ECE 480

Fall 2012

Prof. S. Awad

Final Project

" Write out and sign the Honor Pledge"

1) It is required to design an equivalent analog filter using a digital filter and other appropriate components. The sampling frequency is f_{samp} = 20 kHz and the attenuation (α) specifications of the filter are as follows:

- $\alpha \leq 1$ dB for for the freq. range $0 \leq f \leq 2000$ Hz
- $\alpha \geq 60$ dB for the freq. range $f \geq 2650$ Hz.

   a) Determine the equivalent requirements of the digital filter.

   b) Design a filter to meet the requirements specified in part a) with the minimum possible order. Give the transfer function and hence the difference equation.

   c) Determine the poles and zeros.

   d) Give the direct (canonical) and cascade (product of first and second order systems) structures for implementing the digital filter.

   e) Investigate the effect of coefficient quantization on the stability and frequency response (magnitude, phase and group delay) for the two structures.

   f) Determine the minimum number of bits needed to meet the given requirements (attenution) within a tolerance of 1 dB.

Verify your results through simulation.