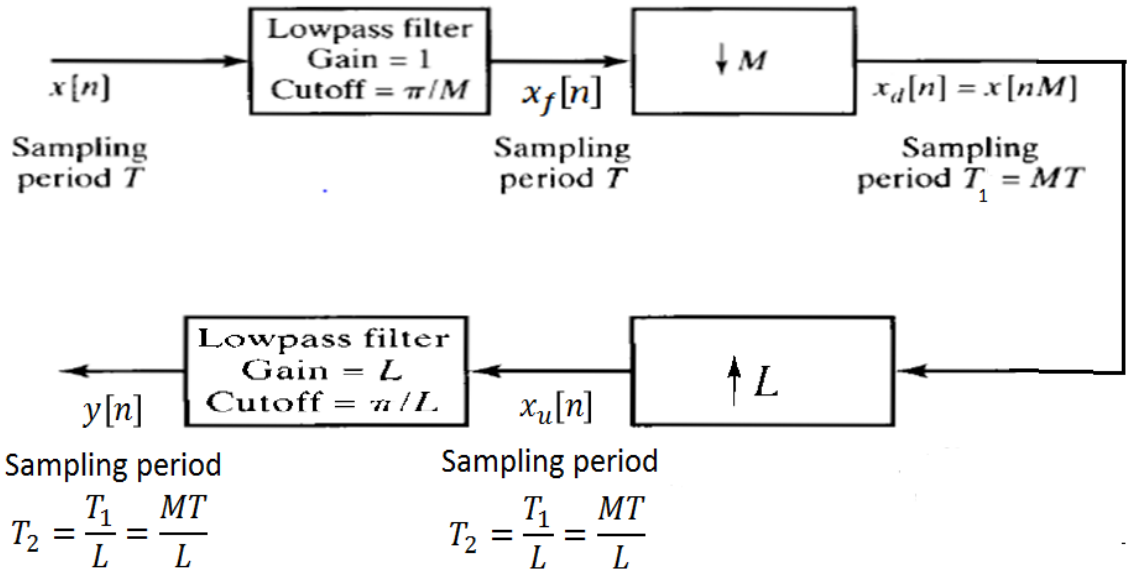
# EE5301: DSP Lab/EE5801: CSP Lab
# Assignment 2

## Problem:

Implementation of decimation and interpolation.

## Technical details:




Take M=L=2

**Input:** $x[n] = 1 * \sin(2\pi f_0 n/f_s) + 0.5 * \sin(2\pi f_1 n/f_s) + 0.6 * \sin(2\pi f_2 n/f_s)$

where $f_0 = 100Hz$ , $f_1 = 200Hz$ , $f_2 = 300Hz$ and

Sampling frequency $f_s = 1600\ Hz$

Samples of x[n] = {0, 1.2906, 1.6314, 1.0478, 0.4000, 0.3407, 0.6314, 0.5835, 0.0000, -0.5835, -0.6314, -0.3407, -0.4000, -1.0478, -1.6314, -1.2906, -0.0000, 1.2906, 1.6314, 1.0478, 0.4000, 0.3407, 0.6314, 0.5835, 0.0000, -0.5835, -0.6314, -0.3407, -0.4000, -1.0478, -1.6314, -1.2906, -0.0000, 1.2906,

1.6314, 1.0478, 0.4000, 0.3407, 0.6314, 0.5835, 0.0000, -0.5835, -0.6314, -0.3407, -0.4000, -1.0478, -1.6314, -1.2906}

**Impulse response** of LPF with gain 1 and cutoff frequency $f_c = 400\ Hz,\ \omega_c = \pi/2$ and 39 tap is

h[n] = { -0.0013, 0.0000, 0.0020, -0.0000, -0.0038, 0.0000, 0.0071, -0.0000, -0.0124, 0.0000, 0.0204, -0.0000, -0.0330, 0.0000, 0.0542, -0.0000, -0.1002, 0.0000, 0.3163, 0.5000, 0.3163, 0.0000, -0.1002, -0.0000, 0.0542, 0.0000, -0.0330, -0.0000, 0.0204, 0.0000, -0.0124, -0.0000, 0.0071, 0.0000, -0.0038, -0.0000, 0.0020, 0.0000, -0.0013}

**Instructions:**

- Take input x[n] and decimate it first and then interpolate to get y[n]. y[n] should come same as x[n] with average error in the order of $10^{-2}$.
- Compute the error vector e[n] = y[n]-x[n]
- To use the LPF at interpolator change the gain of filter with appropriate factor.
- Please take care of practical implementation of decimation and interpolation as discussed in lecture 2.

## Submission Details:

- Write C code to implement above system.
- Write main.c and two separate files named common_functions.c which contains separate functions corresponding to different blocks and header file named common_functions.h which contains function declarations.

- Upload main.c, common_functions.c, common_functions.h files and a text file containing your output y[n] and error vector e[n].
- Also write your understanding about decimation and interpolation in your own words and upload a pdf file.
- Submit all files in a single zip file with your id, Example: EE20MTECH11010_**A1**.zip.