EE -275 Digital Signal Processing & Filtering
FINAL EXAM
Tuesday, November 29, 2005
Due: Friday December 9, 2005, by 3:00 p.m.

Do All Problems.
Please write clearly.

NAME _____

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2._____

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8._____

1. (Zero-phase condition for causal digital filters)

   (i) Chapter 7, problem 7.4.
   For the given $h[n]$, generate the corresponding $H(e^{j\omega})$ and show the conditions necessary for $H(e^{j\omega})$ to have zero phase.

2. (Transfer functions with similar amplitude response)

   (i) Chapter 7, problem 7.5.

3. (Transfer functions that are linear phase, minimum phase and maximum phase)

   (i) Chapter 7, problem 7.8(i) only.

4. (FIR transfer functions with similar amplitude response)

   (i) Chapter 7, problem 7.9(a).

5. (FIR causal filter and constant group delay constraints)

   (i) Chapter 7, problem 7.11.

6. (Simple FIR filter design problem)

   (i) Chapter 7, problem 7.15.

7. (IIR filter design)

(i) Chapter9, Section 9.2.2. Implement the first-order Butterworth filter design, starting on p. 496 and ending on p. 497, Text. For the analog filter equation (9.19) choose any desired $\Omega_c$. Generate the IIR digital filter using the bilinear transformation. Plot frequency responses using $freqs$ and $freqz$. Comment on any specific differences between the two frequency responses.

8. (Gibbs phenomena, windowing and FIR filter design)

(i) Chapter 10, Section 10.9, Problem M 10.1. For the equation 10.6 referred to, generate $N = 2M + 1$ values of the impulse response, using the range $-M : M$. Use the cut-off frequency $\omega_c = 0.4\pi$. You might wish to calculate the impulse response using the sinc function where

$$sinc(x) = \frac{sin\pi x}{\pi x}$$

Obtain the frequency response (DFT) of this filter and plot the absolute value, using M=5 and 20.

Explain the frequency response for the range $-\pi, +\pi$. That is, show the cut-off frequency $\omega_c = 0.4\pi$ and explain the associated Gibbs phenomena.