大同大學 九十 學年度研究所碩士班入學考試試題

考試科目：**通訊原理**　　所別：**通訊工程研究所**　　

註：本次考試不可以參考自己的書籍及筆記；　不可以使用字典；　可以使用計算器。

※ 每題20分

1. The lower frequency and upper frequency of standard AM broadcast band are 540 kHz and 1600 kHz, respectively. If the intermediate-frequency, f_{IF}, is 455 kHz.
   (a) What are frequencies of local oscillator for low-side tuning?
   (b) What are frequencies of local oscillator for high-side tuning?
   (c) From (a) and (b), can you conclude that which system is more difficult in implementation of oscillators? Why?

2. Let m_p be the peak amplitude of a message $m(t)$. The amplitude range $(-m_p, m_p)$ is divided into L uniformly spaced intervals, each of width $2m_p/L$.
   (a) Determine the range of the error caused by quantization.
   (b) Determine N_q, the mean-square error due to quantization.
   (c) Give the output signal-to-noise ratio (SNR).
   (d) When a μ-law compander is used, and assume the output SNR is approximated by $SNR=3L^2/[\ln(1+\mu)]^2$, what is the SNR in an 8-bits quantizer? (For $\mu=100$)

3. Consider a rectangular pulse with duration T:
   $$s(t) = A\cos(2\pi w_c t) \qquad 0 \le t \le T$$
   $$s(t) = 0 \qquad \textit{otherwise}$$
   (a) Find the value of A for which the pulse energy is unity.
   (b) Find the impulse response for the filter matched to $s(t)$.

4. The result of a single pulse (impulse) transmission is a received sequence of samples (impulse response), with values 0.1, 0.3, -0.2, 1.0, 0.4, -0.1, 0.1, where the leftmost sample is the earliest. The value 1.0 corresponds to the mainlobe of the pulse, and the other entries correspond to adjacent samples. Design a 3-tap transversal equalizer that forces the intersymbol interference (ISI) to be zero at one sampling point on each side of the mainlobe. Calculate the values of the equalized output pulses at times $k = 0, \pm1, \pm2, \pm3$. After the equalization, what is the largest magnitude sample contributing to ISI?

5. A quadranture partial response signal (QPRS) is generated as follows:
   $$s(t) = Re\{v(t)e^{j\pi f_c t}\}$$
   where
   $$v(t) = v_c(t) + jv_s(t)$$
   $$= \sum_n B_n u(t-nT) + j\sum_n C_n u(t-nT)$$
   and $B_n = I_n + I_{n-1}$ and $C_n = J_n + J_{n-1}$. The sequences $\{ B_n \}$ and $\{ C_n \}$ are uncorrelated and

   $I_n = \pm1$, $J_n = \pm1$ with equal probability.
   (a) Sketch the signal space diagram for the QPRS signal and determine the probability of occurrence of each symbol.
   (b) Determine the autocorrelation and power spectral density of $v_c(t)$, $v_s(t)$, and $v(t)$.