系所組別：電腦與通信工程研究所乙組

考試科目：通信系統 考試日期：0223，節次：2

※ 考生請注意：本試題可使用計算機

1. Please answer the following questions about "AWGN":
   (a) State the reason(s) why "AWGN" is important in the study of Communication Theory. (3%)
   (b) What is the meaning of "A" in AWGN? (3%)
   (c) What does "W" in AWGN stand for? State its meaning in both frequency-domain and time-domain. (8%)
   (d) What does "G" in AWGN stand for? State its meaning in AWGN. (6%)

2. A linear (n, k) block code is generated by a generator matrix G as

$$G = \begin{bmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \end{bmatrix}.$$

   (a) Show the parity-check matrix H. (4%)
   (b) Determine d_{min}, error-detecting capability, and error-correcting capability of this code. (6%)

3. There are two terminals, Terminal A and Terminal B, located at the two ends of a channel. Terminal A wants to send an analog baseband signal to Terminal B. It is assumed that:
   1. For the analog signal, the amplitude is uniformly distributed over (-1, 1) and the bandwidth is 20 kHz.
   2. For the channel, the passband is from 8 MHz to 8.2 MHz with ideal response, the attenuation is 40dB, and the noise is AWGN with two sided PSD = 10^{-9} W/Hz.

   Based on the assumptions listed above, please design an analog communication system for both terminals so that it can have output SNR = 46 dB at Terminal B with minimum (or as low as possible) transmitted power at Terminal A. Your design should include:
   (a) Depict the whole system block diagram of your design and describe the modulation scheme, modulator and demodulator with necessary parameters. (20%)
   (b) Determine the minimum transmitted power (in dBW) at Terminal A? (10%) (Hint: If you cannot figure out the exact value, you should state how to analyze the link budget.)

(背面仍有題目,請繼續作答)

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4. There are two terminals, Terminal A and Terminal B, located at the two ends of a channel. Terminal A wants to send an analog baseband signal to Terminal B. It is assumed that:
   1. For the analog signal, the amplitude is uniformly distributed over (-1, 1) and the bandwidth is 20 kHz.
   2. For the channel, the passband is from 8 MHz to 8.2 MHz with ideal response, the attenuation is 40dB, and the noise is AWGN with two sided PSD = 10^{-9} W/Hz.
   3. The required output SNR of the analog signal at Terminal B must be great than 46 dB.

   Based on the assumptions listed above, please design a digital communication system for both terminals so that it requests minimum (or as low as possible) transmitted power at Terminal A. Your design has to try to prevent the ISI effect due to band-limitation of the channel.
   (a) Depict the system block diagram of your design and describe in detail the possible design of each block with necessary parameters. (30%)
   (b) If it is required that the bit-error-rate (BER) be less than 10^{-5} for the detection of digital data at Terminal B in order to have the output SNR of the analog signal great than 46 dB, what is the minimum transmitted power (in dBW) at Terminal A? (10%) (Hint: If you cannot figure out the exact value, you should state how to analyze the link budget.)