國立彰化師範大學103學年度碩士班招生考試試題

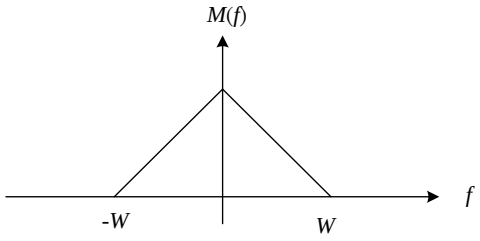
系所：電信工程學研究所　選考丙　　科目：通訊原理

☆☆請在答案紙上作答☆☆　　

1. Suppose the signal $x(t) = m(t) + \sin(2\pi f_c t)$ is applied to a nonlinear system whose output is $y(t) = x(t) + 0.1x^2(t)$.

(a) Determine and sketch the spectrum of $y(t)$ when the spectrum of $m(t)$ is shown below and $W << f_c$. (20%)

(b) Design a receiver to recover $m(t)$ through processing $y(t)$. (10%)



2. Find the output of a linear time-invariant system with impulse response $h(t)$ when driven by the input $x(t)$ in each of the following two cases: (20%)

(a) $h(t) = \text{sinc}(t),\ x(t) = \text{sinc}(t)$

(b) $h(t) = \text{sinc}^2(t),\ x(t) = \text{sinc}(t)$

3. Binary data at 9600 bps are transmitted using 16-QAM modulation with a system using a raised cosine roll-off filter characteristic. The system has a frequency response out to 4.8 kHz. (15%)

(a) What is the symbol rate?

(b) What is the roll-off factor of the filter characteristic?

(c) What is the bandwidth efficiency?

4. For an M-ary PSK system over AWGN channel, the set of M-ary PSK signal waveforms is described as $s_i(t) = A\cos(2\pi f_c t + \phi_i),\ \phi_i = \dfrac{2\pi i}{M}$ for $0 \le t \le T_s$ and $i = 0, 1, ..., M-1$.

(a) Average bit energy E_b = ? (5%)

(b) Describe the set of M-ary PSK signal waveforms in terms of the orthonormal coordinates. (10%)

(c) For $M = 8$, plot the constellation of 8-PSK signal waveforms with Gray code. (10%)

5. For a binary (2, 1, 3) convolutional code generated by generator sequences

$\mathbf{g}^{(1)} = [1\ 1\ 1]$

$\mathbf{g}^{(2)} = [1\ 0\ 1]$

Find the output sequence of the encoder for the message sequence $\mathbf{m} = [1\ 1\ 0\ 0\ 1\ 1]$. (10%)