CARLETON UNIVERSITY – SYSC 4600 Digital Communications

17 November 2016 **Quiz 3** **100 pts, 20 mins** **Prof. H. Yanikomeroglu**

Name: **Student #:** **E-mail:**

Q1 [50 pts] – Transmission Rate

Scenario I: In a SISO system, the bandwidth and SNR are given as W_I = 1 MHz and SNR_I = 30 dB, respectively. Note that SNR = $P_S/P_N = P_S/(WN_0)$.

Scenario II: In order to increase the transmission rate in this SISO system, bandwidth is increased by 100 times; that is, W_{II} = 100 MHz. The transmit power remains unchanged.

Determine, how many times the rate can be increased by increasing the bandwidth by 100 times; i.e., find $R_{max,II}/ R_{max,I}$. (R_{max} = Maximum transmission rate.)

Q2 [50 pts] – Square Root Raised Cosine Filters

It is discussed in the lectures that the power spectral density of the transmitted signal can be written as $S_X(f) = (1/T) |H_{TX}(f)|^2$, where $h_{TX}(t)$ is the transmitter filter and T is the bit duration.

Assume that $h_{TX}(t)$ is chosen as a square root raised cosine filter with 50% excess bandwidth. That is, $H_{TX}(f) = |P(f)|^{1/2}$, with α=0.5. Sketch $S_X(f)$. Compute the total transmit power.