EE 321 Lab Report

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EXPERIMENT - 3

AIM :-

1. Generation and demodulation of PAM signal.

THEOROTICAL BACKGROUND: -

PAM or pulse amplitude modulation is the simplest form of pulse modulation in which amplitude of regularly spaced pulses varies according to the amplitude of message signal. Width of pulses are narrow compared to the period of sampling so that duty cycle is kept low. In this modulating signal is strictly positive.

Demodulation is a process of obtaining the message signal back from the modulated signal. We can obtain the message signal by passing it through a second order Butterworth low pass filter designed using opamp. A Butterworth Filter is a type of Active Filter, where the frequency response of the across its pass band is relatively flat.

WORKING PRINCIPLE: -

The modulator circuit comprises of amplifier and switching circuit. The purpose of amplifier is to make the message signal positive which is very essential for PAM. Then it is passed through a switching circuit which is controlled by the pulse signals. At the collector of Q2, we get a series of pulses whose amplitudes are proportional to the message signal. The resulting output is the desired PAM signal. Also, the frequency of pulse signal should satisfy the Nyquist criterion.

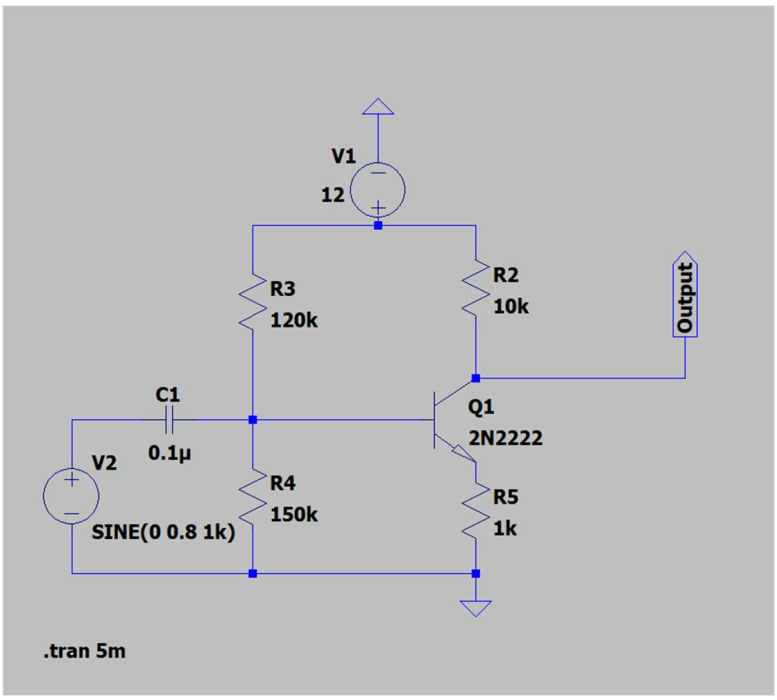
Demodulation of the PAM signal is obtained using a low pass active butterworth filter.

STEPS OF SIMULATION: -

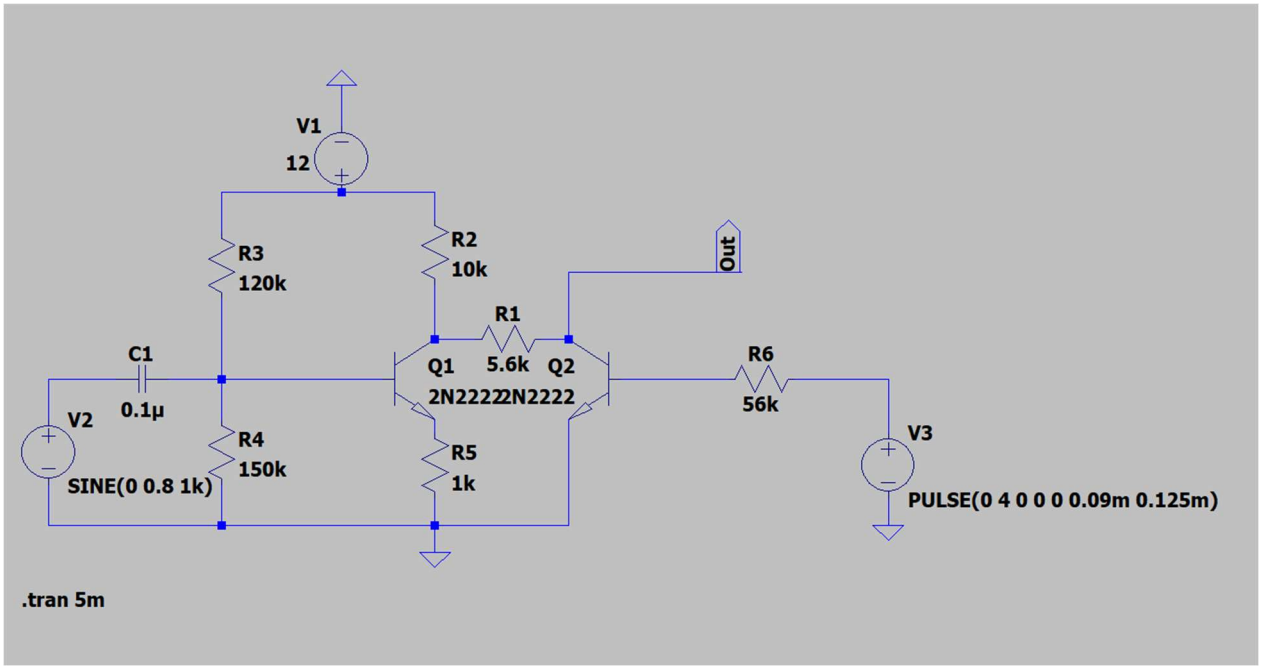
1. Implement the amplifier stage, apply the sinusoidal message signal and obtain the output across the amplifier.
2. Connect the switching circuit and apply the pulse signal with 70-90% duty cycle. Obtain the output across the Q2 transistor.
3. Connect the demodulator signal and obtain the demodulated message signal.

CIRCUIT DIAGRAMS: -

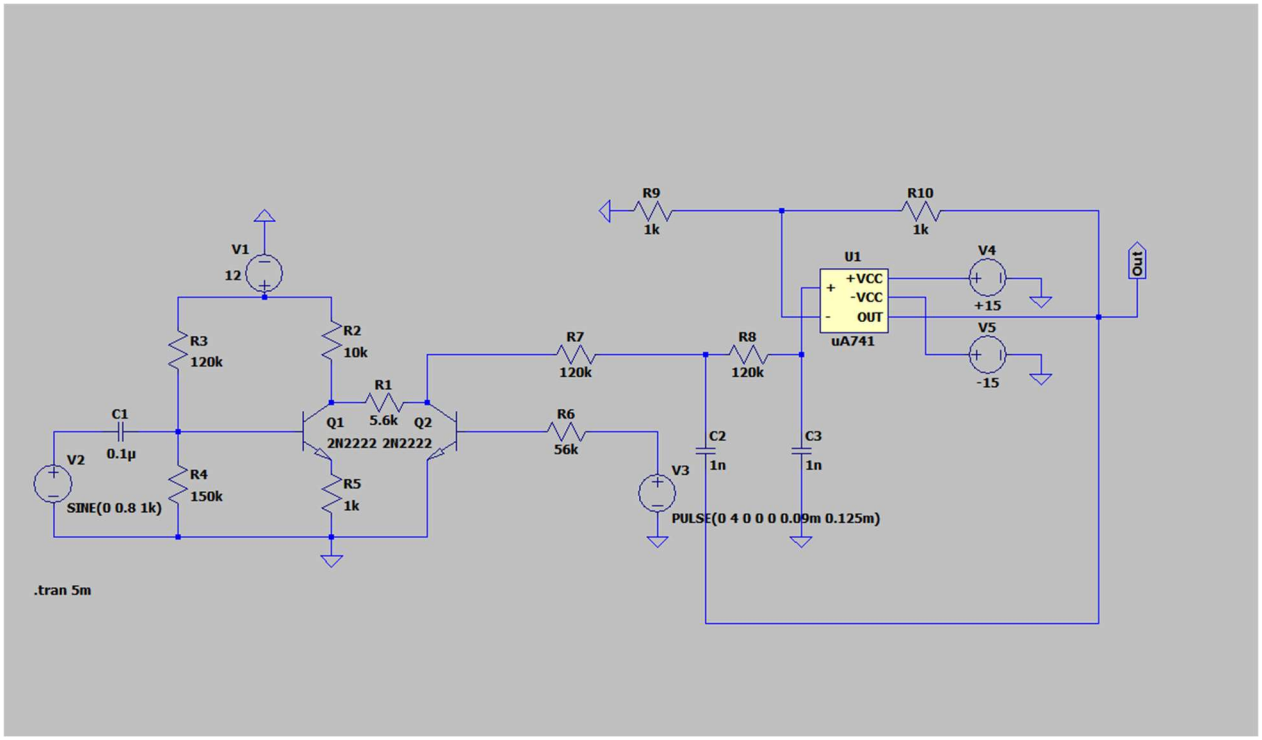
1. Amplifier circuit



2. PAM Signal generator

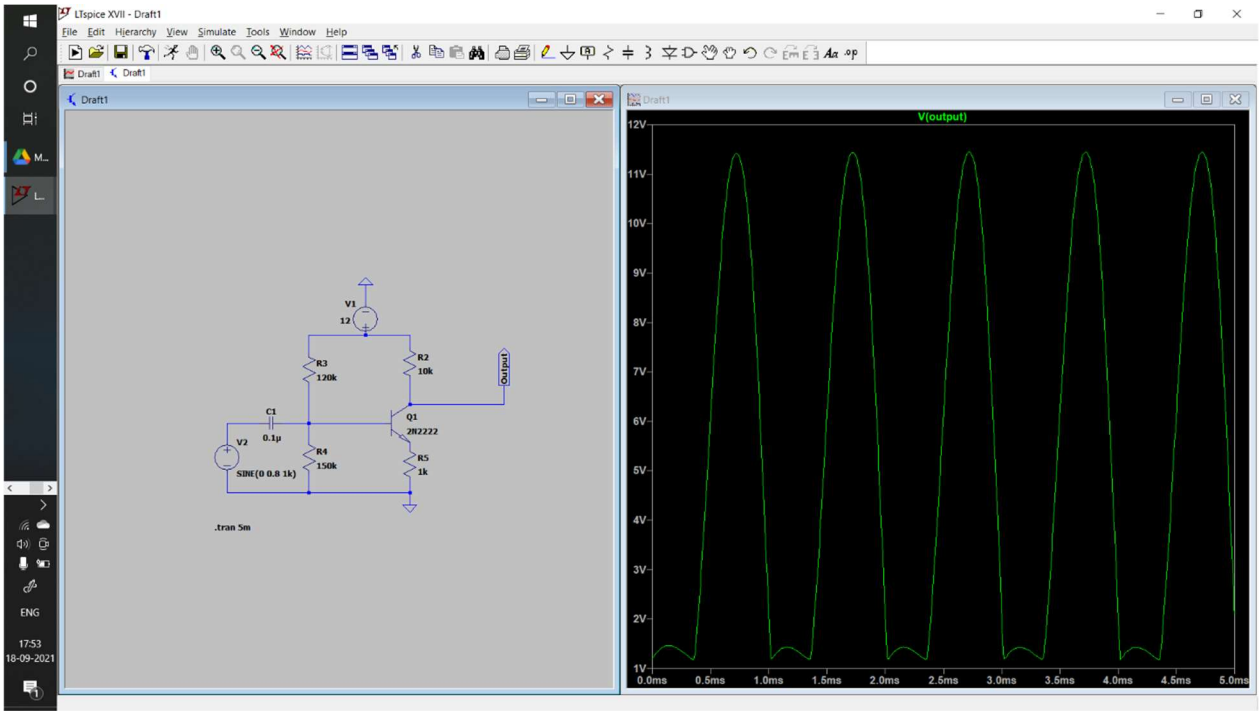


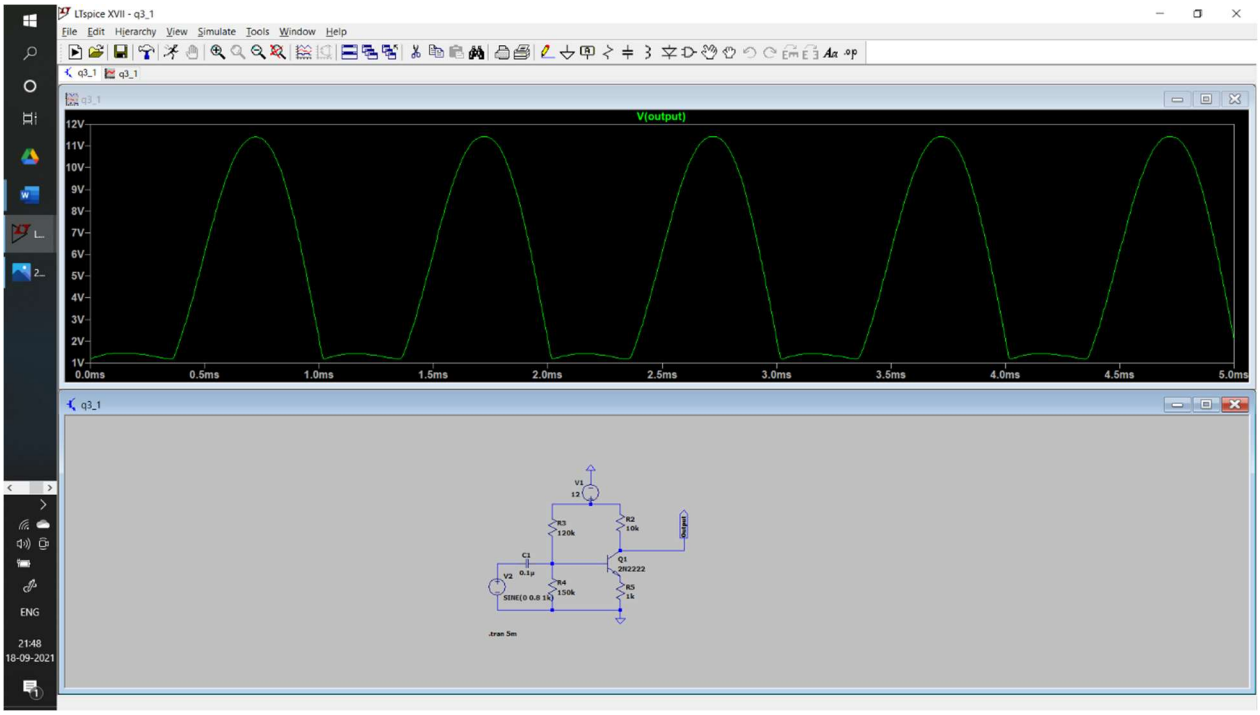
3. PAM Signal generator and Demodulator



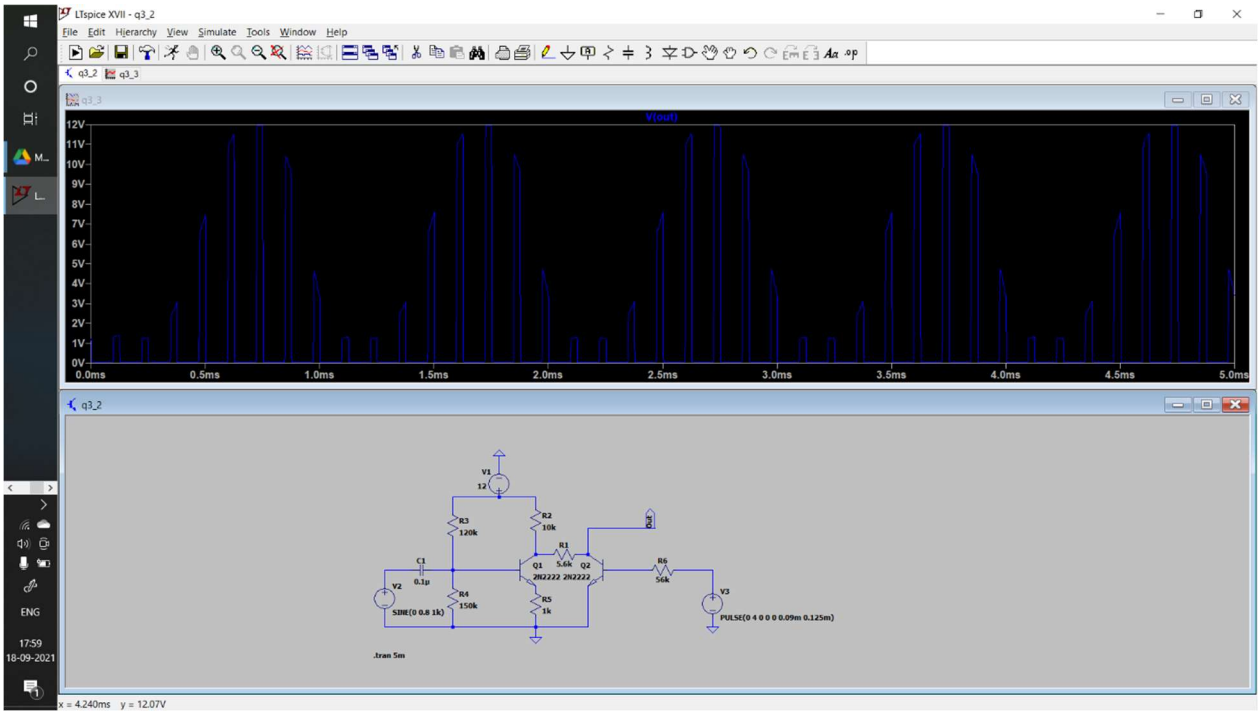
OUTPUT WAVEFORMS, CALCULATIONS AND RESULTS: -

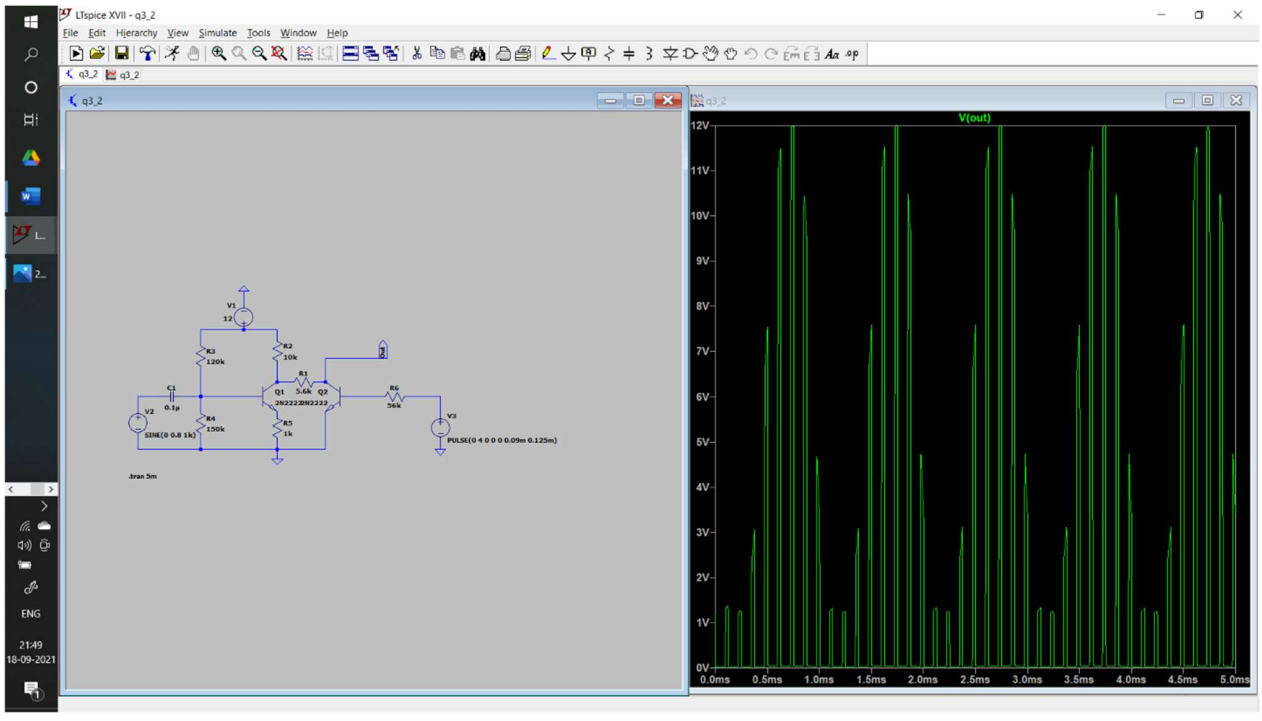
1. Amplifier circuit



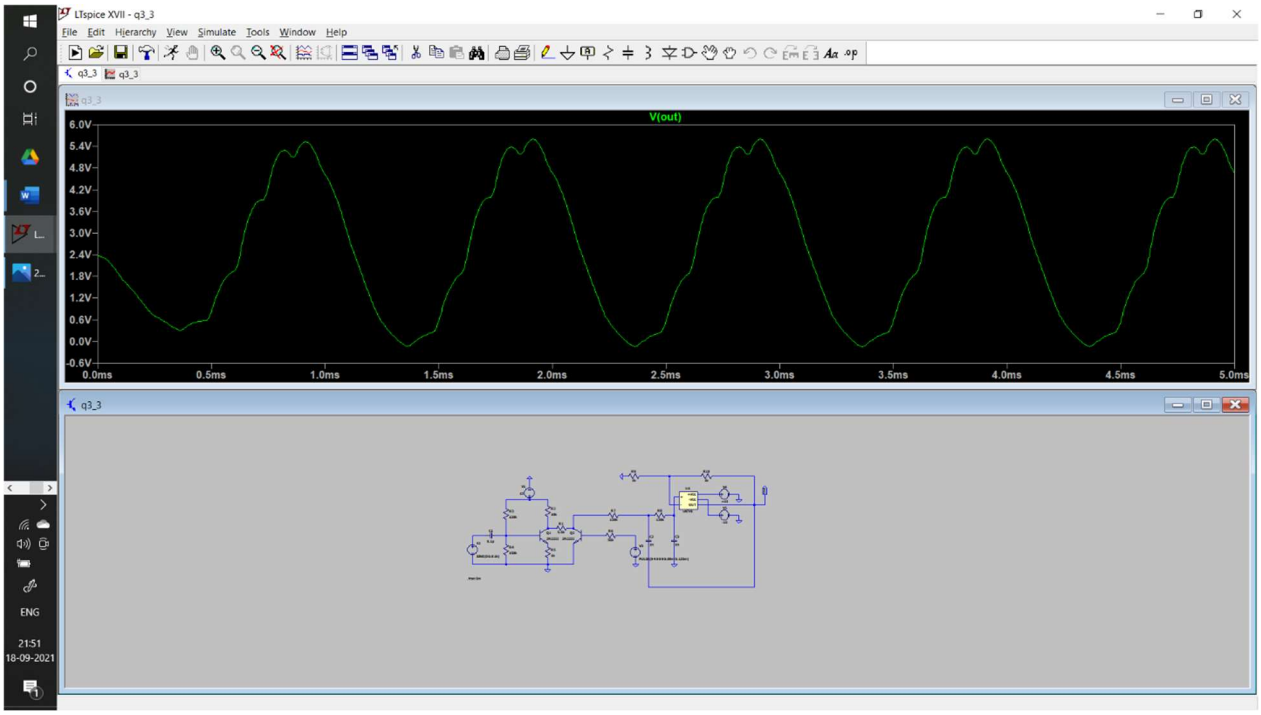


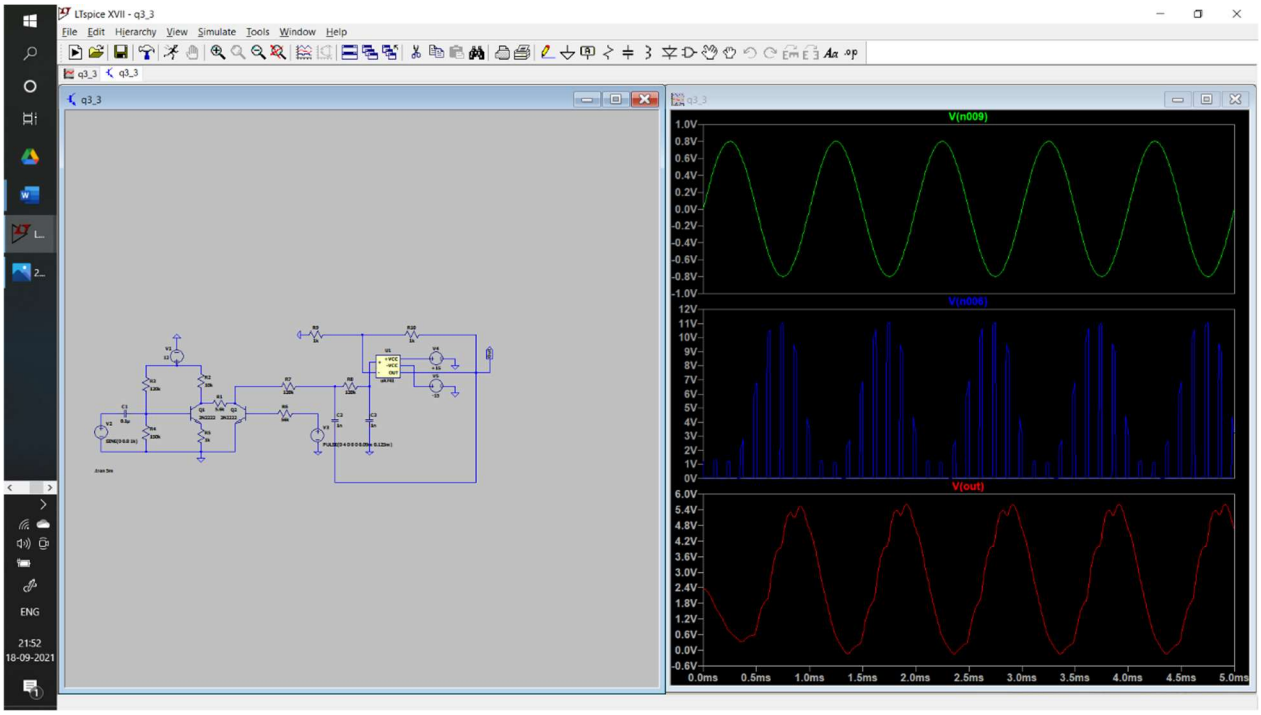
2. PAM Signal generator





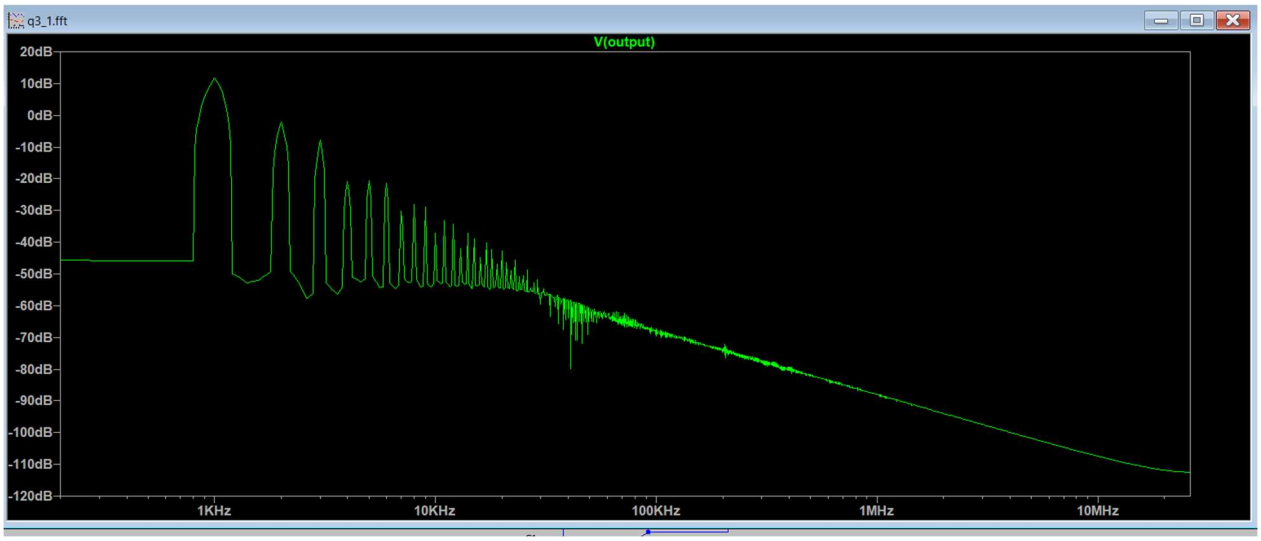
3. PAM Signal generator with demodulator

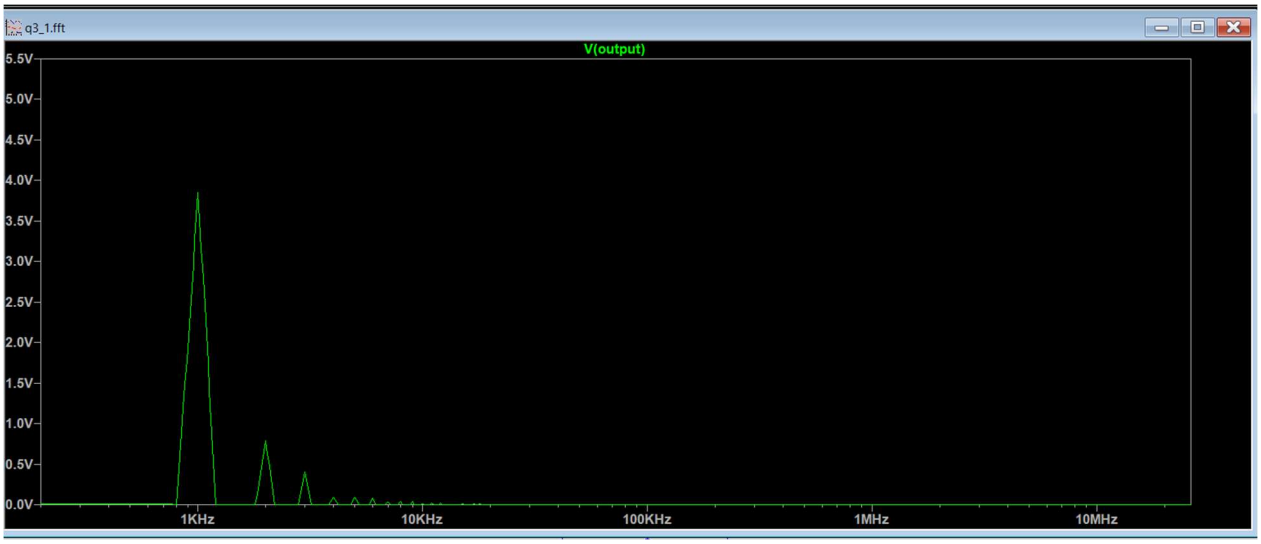




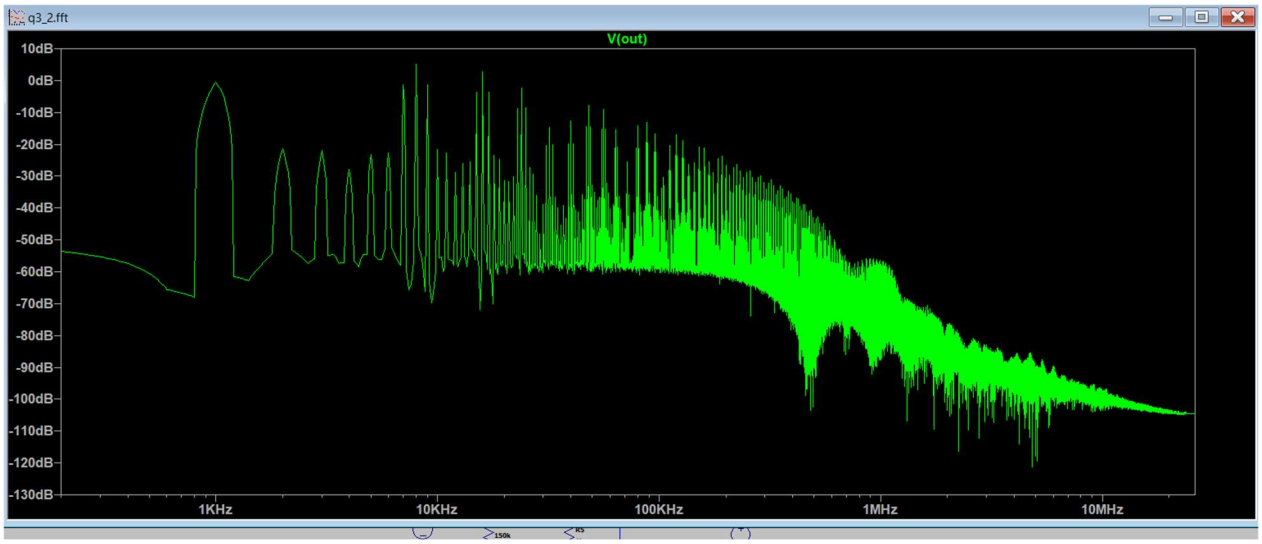
Outputs in Frequency Domain :-

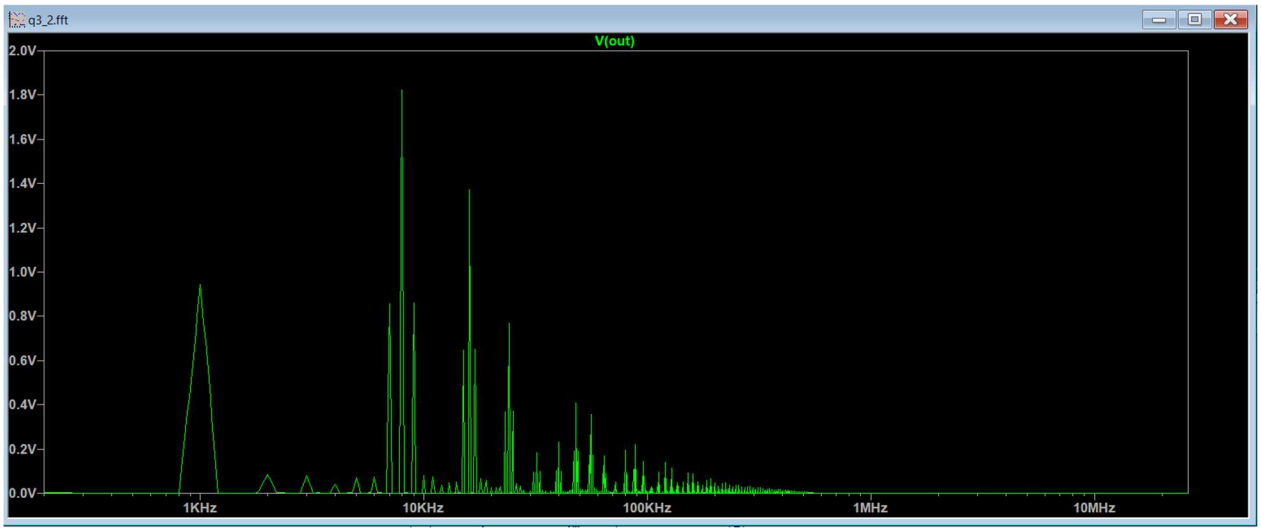
1. Amplifier circuit



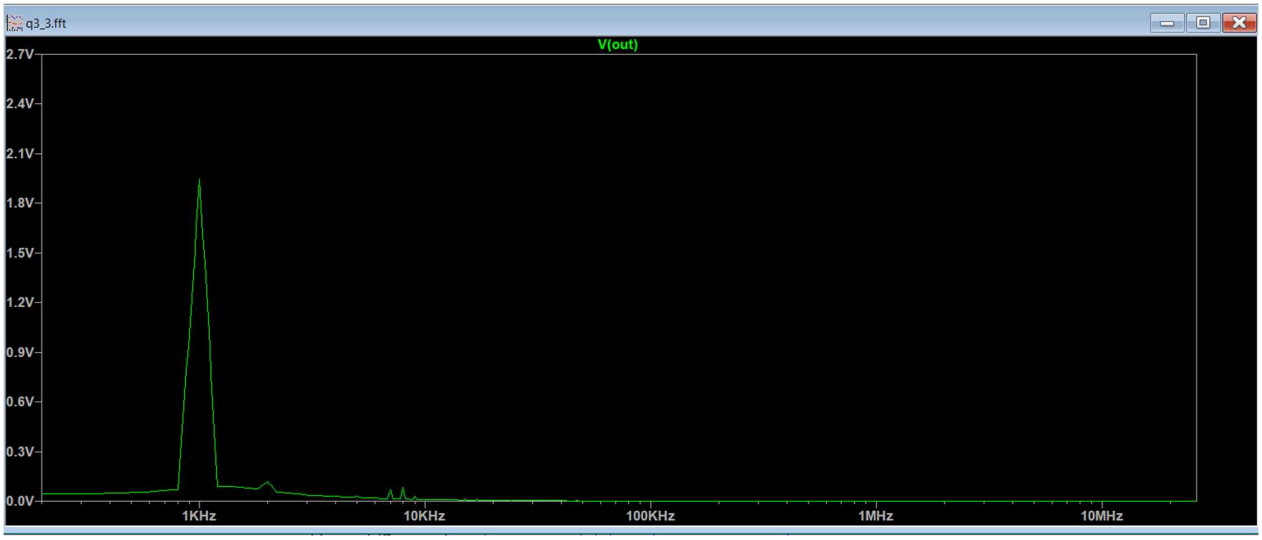


2. PAM Signal generator





3. PAM signal generator with demodulator



Peaks are observed at 99 kHz, 101 kHz. When there is no DC offset given the carrier is suppressed but when DC offset is given, carrier frequency is also observed in the frequency domain. Also, very high frequency noise components areobserved in the modulated signal.

Answers of Lab Questions :-

A1. The use of amplifier is to make the message signal positive to obtain PAM.

A2. High duty cycle is used to satisfy the Nyquist criteria.

Thank you!