國立彰化師範大學 99 學年度碩士班招生考試試題

系所：電信工程學研究所　　選考乙　　科目：通訊原理

☆☆請在答案紙上作答☆☆　　

1. Plot the spectra of the following functions. (a) $f_1(t) = \sum_{m=-\infty}^{\infty} \delta(t - mT_0), -\infty < t < \infty$

   (b) $f_2(t) = e^{-t^2}, -\infty < t < \infty$ (c) $f_3(t) = \cos^2(2\pi f_0 t), -\infty < t < \infty$ (20%)

2. Plot the basic building blocks of a phase-locked loop (PLL). How to use it to demodulate a frequency modulation (FM) signal? (15%)

3. Consider a sinusoidal process with random phase, defined by $X(t) = A\sin(2\pi f_c t + \Theta)$ where A and f_c are constants and Θ is a random variable that is uniformly distributed over the interval $(-\pi, \pi)$. Find the autocorrelation function of $X(t)$. Is $X(t)$ a stationary process? (15%)

4. For a binary symmetric channel (BSC) with the transition probability p = 0.1, the input signal set s and the output signal set z consist of the binary elements (0 and 1). Assume that the a priori probability $P(s = 0) = 0.6$. Find the probability $P(s = 0 \mid z = 1)$. (10%)

5. Plot the block diagram of the transmitter and receiver of a 16-QAM system. (20%)

6. Consider a data sequence encoded with a single-error-correcting (7, 4) code and then modulated using coherent BPSK. If the received E_b/N_0 is 10 dB, find the probability of code-bit error and the probability of information-bit error. (20%)