ECE 457
HOMEWORK #11
Due April 22, 2005

- Read Chapter 6.3.
- Office Hours: W 11:30-1:00, Th 9:30-11:00

1. Design an FM system that achieves an SNR at the receiver equal to 40 dB and requires the minimum amount of transmitter power. The bandwidth of the channel is 120 kHz; the message bandwidth is 10 kHz; the normalized message power is 0.5; and the power spectral density of the noise is 10^{-8}. What is the required transmitter power if the signal is attenuated by 40dB in transmission through the channel?

2. A normalized message signal has bandwidth of 8kHz and a power of 0.5. We must transmit this signal via a channel with available bandwidth of 60 kHz and attenuation of 40dB. The channel noise is additive and white with a power spectral density of $10^{-12} W/Hz$. A frequency modulation scheme, with no pre-emphasis/de-emphasis filtering is used.

   a) If we want the SNR to be at least 40 dB, what is the minimum required transmitter power and the corresponding deviation ratio?
   b) If the minimum SNR is increased to 60 dB, how would your answer change?
   c) If we use pre-emphasis/de-emphasis filters with a time constant of 75μ sec, how would the answer change?

3. 6.21 from Ziemer and Tranter.

4. 6.24 from Ziemer and Tranter.

5. The normalized message signal has a bandwidth of 5000 Hz and power of 0.1 W, and the channel has bandwidth of 100 kHz and attenuation of 80 dB. The noise is white with power spectral density 0.5×10^{-12} W/Hz and the transmitter power is 10kW. What is the highest possible SNR at the output if PM is employed?