BUE The British University In Egypt الجامعة البريطانية في مصر Matlab Laboratory	**Electrical & Communications Engineering Department** **Module Name: Analog Communication** **Module Code: 22ECE12I** **Semester: Two 23-24** **Lab Title: Analog Filter** **Lab No.: 1**

Theory:

The goal of filtering is to perform frequency-dependent alteration of a signal. In communication systems, filters are used to shape signal spectra and remove out of band noise. The requirements of filters are obviously described in frequency-domain. However, the design of filters is usually accomplished in either *s* -domain (analog filters) or *z* -domain (digital filters).

The specifications for filter design include edge frequencies, passband ripple, and stopband attenuation. Various methods are supported in the MATLAB and Simulink environments to design both analog and digital filters. If the Filter Designs option is selected, it offers a menu of classic filter designs (LP, HP, BP, BS) as well as other selections. The desired filter is simply dragged into the model window like any other block. The filter design parameters then need to be selected via the dialog box.

All filter design functions in MATLAB and Simulink use a frequency scaling that is somewhat nonstandard. When entering the normalized passband and stopband edge frequencies$\widehat{\omega}_p$ and $\widehat{\omega}_s$ (radians/sample), the values must be divided by π . Thus, an edge frequency specified as $\widehat{\omega} = 0.22\pi$ would be entered as 0.22 in MATLAB. Therefore, if the specifications call for a passband edge frequency of 1000 Hz when the sampling frequency is 5000 Hz, we must enter 0.4 in MATLAB, because the normalized edge frequency in radians is $\widehat{\omega}_p = 2\pi f_p T_s = 2\pi\left(\frac{1000}{5000}\right) = 0.4.$

Objectives:

1) To understand the Design of Analog filter.
2) The filter frequency Response.
3) Role of filter to limit out-of-band Gaussian noise

Prerequisites:

1) Basic familiarity with Simulink and Matlab environment.

Procedures:

Consider the design of an LP digital filter using an SP block set to limit out-of-band Gaussian noise The following filter specifications are selected:

- Passband frequency f_p = 2 Hz
- Stopband frequency f_s = 5 Hz

- Maximum passband ripple R_p = 1 dB
- Minimum stopband ripple R_s = 60 dB
- Sampling frequency = 100 Hz

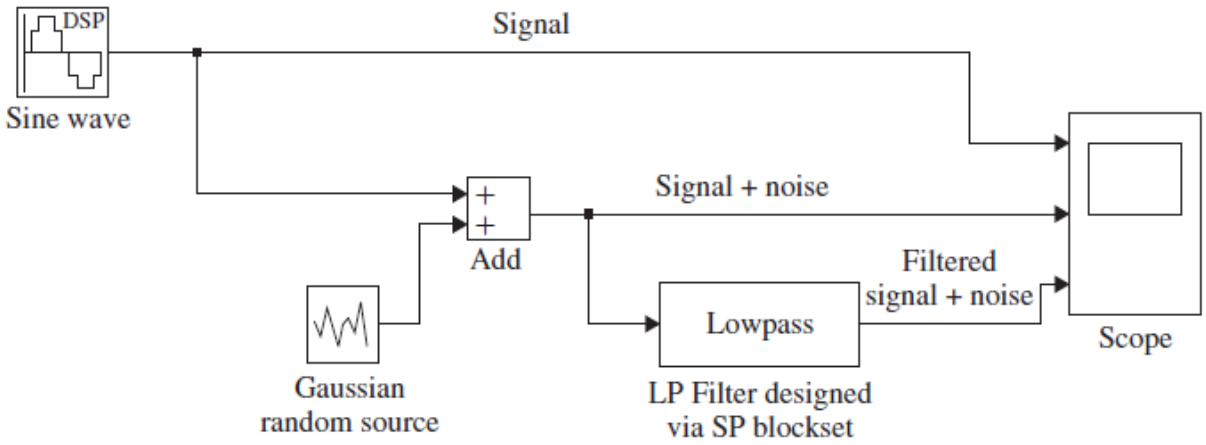

Figure 1: LP filter design Connection Diagram

1) Use Matlab's simulink to generate a sine wave (The message signal) with frequency of 0.1 Hz,
2) sample time of 0.01 sec, and 5 volts peak, as filter input.
3) Change the frequency of the sine wave and record the amplitude of the output and calculate the filter gain in dB.
4) Sketch the frequency response of the designed filter.
5) Use an out of band Gaussian Random source block to generate a Noise.

Individual task:

6) Use Add block to combine the message signal (frequency of 1 Hz) and the random Noise.
7) Draw the two signals showing axes values and amplitudes.
8) Change the frequency of the message signal upwards and downwards.
9) Comment on the effect of changing the signal frequency.

Report:

Attach a report listing all your answers, drawings, and comments indicating question numbers.

Performance Measure:

Participation	Quality of Answers
10	10