PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENIGNEERING

Final Examination: Semester II	Academic Year: 2003
Date: 25 February 2004	Time: 9:00-12:00
Subject: 240- 552 Digital Signal Processing	Room: R300

Instructions:

This exam has 5 problems, 6 pages and 60 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. No calculators are allowed. You may consult one A4 sheet of notes (two sides).

Name:_____ Student code:_____

1 (10 pts) _____ 4 (10 pts) _____

2 (15 pts) _____ 5 (10 pts) _____

3 (15 pts) _____

TOTAL _____

"ทุจริตในการสอบ โทษขั้นต่ำ คือ พักการเรียน 1 ภาคการศึกษา และปรับตกในรายวิชาที่ทุจริต"

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

System I $H(z) = \dfrac{1}{1 - 0.5z^{-1}}$

System II $H(z) = \dfrac{1 - z^{-1}}{(1 + j0.9z^{-1})(1 - j0.9z^{-1})}$

2. Sketch (in s-plane) poles and zeros of a continuous-time Butterworth filter whose order is 4 and cut-off frequency = 0.5 rad./sec. (5 points)

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

3. Short answers:

a) The filter design techniques of impulse invariance and the bilinear transform each have some advantages. List advantages that each technique has over the other. (5 points)

b) A discrete-time system is described by the following difference equation

$$y[n] = x[n] + 0.2\, x[n\text{-}1]$$

where $x[n]$ is the input sequence and $y[n]$ is the output sequence. Is this system a low-pass or high-pass filter? Justify your answer. (10 points)

4. $x[n]$ is a 4-point sequence defined as follow:

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

Calculate the 4-point DFT $X[k]$. (10 points)

5. Explain the difference between Bufferworth filter, Chebyshev filter and Elliptic filter (10 points)