EE 340 : Communication Lab

Midsem Solution

Batch- B

Question 1(a)

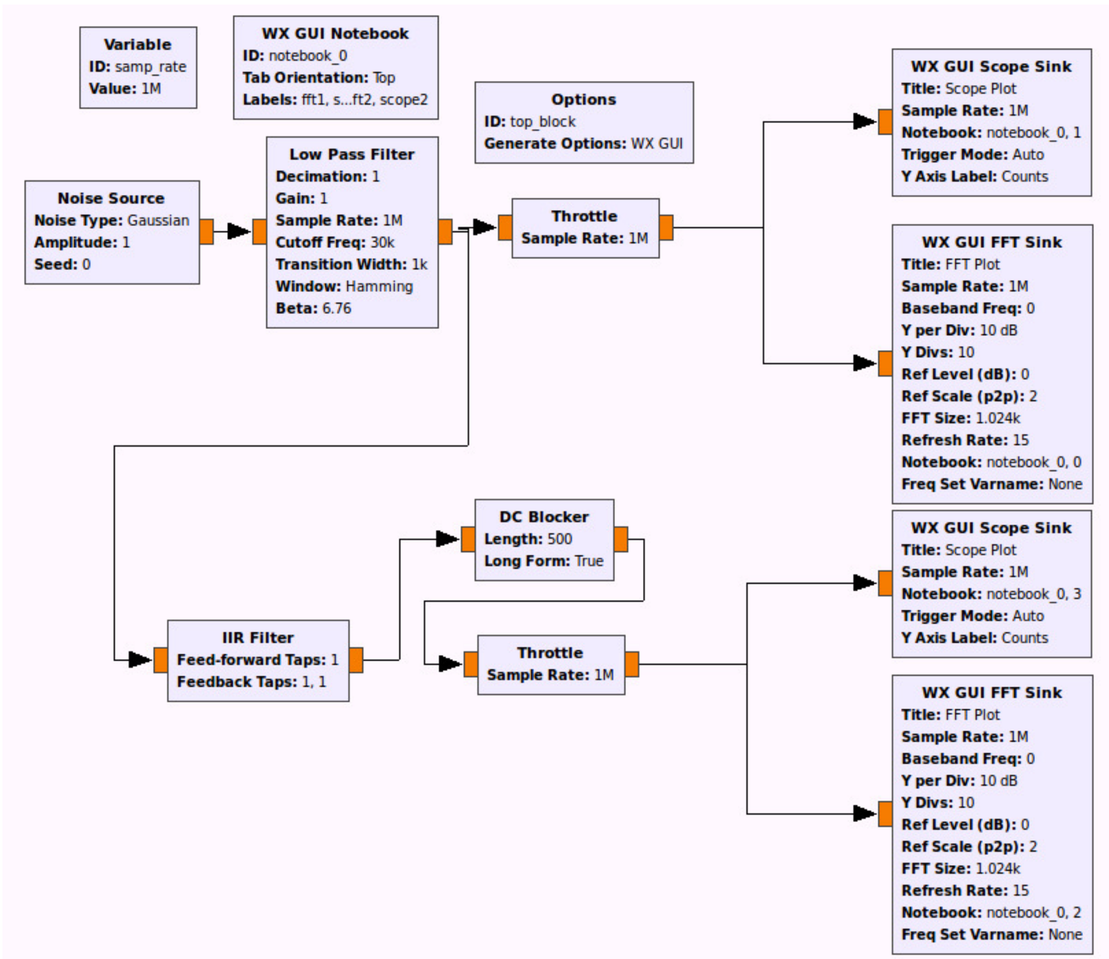

Figure 1 Flowgraph for Question 1(a)

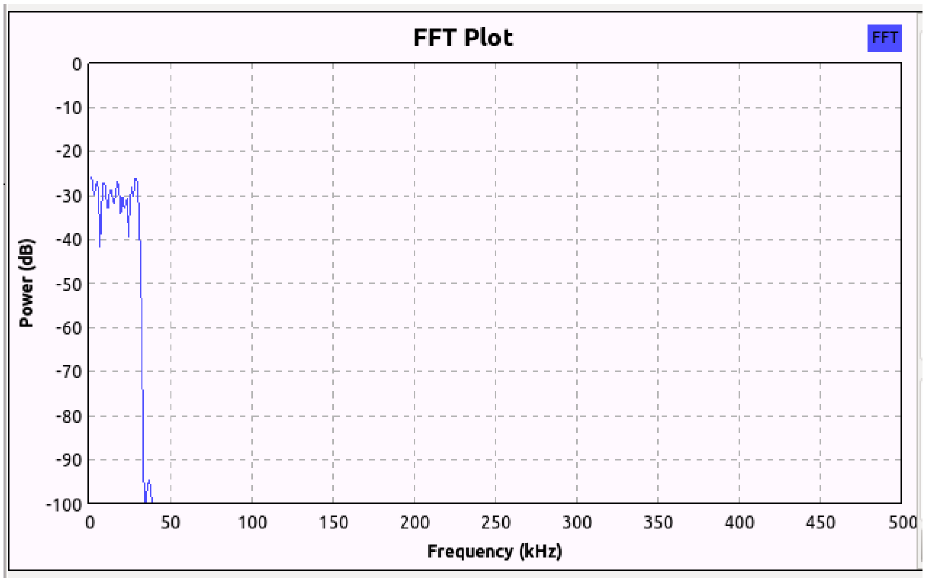

Figure 2 FFT for Question 1(a)

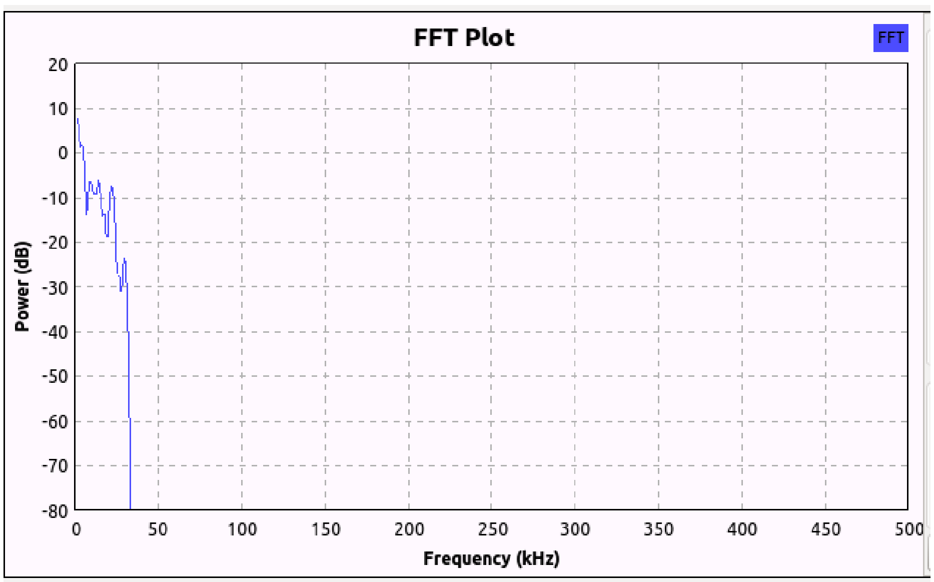

Figure 3 FFT for Question 1(a)

Marking Scheme:

Two marks each for each correct spectrum (deduct one mark if the sample rate or cut-off frequencies are not correct, or the spectrum is complex – for each one separately).

Question:- 1(b)

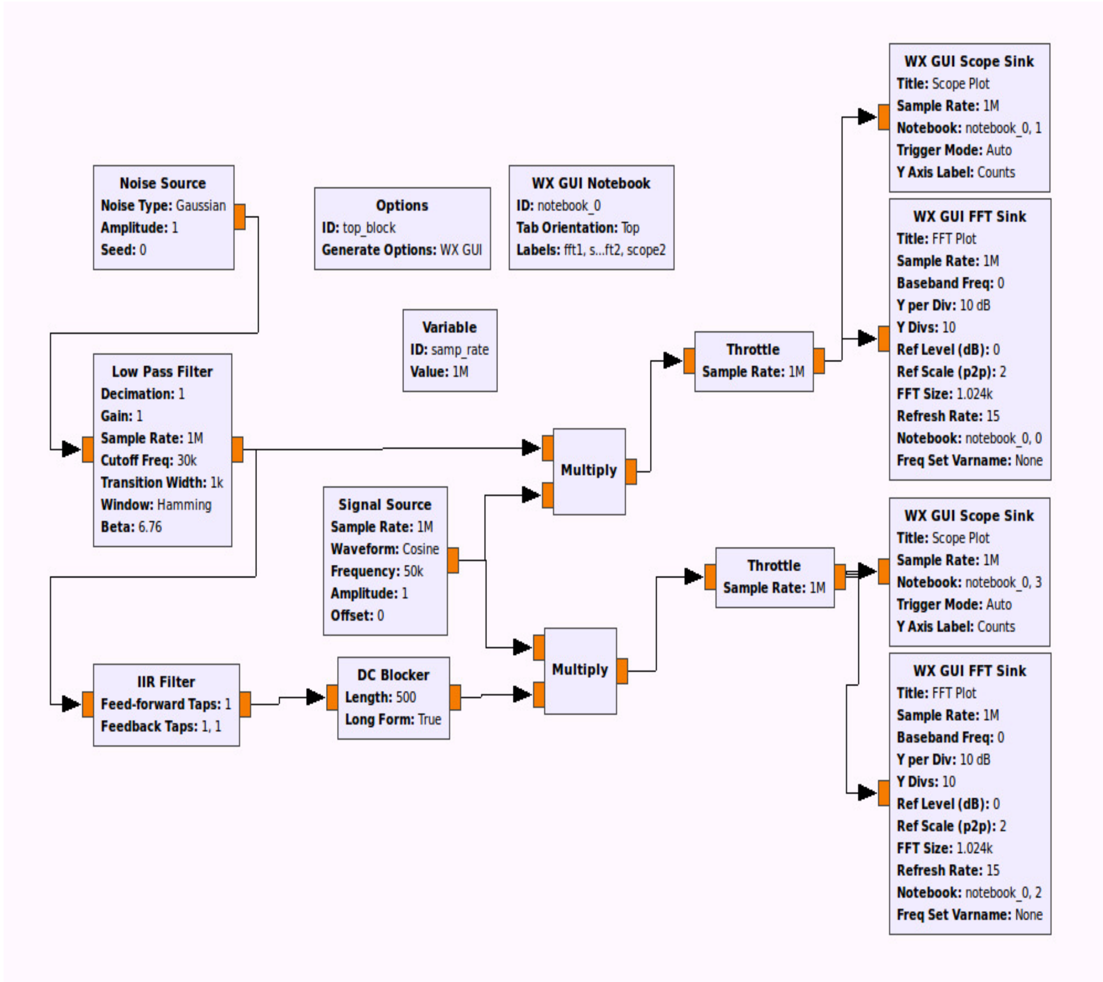

Figure 4 Flowgraph for Question 1(b)

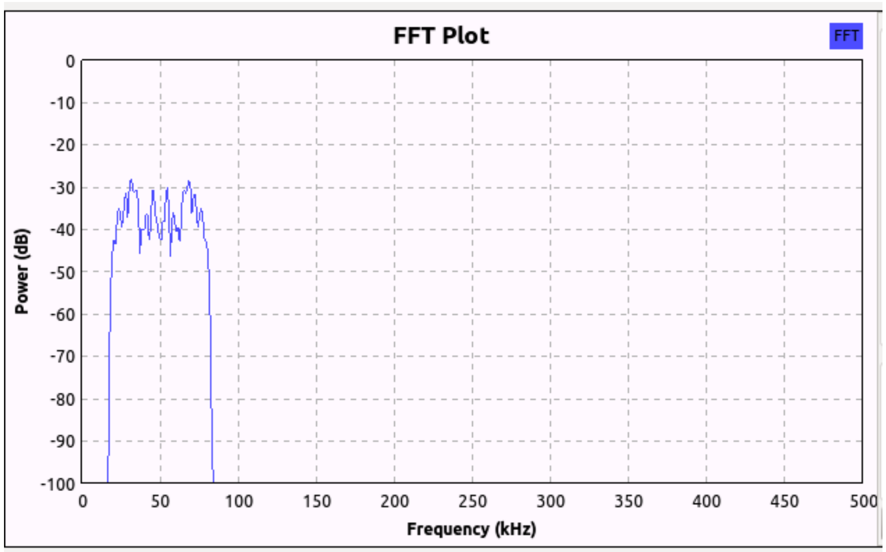

Figure 5 FFT for Question 1(b)

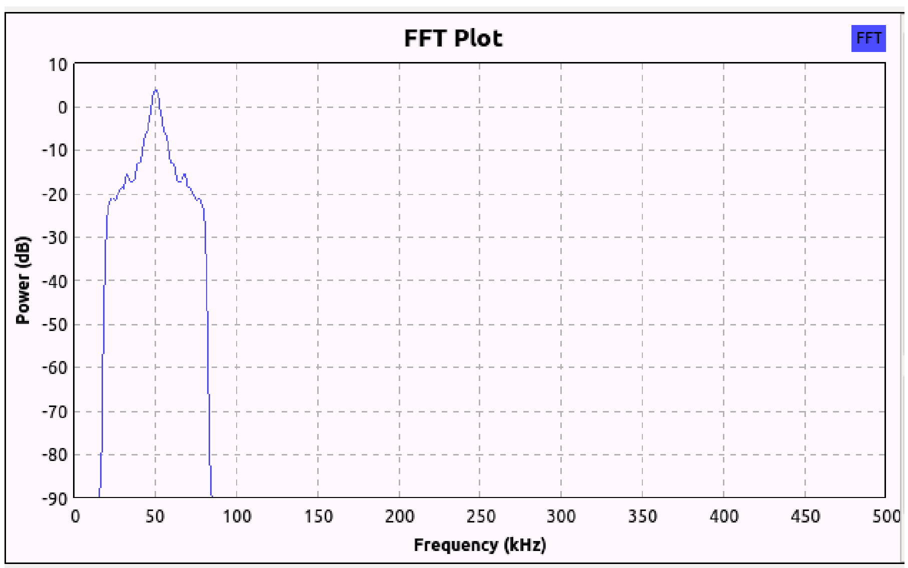

Figure 6 FFT for Question 1(b)

Marking Scheme:

One mark each for each correct spectrum (deduct one mark in total if spectrum is complex or there are some other spectral components).

Question:- 1(c)

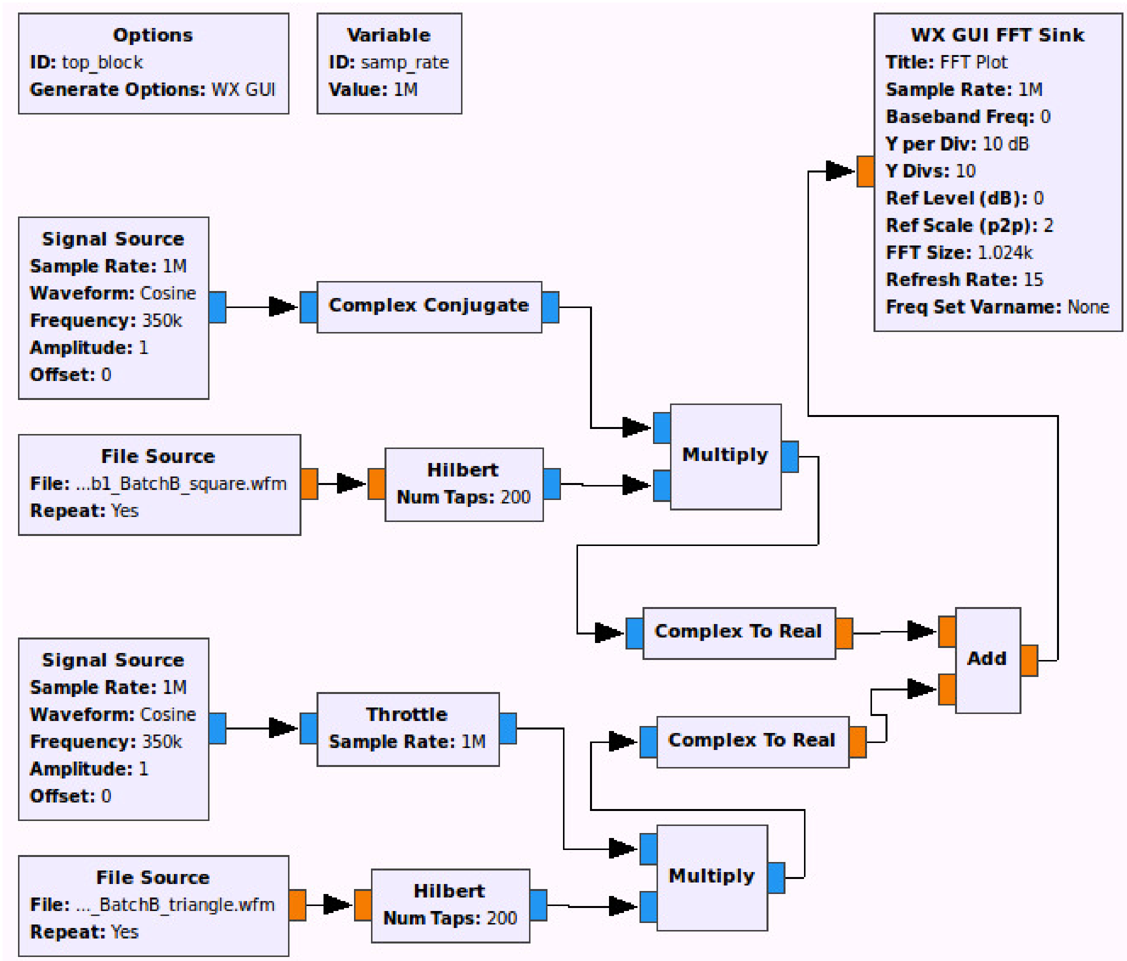

Figure 7 Flowgraph for Question 1(c)

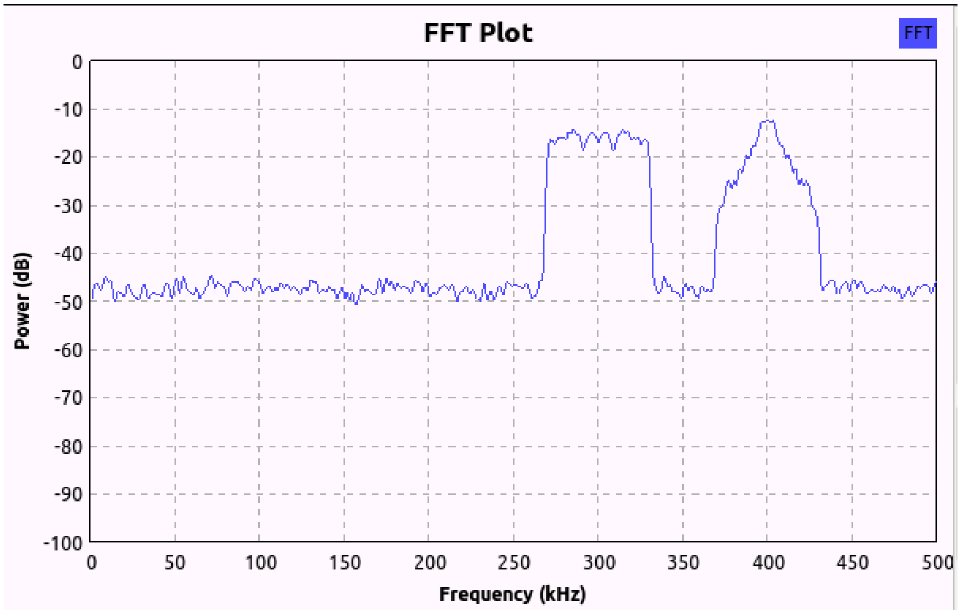

Figure 8 FFT for Question 1(c)

Marking Scheme:

FOUR marks if the spectrum is correct – please check the block diagram to ensure that the waveforms from the file give the desired spectrum (deduct one mark if complex spectrum is shown or one mark per error for any other errors – discuss with the instructor if required).

Question:- 2(a)

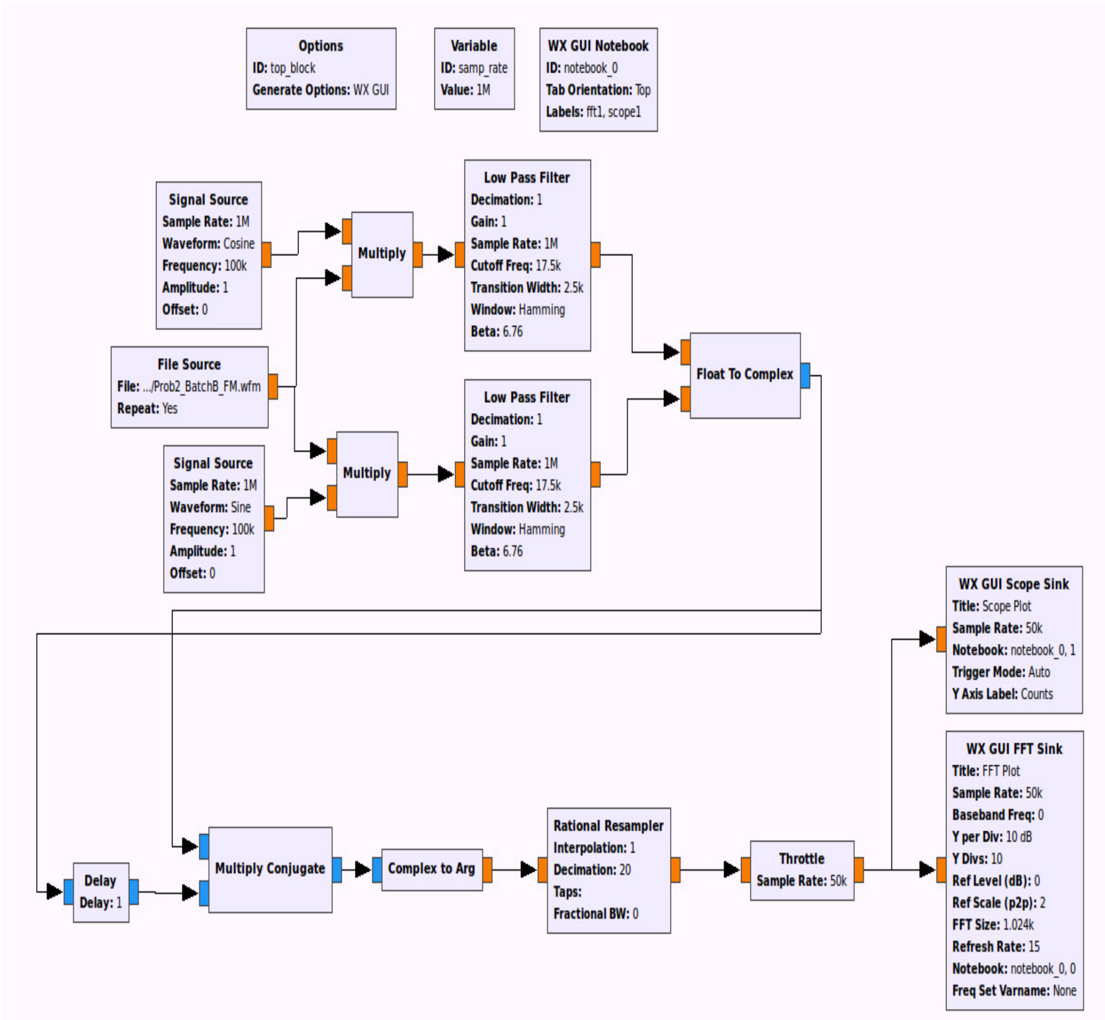

Figure 9 Flowgraph for Question 2(a)

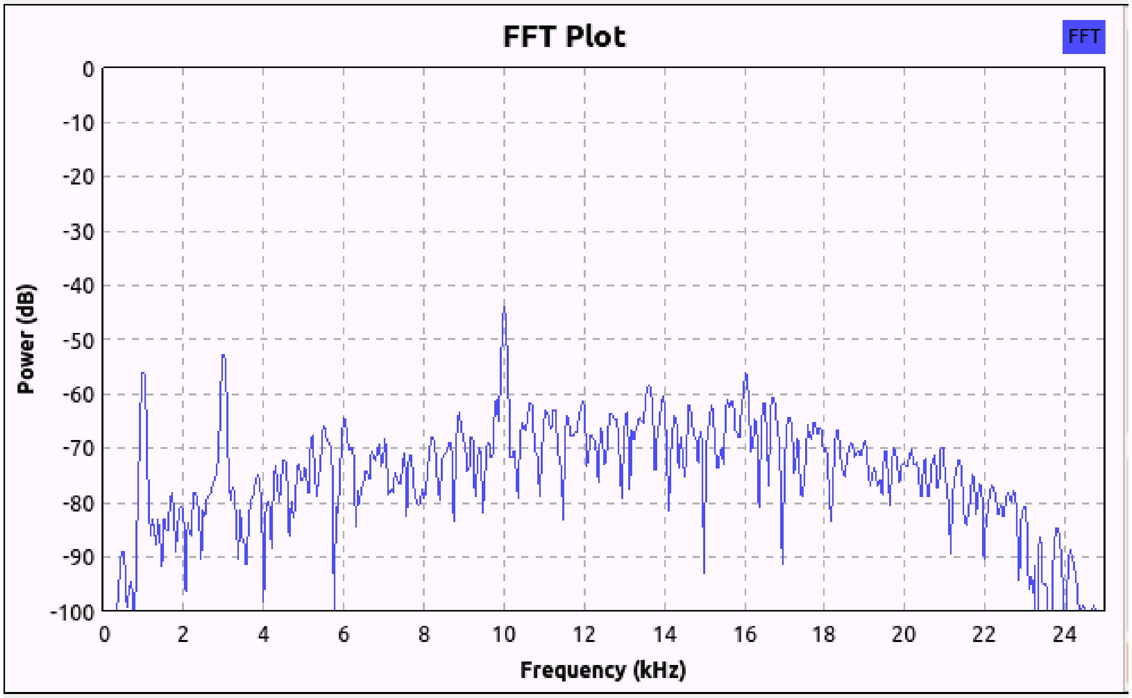

Figure 10 FFT for Question 2(a)

THREE marks for correct real to complex conversion of the signal (even if final demodulation is not shown).

THREE marks for FM demodulation (using delay, multiplication by conjugate and taking the argument) also done correctly (deduct one mark if frequency scale for tones is not correct)

Question:- 2(b)

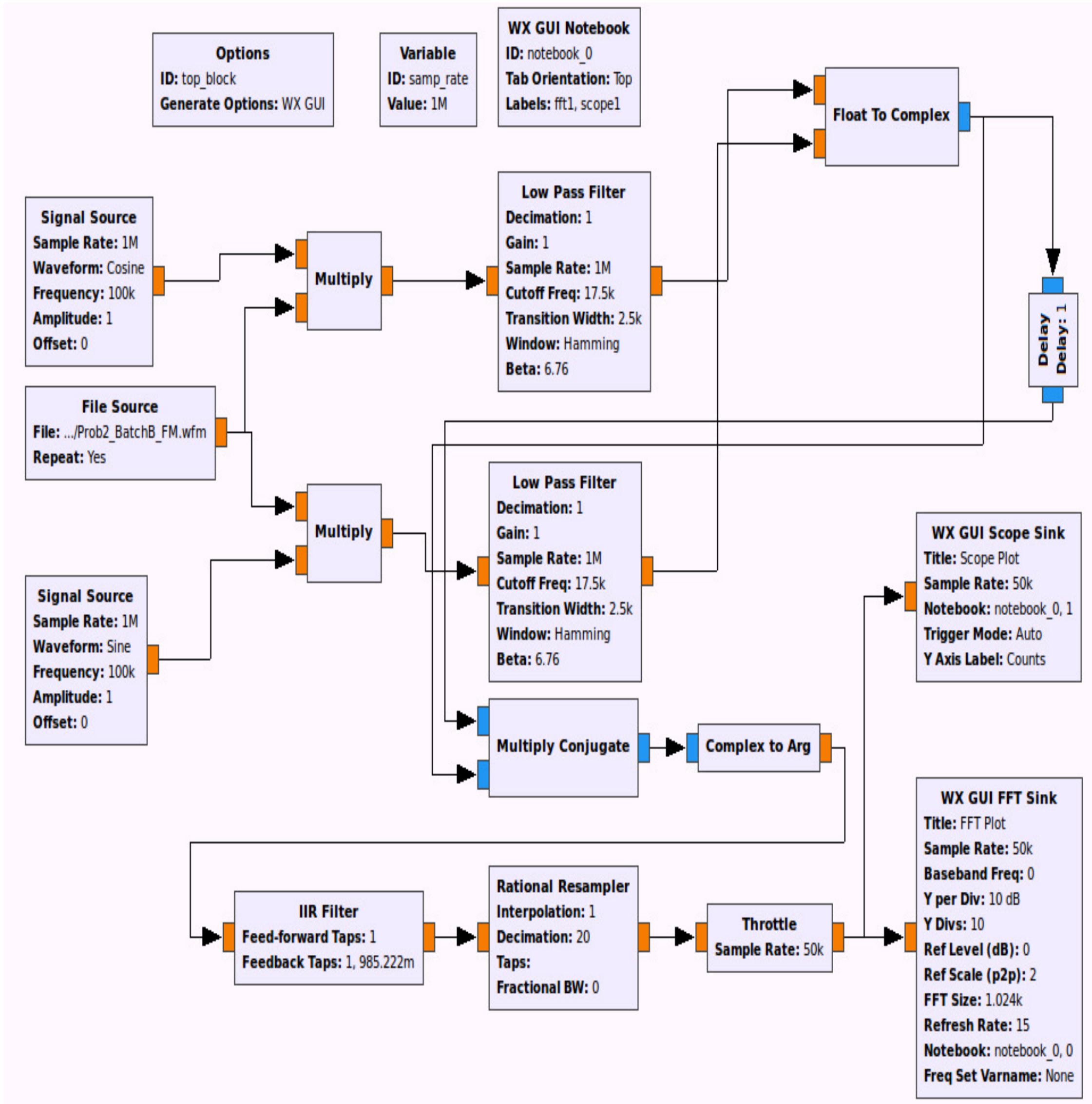

Figure 11 Flowgraph for Question 2(b)

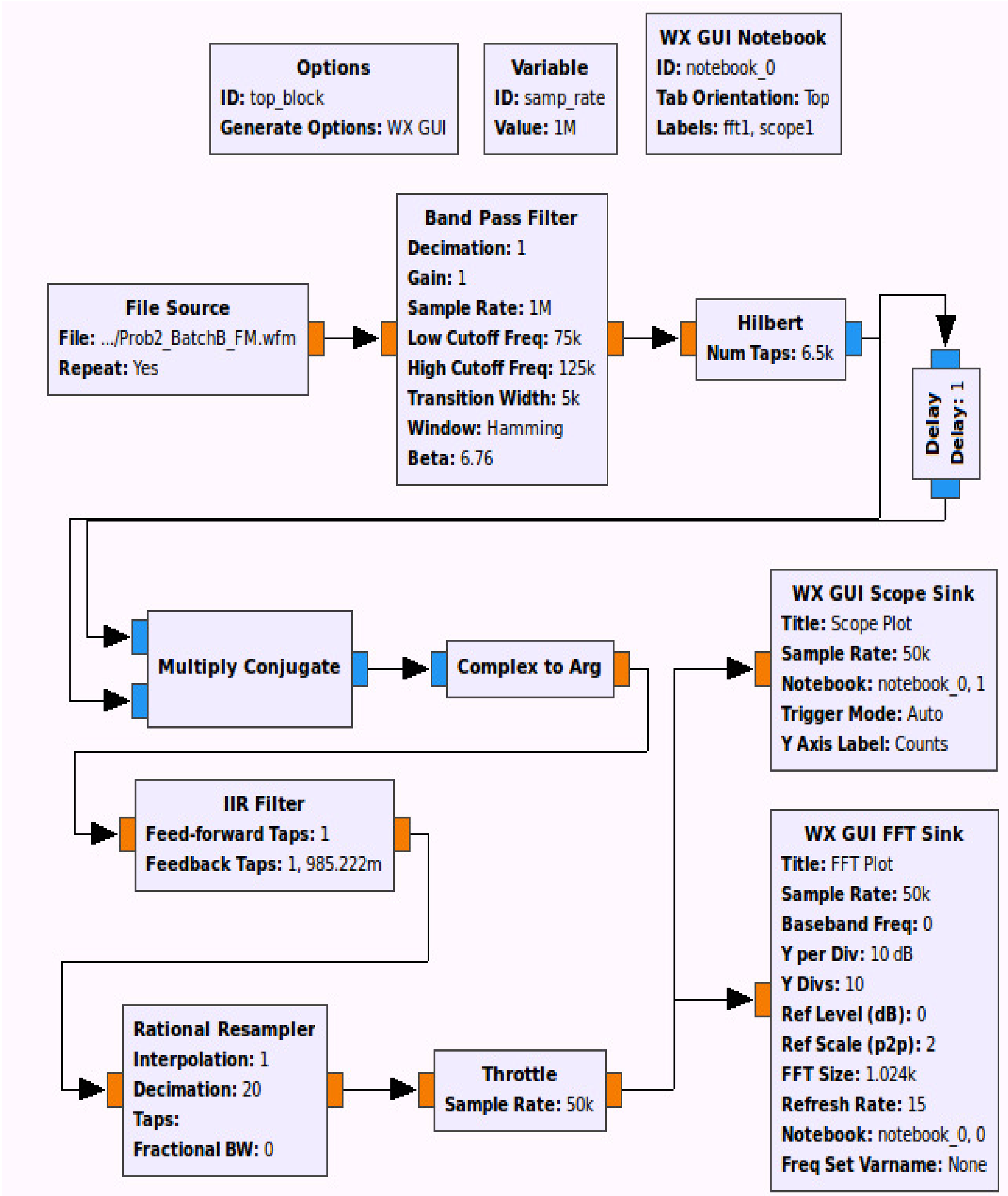

Figure 12 Alternate flow graph for Question 2(b)

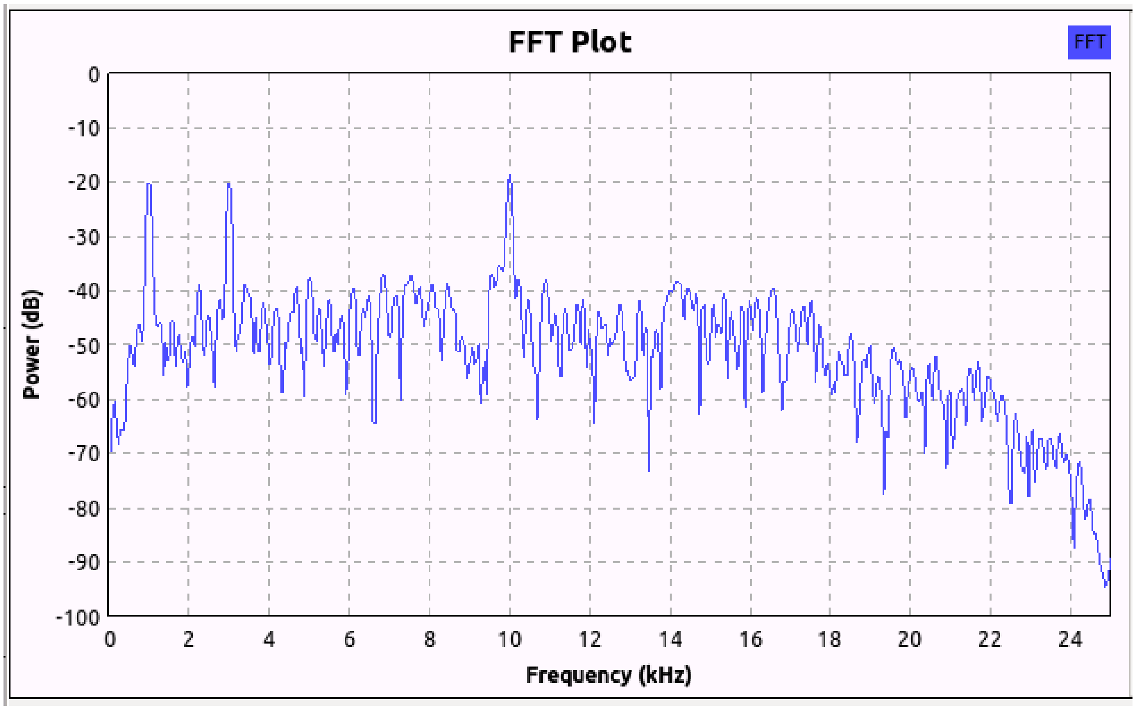

Figure 13 FFT for Question 2(b)

A first order de-emphasis filter can be approximated as:

$$H(z) = \frac{1}{1 - a_0 z^{-1}}$$

$$H(s) = \frac{1}{1 - a_0 e^{-sT}}$$

$$H(s) = \frac{1}{1 - a_0(1 - sT)}$$

$$H(s) = \frac{1}{(1 - a_0)(1 + \frac{a_0}{(1 - a_0)} sT)}$$

$$\text{Time constant, } \tau = \frac{a_0 T}{1 - a_0}$$

From the flowgraph, $a_0 = 0.985$ gives equal amplitudes for the three demodulated tones, and T = 1 usec (as the sample rate is 1 MHz).

$$\Rightarrow \tau = 66\,\mu\text{sec}.$$

And corner frequency is

$$f_c = \frac{1}{2\pi\tau} = 2.42\ kHz\ .$$

TWO marks if de-emphasis is applied correctly and is showing expected results.

ONE mark for correct calculation of the corner frequency and time constant (deduct only ½ mark if there is an extra 2pi factor somewhere in any of the answers).