BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
SECOND SEMESTER 2019-2020
EEE F243 / INSTR F243- Signals and Systems
MATLAB-BASED ASSIGNMENT: Open Book

Max Marks: 20 **Due Date: 08-05-2020 (Due by 5 pm)** **Date: 01-05-2020**

Instructions: Please make sure you add a title, axis labels, x-axis limit and y-axis limit, and legend (if required) to each of your figures. The marks will be deducted if the figures are not clear and/or any of these are not mentioned.

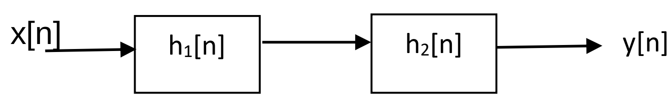
You need to save the MATLAB code and the figure in a TIFF format.

Q1a) Generate a single-frequency cosine signal of amplitude = 2 and duration = 2 seconds (i.e., from 0 to 2 secs). The frequency (in Hz) is the last-three digits of your BITS ID number (e.g., if 2014A3PS0723P, then the frequency = 723Hz). Assume that the sampling frequency = 20kHz. Make sure a single cycle corresponds to a fundamental period.

Q1b) Now, generate a new signal which is same as the signal in Q1a) but delayed by 100 msec.

Plot these signals as a function of time (up to 2 cycles). Note: Show results as subplots of 2x1. **(5M)**

Q2) Consider the LTI systems shown below:



$x[n] = u[n-1] - u[n-6]$, $h_1[n] = \begin{cases} 1 & -a \le n \le 4, \\ 0 & \text{otherwise.} \end{cases}$ $h_2[n] = u[n-1] - u[n-2]$

Note the constant a in $h_1[n]$ is the maximum value between the last-three digits of your BITS ID number (e.g., if 2014A3PS0723P, then a = 7).

Plot $x[n]$, $h_1[n]$, $x[n]*h_1[n]$, and $y[n]$ as subplots of 2x2. **(5M)**

Q3) The system function of a causal LTI system is given by:

$$H(z) = \frac{(a)z^2 + (b)z + c}{(c)z^2 + (b)z + a}$$

The constants a, b and c correspond to the last-three digits of your BITS ID number (e.g., if 2014A3PS0723P, then a = 7, b = 2 and c = 3). However, based on your BITS ID number, if

a = 0, then replace by 2, if b = 0, then replace by 1.5 and if c = 0, then replace by 0.5. If a = b = c, then replace only a by "**Y**" as shown in the BITS ID example (e.g., 201**Y**A3PS0222P).

Sketch the pole-zero diagram and comment on its stability. Additionally, display the locations of poles and zeros. **(5M)**

Q4) An input signal is a combination of two cosine signals. The first cosine signal has a frequency equal to the last-three digits of your BITS ID number whereas the second cosine signal contains a frequency of 11xxxHz (where, xxx corresponds to the last-three digits). For example, if the BIT ID number is 2014A3PS0723P, then the first frequency = 723 Hz and the second frequency = 11723 Hz. Note that the individual cosine signal generation is the same as in Q1a; i.e., amplitude = 2, duration = 2 seconds and sampling frequency = 20kHz).

Sketch the magnitude spectrum of the input signal. Make sure your x-axis is in frequency (in Hz), ranging between 0 to 10kHz. Comment on your observations. Note: Use "FFT" command in MATLAB. **(5M)**