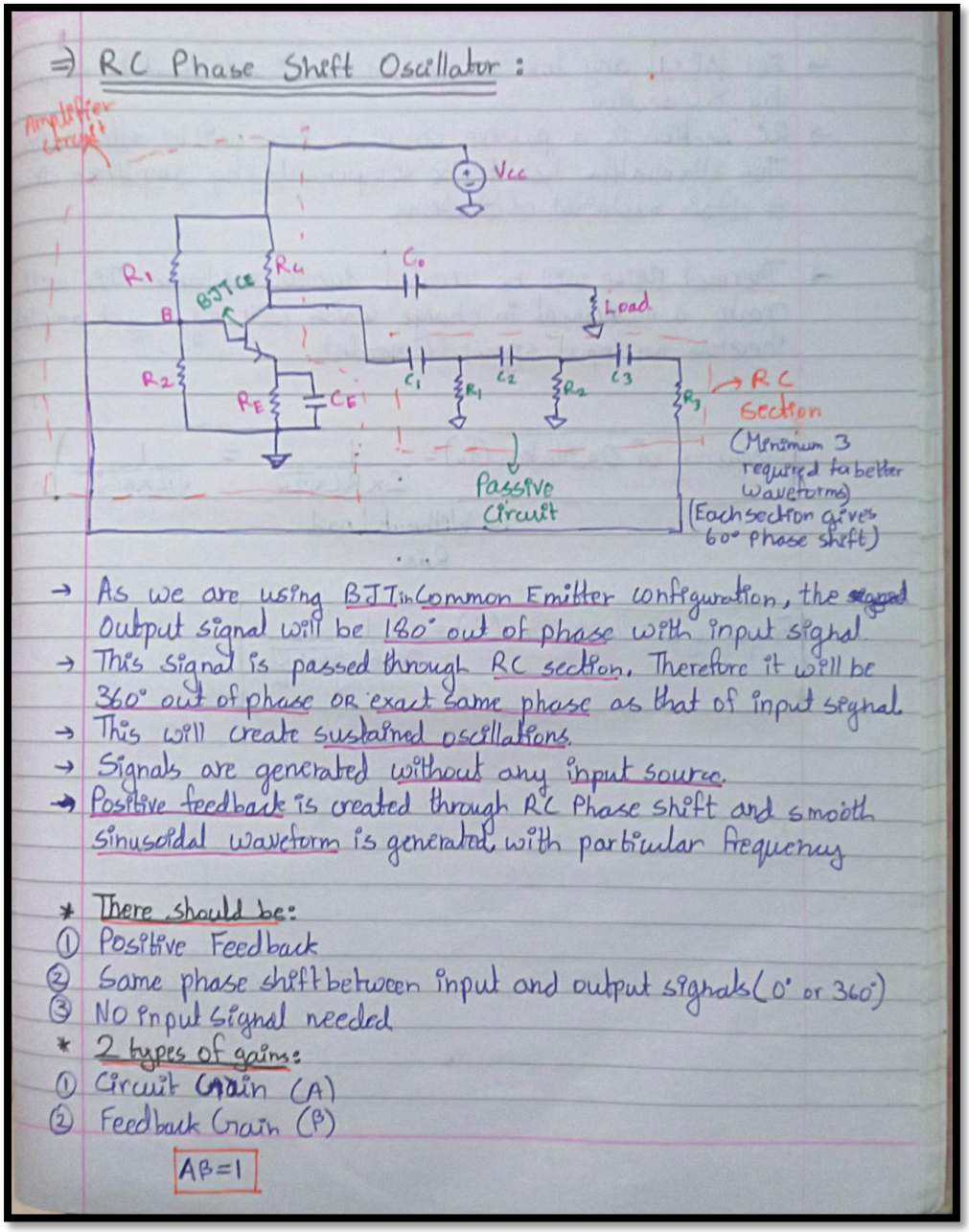
Aim:

Simulation of RC Phase Shift Oscillator using LT Spice

Tools and Apparatus:

LTSpice, BJT Transistor, Resistors, Capacitors, Voltage Sources

Theory and Design:



→ For $A\beta = 1$, any loss or gain in the circuit shout be compensate by RC section.

→ RC section is a passive circuit so there will be attenuation. This attenuation has to be compensated by amplifier circuit to obtain sustained oscillations.

→ Thermal noise will be created due to resistance. This will create a movement in charge which will again get amplified therefore no input signal is needed.

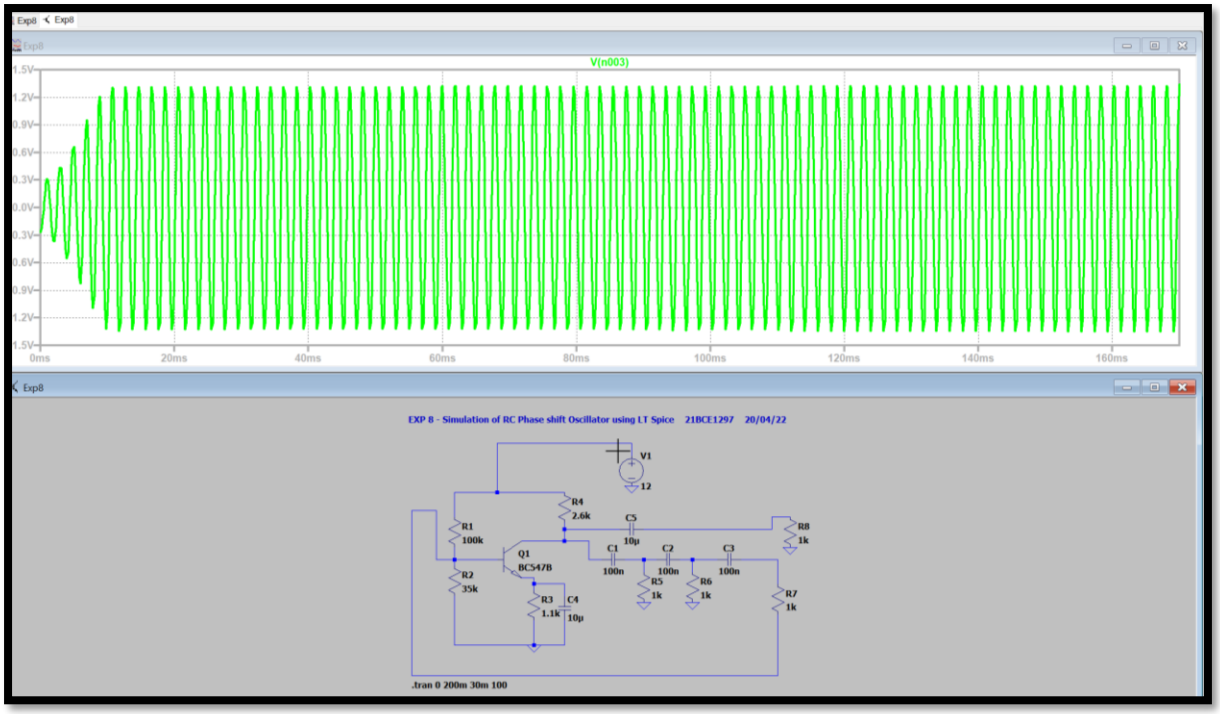
Frequency of Oscillation $(f_o) = \frac{1}{2\pi RC\sqrt{2N}} = \frac{1}{\sqrt{2\pi RC\sqrt{6}}}$

↳ Without Load Res.

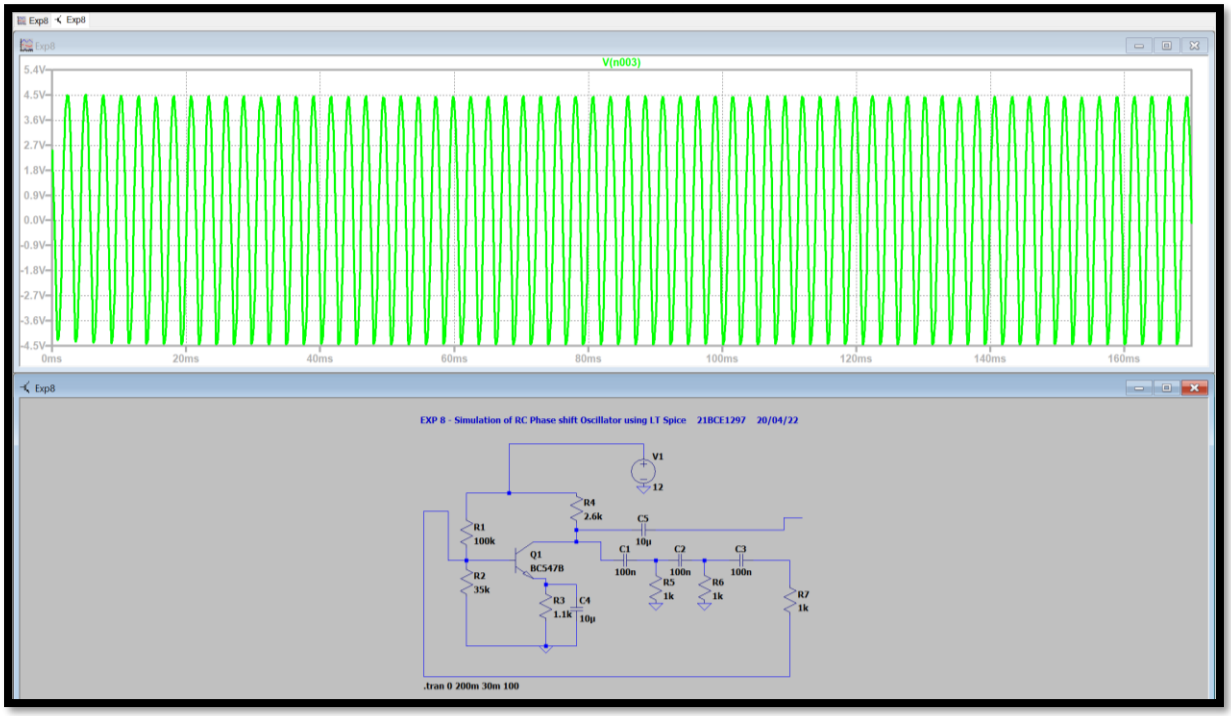
Frequency of Oscillation $(f_o) = \frac{1}{2\pi RC\sqrt{6+4\frac{R_L}{R}}}$

Simulation Results:

1. With Load



2. Without Load



Conclusion:

1. With Load:

- $f_0 = \frac{1}{T} = \frac{1}{63.80-61.87} \times 10^3$ = 517.15 Hz (Simulated)
- $f_0 = \frac{1}{2\pi RC\sqrt{2N}} = \frac{1}{2\pi(1k\Omega)(100nF)\sqrt{6}}$ = 649.75 Hz (Calculated)

2. Without Load:

- $f_0 = \frac{1}{T} = \frac{1}{62.41-59.82} \times 10^3$ = 386.6 Hz (Simulated)
- $f_0 = \frac{1}{2\pi RC\sqrt{2N+4\times\frac{R_C}{R}}} = \frac{1}{2\pi(1k\Omega)(100nF)\sqrt{6+4\times\frac{2.6}{1}}}$ = 393.005 Hz (Calculated)

Inferences:

1. **Oscillation frequency (f_0)**:
   a. With Load: 500-600 Hz
   b. Without Load: 350-400 Hz
2. It gives positive feedback and no input source is needed.
3. Minimum 3 RC sections should be connected to obtain better waveform
4. Marginal error occurs between stimulated and calculated values due to loading effect.
5. Connect all components properly.