編號：　274　系所：電腦與通信工程研究所乙組　　科目：通信系統

本試題是否可以使用計算機：☑可使用，☐不可使用　（請命題老師勾選）

1. A certain communication channel is characterized by 20 dB attenuation and additive white noise with two-sided PSD = 10^{-13} W/Hz. The bandwidth of the message signal is 5 MHz and its amplitude is uniformly distributed in the interval [-1, 1]. If we require the SNR after demodulation to be 30 dB, determine the minimum transmitted power (in dBm) for each of the following modulation schemes.
   (a) SSB modulation. (10%)
   (b) AM with a modulation index of $\sqrt{2}/2$. (10%)

2. A superheterodyne receiver operates over the radio frequency (f_{RF}) range of 800~888 MHz. The local oscillator frequency is chosen such that $f_{LO} > f_{RF}$. If the image frequency is required to fall outside the operation (receiving) range, determine the minimum IF frequency (f_{IF}) and the corresponding range of f_{LO}. (10%)

3. Specify the Nyquist sampling rate for each of the following signals:
   (a) $g(t) = \text{sinc}(100t) + \text{sinc}^2(400t)$. (5%)
   (b) x(t) with spectrum shown in Fig. 1. (5%)

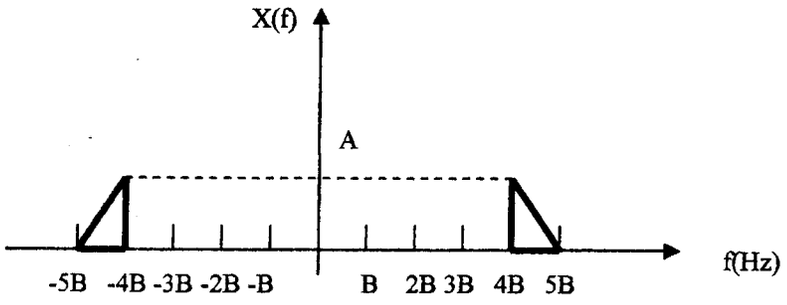

Fig. 1

4. (a) Assume signal $x(t) = 10 + \cos(10^4 t) + 10\cos(10^3 t)$ is the input of a basic DM system with step size Δ = 0.01V. Determine the smallest transmission rate of this system that will not cause slope overload. (5%)
   (b) The output of the DM modulator in part (a) is transmitted through a bandpass channel with passband from 918 to 919.6 MHz by using Gray coded QPSK modulation scheme. Determine the carrier frequency and the roll-off factor of raised cosine spectrum that utilizes the entire frequency band. (10%)
   (c) For the modulator in part (b), Draw the signal constellation and assign the data bits for each signal point. (5%)

（背面仍有題目，請繼續作答）

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5. The encoder of a binary convolutional code is shown as Fig. 2.

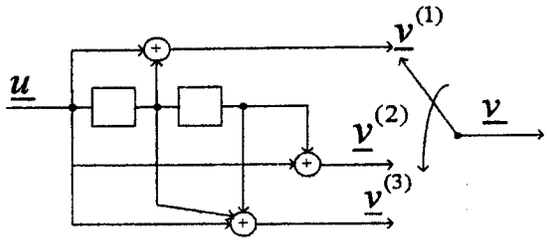

Fig. 2

(a) Determine the values of n, k, and code rate R of this code. (5%)

(b) Draw the state-diagram for this code. (5%)

(c) Draw the trellis diagram for this code. (5%)

(d) If a message sequence is [1 0 1 1 0], what is output sequence? (5%)

6. The binary bit sequence 1 0 0 0 1 0 1 1 1 0 0 is applied to the input of a duobinary baseband modulator. Assume there is a preamble bit 1 and the output signal levels are $\in \{0, +A, -A\}$.

(a) Determine the modulator's output without precoder. (10%)

(b) Determine the modulator's output with precoder. (10%)