大葉大學 九十二 學年度　研究所碩士班　招生考試試題紙					
系　所　別	組 別	考　試　科　目 （中 文 名 稱）	考 試 日 期	節 次	備　　註
電信工程學系 碩士班	乙組	通訊原理	4 月 13 日	第 3 節 13:30 ~ 15:00	可攜帶計算機

註：考生可否攜帶計算機或其他資料作答，請在備註欄註明（如未註明，一律不准攜帶）

1. (15%) An analog signal, $x(t)$, has amplitude of $|x(t)| \leq 1$ and a spectrum of $X(f)$. The signal is transmitted in an amplitude modulation communication system, where the carrier has a frequency of f_c and an amplitude of A_c. Find the RF spectrum for
   (1) DSB-SC modulation and
   (2) AM modulation with a modulation index of 0.8.
   (3) Compare the bandwidth and power efficiency of the above two modulations.

2. (15%) A commercial FM radio transmitter that has a carrier frequency of 800 *MHz* and a maximum frequency deviation of 40 *kHz* is designed to transmit voice signals ranged from 0 to 4 *kHz*. Determine
   (1) the modulation index or the deviation ratio,
   (2) the transmission bandwidth according to Carson's rule, and
   (3) the transmission bandwidth for a modulation signal ranged from 0 to 400 *k*Hz.

3. (15%) Due to multi-path transmissions in radio communication systems, the received signal for a transmitted signal of $s(t)$ is

$$y(t) = a_1 s(t - \tau_1) + a_2 s(t - \tau_2),$$

   where a_1, a_2, τ_1 and τ_2 are constants. In order to ensure a distortion-less transmission, a channel equalizer is required to compensate the distortion created by the channel. Determine
   (1) the impulse response of the radio channel,
   (2) the transfer function of the radio channel, and
   (3) the transfer function of the equalizer.

4. (10%) A binary radio transmission systems has a transmitted signal of

$$s(t) = A_c b(t) \cos(\omega_c t + \theta)$$

   where $b(t)$ is the binary bit sequence having a value of either 1 or –1. Determine the average normalized power of transmitted signal.

5. (15%) A binary communication system that receives equal likely antipodal signal $s_1(t)$ and $s_2(t)= -s_1(t)$ plus AWGN, where $s_1(t)$ is shown in Figure 5 . Assuming the receiving filter is Matched Filter, and the Power spectral Density (PSD) of the noise is $N_0 =10^{-12}$ Watts/Hz. Determine the error probability for this system in terms of the Gaussian Q function or the complementary error function.

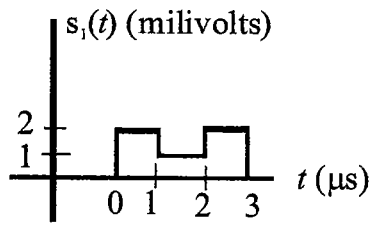

Figure 5

6. (15%) Consider a digital base-band transmission system that transmits $A/2$ and $-A/2$ for the logical one and zero, respectively, with a bit rate of R_b. The digital signal is transmitted in a loss-less Additive White Gaussian Noise (AWGN) channel, where the AWGN has a single sided PSD of N_0. If the receiver has a bandwidth of $B= R_b$, derive the probability of bit error in the receiver in terms of the received signal-to-noise power ratio (SNR). (PSD : Power spectral Density)

7. (15%) An analog signal is PCM formatted and transmitted using binary waveforms over a channel that is band-limited to 100 kHz, where 32 quantization levels are used in PCM encoding. Assume that the overall equivalent transfer function is of the raised cosine type with roll-off r=0.6, where the transfer function the raised cosine filter is shown in Figure 7. Determine

   (1) the maximum bit rate can be used without introducing ISI, and

   (2) the maximum bandwidth of the original analog signal that can be accommodated with these parameters.

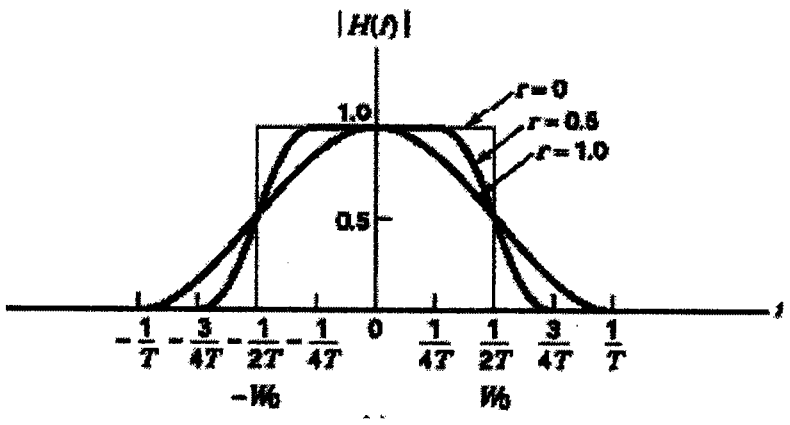

Figure 7