INTERNATIONAL INSTITUTE OF INFORMATION TECHNOLOGY

HYDERABAD

Department

of

Electronics & Communication Engineering

Analog Electronic Circuits

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Project: Hartley Oscillator

Initial Report

Team No. 22

Team members:

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Aim:

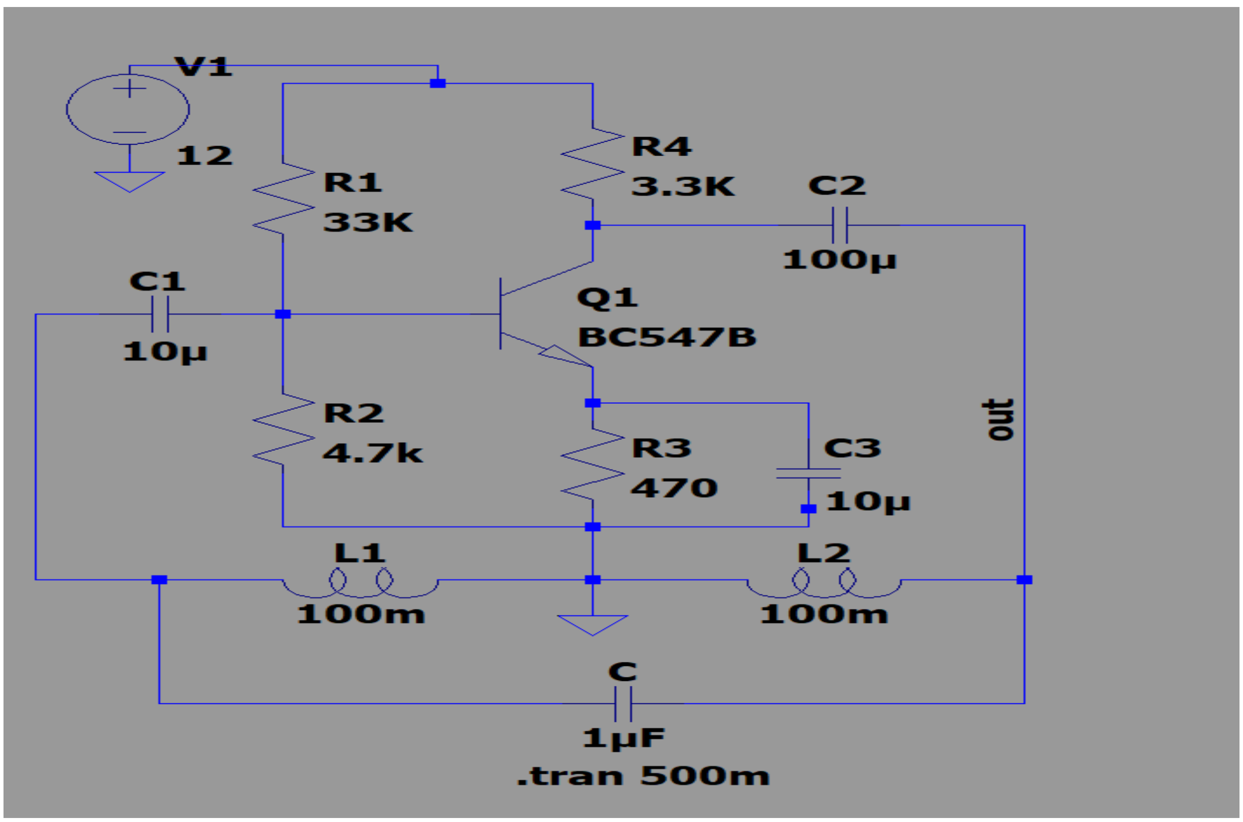
Generating AC output from DC input using Hartley Oscillator.

Function:

The Hartley Oscillator design uses two inductive coils in series with a parallel capacitor to form its resonance tank circuit producing sinusoidal oscillations. The frequency of oscillation is given by omega/2pi where omega is $\omega_0 = 1/\sqrt{(L_1 + L_2)C}$ and that for oscillations to start is

$$g_m R > L_1/L_2$$

Circuit:



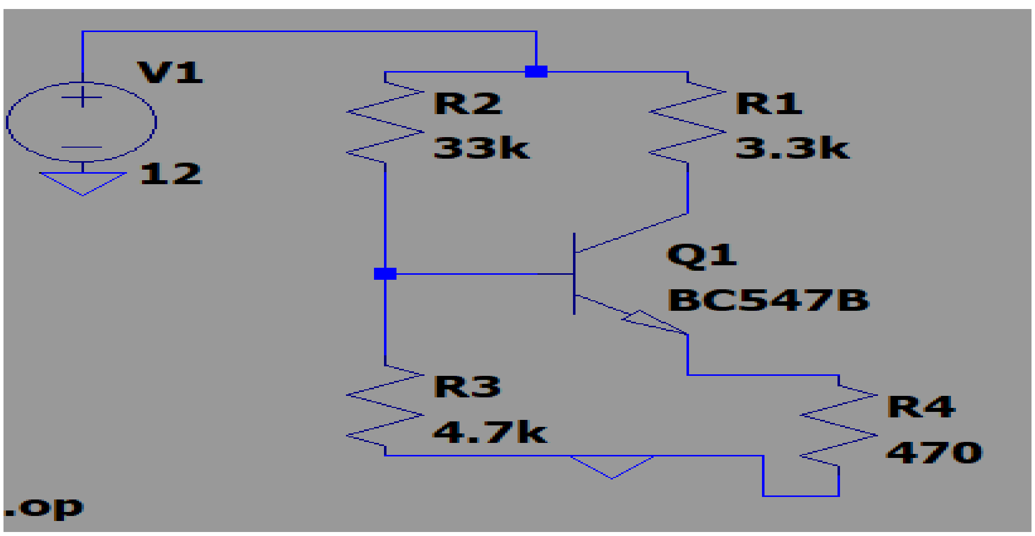
Theory:

R_1, R_2, R_3 provide the necessary bias for the circuit. C_1 and C_2 allow only the AC component of the signal to pass. The Radio Frequency Choke (RFC) offers a very high impedance to high-frequency currents which means it shorts for DC and opens for AC. Hence, it provides DC load for the collector and keeps AC currents out of the DC supply source.

The theoretically obtained value is **340.66 Hz**

Working of the circuit :

Amplifier part: The part of the circuit which will help in amplifying the output of the tank circuit.



--- Operating Point ---

V(b):	6.25821	voltage
V(a):	1.47241	voltage
V(c):	0.820468	voltage
V(n001):	12	voltage
Ic(Q1):	0.00173994	device_current
Ib(Q1):	5.74033e-006	device_current
Ie(Q1):	-0.00174568	device_current
I(R4):	0.00174568	device_current
I(R3):	0.000313278	device_current
I(R2):	0.000319018	device_current
I(R1):	0.00173994	device_current
I(V1):	-0.00205895	device_current

So from above, we found Ic = 0.00173994

Transconductance = gm = Ic/Vt = 0.00173994/26mv

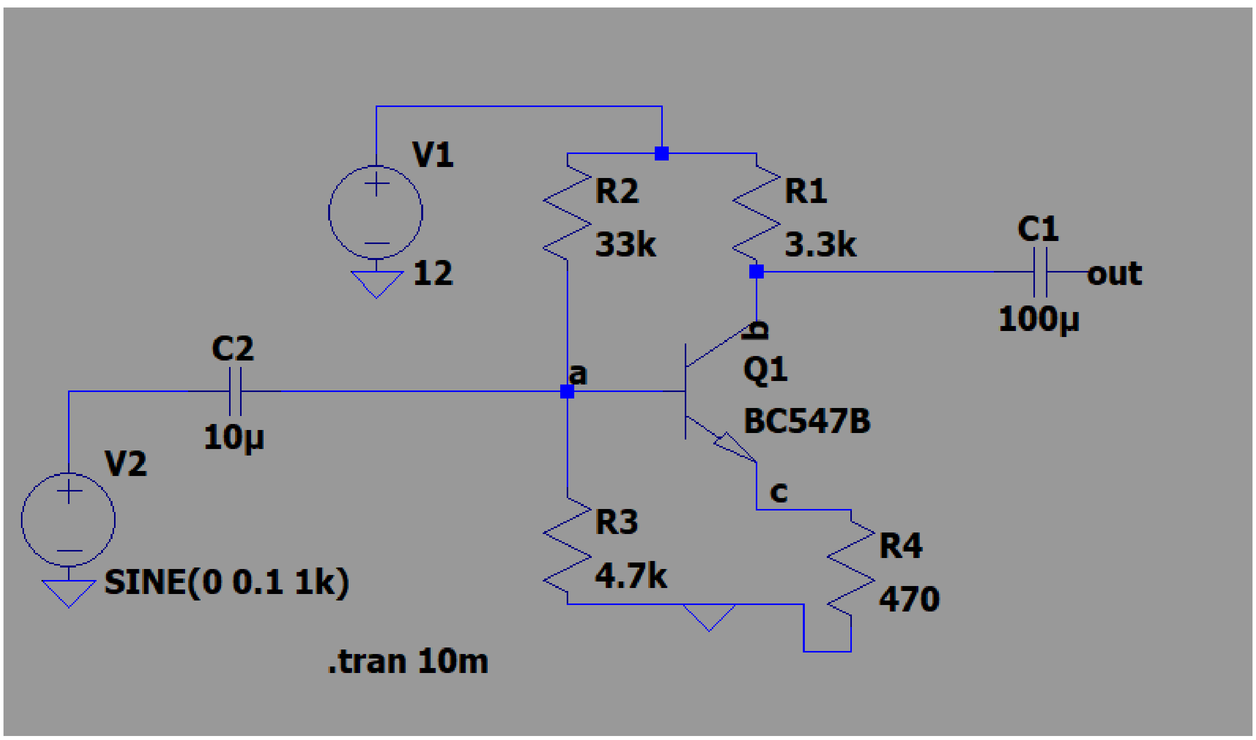
Gm = 0.06692A/V

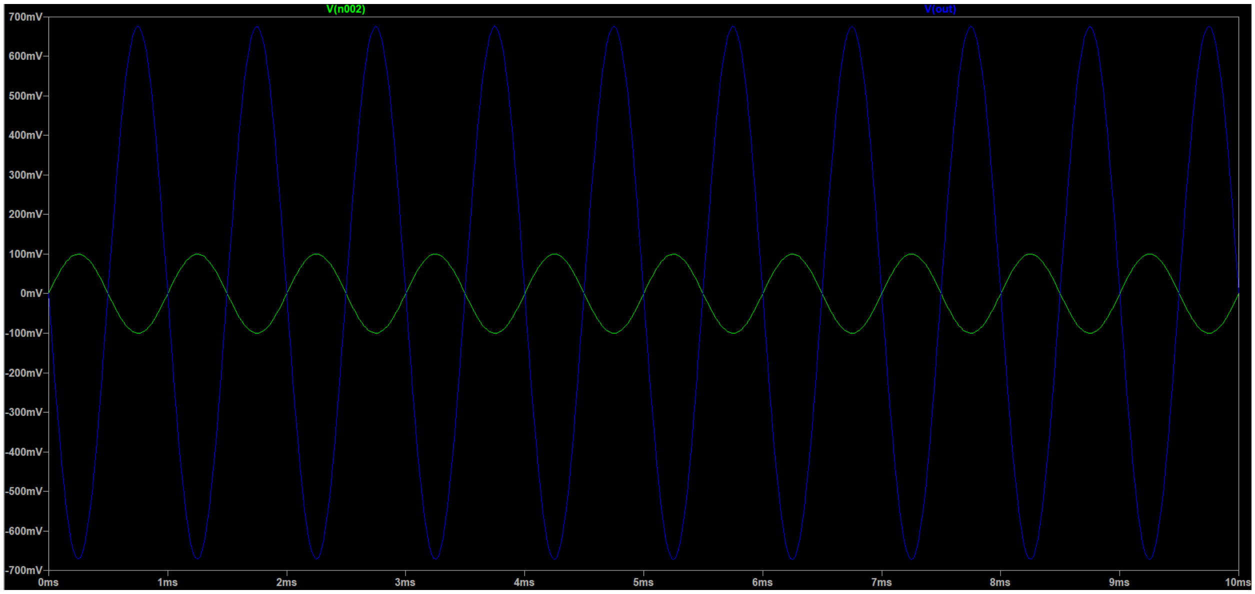
Now for common emitter calculated value of grain is

$$A_V = -g_m R_C / (1 + g_m R_E)$$

Av = 6.9990

Working of amplifier :





We can see that the gain of the amplifier is -6.89. The value of gain approximately matches with the theoretically calculated gain.

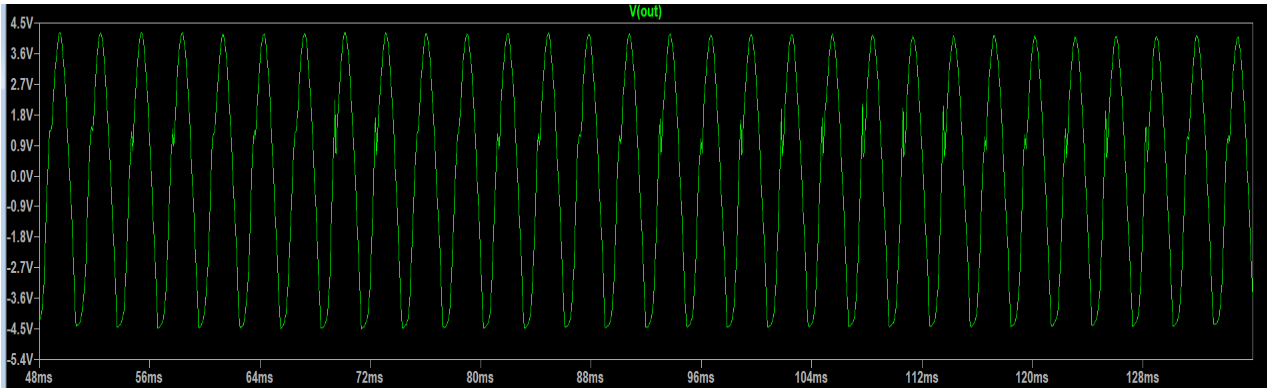
<u>Tank Circuit:</u>

The frequency determining network is a parallel resonant circuit that consists of the inductors L_1 and L_2 along with a variable capacitor C. The junction of L_1 and L_2 are earthed. The coil L_1 has one end connected to the base via C_2 and the other to the emitter via C_3. So, L_2 is in the output circuit.

Observations:

By changing the values of tank circuits components we can vary the frequency. (as mentioned in the functioning of the hartley oscillator)

- C = 1uF, the output is as follows:



On LTSPICE we got a frequency of **340 Hz** and theoretically we got **340.66 Hz.**

Application:

1. It is used to produce sinusoids of the desired frequency.
2. It can also be used as an R.F oscillator.

Future Work:

We are thinking of using a buzzer via which we can show the frequency change in sinusoids occurring by changing the values of components (or using a variable capacitor or inductor instead of constant value components) of the tank circuit.