

Indian Institute of Science

Mathematical Methods and Techniques in Signal Processing

Instructor: Shayan Srinivasa Garani

Home Work #3, Spring 2020

Late submission policy: Points scored = Correct points scored $\times e^{-d}$, $d = \#$ days late

Assigned date: Mar. 11th 2020

Due date: Mar. 26th 2020

PROBLEM 1:

In this homework, you will build and experiment with an efficient sampling rate converter. You can select a 1D signal of your choice, possibly speech or music/audio. Sample the analog signal with an appropriate sampling rate. You need to resample this at 3.5 times the original rate using multirate operations, followed by filtering with a cut off at $|\omega| < \frac{\pi}{4}$.

Experiment with a 10th order Butterworth IIR filter and also with an equiripple FIR filter whose order matches the pass band/stop band properties of the Butterworth design. Play the filtered signals and sketch the signal spectrum at each stage. Show your design architecture details carefully. Can you comment on the computational efficiency of your design? Document your results, including the software code in an Appendix.

NOTE: You can make any reasonable assumptions, but state them clearly.

(100 pts.)