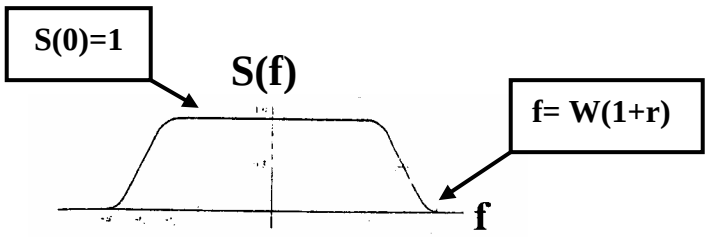
Principles of Communication Systems
Columbia University
ELEN E3701
Spring Semester- 2008

Problem Set # 7

Problems Due: 25 March 2008

Problem #1

a. Find the inverse Fourier transform, s(t), of the raised cosine spectrum, S(f), shown below.



Hint: Try convolving two spectra in the frequency domain to "get" S(f). Then s(t) will be the multiplication of the two inverse Fourier Transforms.
One of the spectra is the ideal rectangular spectrum with bandwidth equal to W Hz. The other is a cosine wave with a small period.

Problem #2

A modified duobinary (or Class IV partial response signal), $p_{mod\text{-}duo}(t)$ is defined below.

$$p_{mod\text{-}duo}(t) = s(t) - s(t - 2T): \quad T=1/2W$$

where, s(t) is a perfectly bandlimited Nyquist signal of bandwidth W, (with S(f)=1; -W < f< W) with 0% rolloff.

a. Find the spectrum for the modified duobinary (Class IV Partial Response) signal. –

Notice that there is no DC component, in the spectrum. This means that this signal can be transmitted through a channel which does not pass DC, for example a transformer coupled channel. It also means that even if you continually transmit a series of "ones" of information, there will be no DC component in the transmitted signal.

b. Find the equation for the function $p_{mod\text{-}duo}(t)$, and show that it decays at a rate of $1/ t^2$.

b. How much more energy is there in the modified duobinary signal than in one perfect Nyquist signal with 0% rolloff?