UNIVERSITY OF VICTORIA

MIDTERM EXAMINATIONS, FEBRUARY 1998

ELEC 310 SIGNAL ANALYSIS II - SECTION S01

TO BE ANSWERED IN BOOKLETS

DURATION: **50 minutes**
INSTRUCTOR: **Dr. P. F. Driessen**

THIS EXAMINATION CONSISTS OF:

COVER SHEET
THREE PAGES OF QUESTIONS

STUDENTS MUST COUNT THE NUMBER OF PAGES IN THIS EXAMINATION PAPER BEFORE BEGINNING TO WRITE, AND REPORT ANY DISCREPANCY IMMEDIATELY TO THE INVIGILATOR

CANDIDATES ARE NOT PERMITTED ANY REFERENCE MATERIAL EXCEPT ONE OR TWO SHEETS OF NOTES

AT THE END OF THE EXAMINATION, PLEASE SUBMIT:

1. Answer Booklets
2. Question Paper
3. Note Sheets

TOTAL MARKS 30.

Question 1 (10 marks)

1.1. For a transfer function with one pole and one zero, where (approximately) in the complex z-plane would you place the pole γ_1 and zero z_1 to obtain a high pass filter characteristic with zero response at $f = 0$ and maximum response at $f = f_s/2$?

1.2. Draw a sketch to show the pole and zero locations.

1.3. Draw a sketch of the approximate frequency (magnitude) response.

1.4. Derive the difference equation to implement this high pass filter in terms of γ_1, z_1.

1.5. Draw a diagram of an implementation of the filter.

Question 2 (10 marks)

2.1. Find the (causal) inverse $z-$ transform of

$$F[z] = \frac{2z(3z+17)}{(z-1)(z^2-6z+25)} \tag{1}$$

using partial fractions.

2.2. Write numerical values for the coefficients of the first two terms.

Question 3 (10 marks)

Design a simple digital filter whose transfer function corresponds to a delay of two sample times, i.e.

$$y(k) = x(k-2) \tag{2}$$

Assume a sampling frequency $f_s = 48$ KHz.

3.1. Specify $H(z)$.

3.2. Find the frequency response (amplitude and phase) of this filter.

3.3. Find the impulse response $h(k)$ of this filter by taking the inverse z-transform of $H(z)$.

3.4. Show by convolution that the output of the filter $y(k)$ is $x(k-2)$ as expected.

END