PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Final Examination: Semester I	Academic Year: 2007
Date: 10 October 2007	Time: 9:00-12:00
Subject: 240-552 Digital Signal Processing	Room: A401

Instructions:

This exam has 7 problems, 10 pages and 95 points. Please show all your work for full credit. You may use the back of the pages for scratch work. This exam is closed book and closed note. You are allowed to bring in a calculator and one A4 sheet of notes.

Name:______________________________ Student code:__________

1 (10 pts) ____________

2 (25 pts) ____________

3 (10 pts) ____________

4 (20 pts) ____________

5 (10 pts) ____________

6 (10 pts) ____________

7 (10 pts) ____________

TOTAL ____________

ทุจริตในการสอบ โทษขั้นต่ำคือ
ปรับตกในรายวิชาที่ทุจริต และพักการเรียน 1 ภาคการศึกษา

1. Sketch the frequency response of the following systems: (10 points)

System I $H(z) = \dfrac{z}{z-0.1}$

System II $H(z) = \dfrac{1-0.7z^{-1}}{(1-(0.4-j0.2)z^{-1})(1-(0.4+j0.2)z^{-1})}$

2. Sketch (in s-plane) poles and zeros of a continuous-time Butterworth filter whose order is 5 and cut-off frequency = 0.3 rad./sec. (5 points)

If the continuous-time filter is transformed to a discrete-time filter using the impulse invariance method (T=1), where are the poles in the z-domain? (10 points)

If the continuous-time filter is transformed to a discrete-time filter using the bilinear transform method (T=1), where are the poles in the z-domain? (10 points)

3. Let $x[n]$ = {1 2 3 4} and $y[n]$ = {-1 1 0 -1}, compute the circular convolution of the two sequences. (10 points)

4. Given the two finite-length sequences $x[n]$ and $y[n]$ as defined below: (10 points)

$$x[n] = \cos\left(\frac{\pi n}{2}\right) \qquad n = 0,1,2,3$$

$$y[n] = \frac{n}{4} \qquad n = 0,1,2,3$$

a) Compute the DFT of the two sequences (10 points)
b) If $Z[k] = X[k]Y[k]$, determine $z[n]$ (10 points)

5. Design a discrete-time Butterworth low-pass filter with the following specifications:

Passband frequency	0.4π rad./sec.
Stopband frequency	0.7π rad./sec.
Max. passband attenuation	1 dB
Min. stopband attenuation	30 dB

Determine poles and zeros of the discrete-time filter, assuming that the bilinear transform method was used (T=1). (10 points)

6. Prove that $F(F(x[n])) = x[-n]$, where $F(.)$ is the Discrete Fourier Transform. (10 points)

7. Show or prove that FIR filters always have a linear phase response (10 points)

---- End of Exam ----