

# CARLETON UNIVERSITY

## Department of Systems and Computer Engineering

**SYSC 4700 Telecommunications Engineering Winter 2008**

### Assignment 3

**Posting date: Sunday, March 30, 2008**

**Due date: 4:00 pm, Tuesday, April 8, 2008 (in box outside ME 4438)**

#### Question 1 [10 marks] FDD FD/TDMA Digital Cellular Network

A metropolitan area is to be given cellular digital telephony service. Throughout this area there is approximately uniform service demand. Assume that frequency is allocated in two blocks of 4.5 MHz with a separation of 40 MHz, one block for uplink and the other for downlink, which constitutes a frequency-division duplex (FDD) operation.

The system uses the hybrid frequency-division/time-division multiple access (FD/TDMA) scheme as follows: the given frequency band is divided into 500 KHz “channels” (which is the frequency-division part), and on each of those “channels” a total of 40 high-quality digital voice circuits are multiplexed in a TDMA manner.

(a) Draw the time-frequency plane and partition that plane appropriately for this FDD FD/TDMA system.

The modulation scheme used is 16-QAM which is implemented by sinc pulses.

(b) Find the bit rate for each user.

It is decided that the cluster size is equal to 4 (i.e., 4 cells per cluster).

(c) Find the total number of (active) users a cluster can support.

This metropolitan area has a population of two million and it is statistically known that at any given time at most 8% of the entire population is using the cellular service.

(d) Find the network deployment cost for the service provider if each base station costs around \$400,000 (assume that the deployment cost is almost entirely composed of base station costs).

**Question 2 [10 marks]**

Briefly explain the followings (one sentence per item):

- handover (sometimes also called “hand-off”)
- downlink
- multiplexing
- multiple access
- ITU
- 3<sup>rd</sup> generation
- WiMax
- 802.11
- WCDMA
- CDMA2000