

大同工學院 87 學年度研究所招生入學考試試題

第 1/1 頁

考試科目 通訊原理

所別 通訊工程研究所

註：本次考試 參考自己的書籍及筆記 查字典 使用計算器

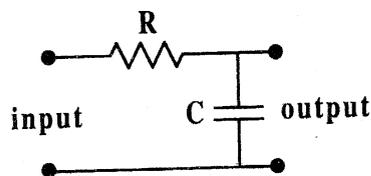
1. (a) Please give the transfer function of a transmission distortionless system. (5%)

(b) Consider the low-pass RC filter as shown.

Is this system transmission distortionless?

What are the group and phase delays?

What are the units of these delays? (10%)



(c) A white noise with power spectral density $G_n(f) = N_0/2$ forms the input to the low-pass filter.

Find the power spectral density, $G_Y(f)$, of the output signal. (5%)

2. Consider the exponential modulation for which the modulated wave $\Phi_{EM}(t)$ is

$$\Phi_{EM}(t) = A \cos\left[\omega_c t + k \int_{-\infty}^t f(\tau) h(t-\tau) d\tau \right]$$

where k is constant, $f(t)$ is the input signal and $h(t)$ is the unit impulse response of a linear time-invariant system.

(a) If $\Phi_{EM}(t)$ is phase-modulated (PM) wave, then $h(t) = ?$ (10%)

(b) If $\Phi_{EM}(t)$ is frequency-modulated (FM) wave, then $h(t) = ?$ (10%)

3. The message signal on the input to an analog-to-digital converter is a sinusoid of 20 V peak to peak. Please compute the signal-to-quantization-noise ratio as a function of the wordlength N of the analog-to-digital converter. (20%)

4. An analog waveform with maximum frequency $f_m = 4$ kHz is to be transmitted over an 16-level PCM system. The quantization distortion is specified not to exceed $\pm 1\%$ of the peak-to-peak analog signal.

(a) What is the minimum number of bits/sample should be used in this PCM system? (5%)

(b) What is the minimum required sampling rate, and what is the resulting bit transmission rate? (10%)

(c) What is the PCM pulse or symbol transmission rate? (5%)

5. For a BPSK receiver, the input digital waveforms are $s_1(t) = A \cos \omega_c t$ and $s_2(t) = -A \cos \omega_c t$, where $A = 1$ mV and the single-sided noise power spectral density is $N_0 = 10^{-11}$ W/Hz. Assume that data rate is 5000 bits/s and signal power and energy per bit are normalized relative to a 1- Ω resistive load. Please find the expected number of bit errors made in one day by this continuously operation coherent BPSK receiver. (20%)

Hint: The complementary error function is given as:

$$Q(x) = \frac{1}{\sqrt{2\pi}} \int_x^{\infty} \exp\left(-\frac{u^2}{2}\right) du \cong \frac{1}{x\sqrt{2\pi}} \exp\left(-\frac{x^2}{2}\right),$$