University of Toronto

Faculty of Applied Science and Engineering

Final

Date - Dec. 9, 1999

Duration: 2.0 Hr.

ECE1392S — Integrated Circuit for Digital Communications

Examiner - D.A. Johns

ANSWER QUESTIONS ON THESE SHEETS **USING BACKS IF NECESSARY**

1. Calculator type unrestricted. Single aid sheet allowed.
2. Grading indicated by [ ]. Attempt all questions since a blank answer will certainly get 0.
3. Part marks are given. Clarity and neatness will be appreciated.

Last Name: _____

First Name: _____

Student #: _____

Question	Mark
1	
2	
3	
4	
Total	

(max grade =40)

[10] Question 1:

(a) Under what conditions is the use of a root-raised-cosine filter optimum?

(b) What is the maximum symbol-rate that can be used when the channel is bandlimited to 100kHz and 25% excess bandwidth is used?

[10] Question 1: (cont'd)

(c) Derive the crest factor (i.e. peak-to-rms ratio) for a uniformly distributed random signal?

(d) What is the capacity of a 1MHz flat channel with additive white noise such that the SNR equals 30 dB?

[10] Question 2:

Consider a partial-response system which can be modelled as 1+D (or $1+z^{-1}$) encoded.

(a) Draw the transmit trellis for such a system when the input signal is +1 or -1.

(b) Show the receive trellis and all the state and branch metrics assuming the initial state value is -1 and the receive signal is: -0.1 0.2 -1.9 -2.1 1.1 0.1 0.1 1.8

[10] Question 2: (cont'd)

(c) Discuss how the difference metric algorithm would operate in this 1+D case.

[10] Question 3:

(a) Explain how a decision feedback equalizer would deal with a large sinusoidal interferer (use an example and diagrams). What are the drawbacks to this method when dealing with this interference?

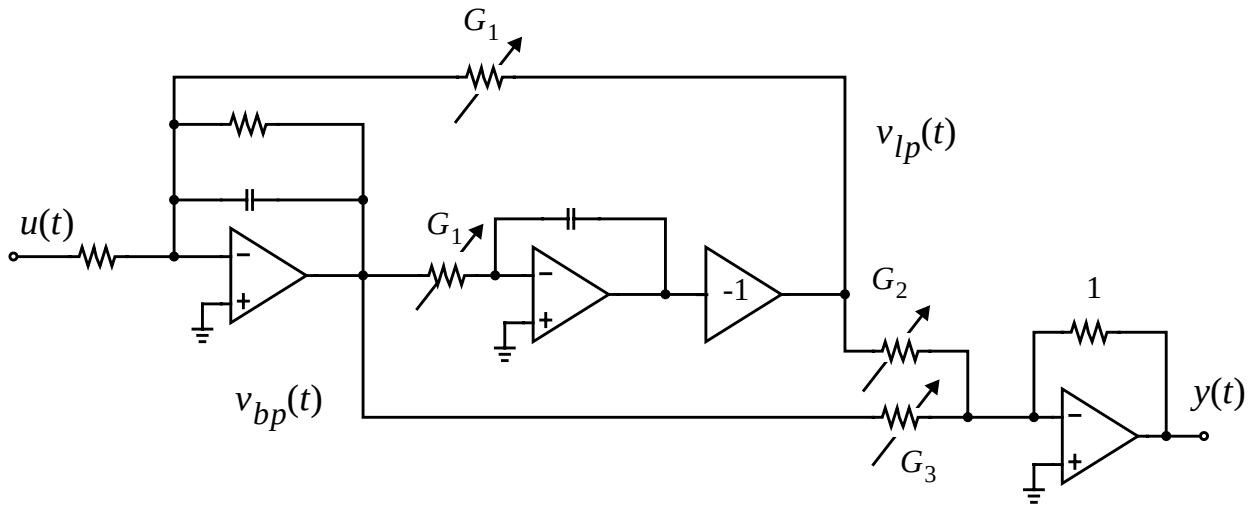
(b) Why is a transposed FIR filter sometimes used in the feedback equalizer of a DFE?

[10] Question 3: (cont'd)

(c) How would a DMT system deal with a similar sinusoidal interferer? What are the drawbacks to this method when dealing with this interference?

(d) Explain what a cyclic prefix is and why it is used in a DMT system.

[10] Question 4:



(a) Show how to obtain the gradient signal for G_1. Note that G_1 occurs in 2 locations in the filter (they should track each other and have one update equation).

[10] Question 4: (cont'd)

(b) In an all analog adaptive system, there is a worst case offset of 200mV on the gradient signal, a worst case offset of 100mV on the error signal and a worst case input offset of 75mV in the integrator (used for adaptation). Assuming that the error signal and gradient signals are each 1V rms, what is the worst case correlation after adaptation (use a normalized correlation coefficient such that it goes between +1 and -1 with 0 being uncorrelated).