

國立彰化師範大學105學年度碩士班招生考試試題

系所： 資訊工程學系(選考庚)、
資訊工程學系積體電路設計碩士班(選考庚)、
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☆☆

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1. A system defined by

$$y(t) = \int_{-\infty}^t x(\tau) d\tau$$

is an integrator.

- (1) Is this system LTI? (4%)
 - (2) Is this system causal? (5%)
 - (3) Find the impulse response of this system. (5%)
2. A message signal $m(t)$ is defined as $m(t) = \sin\left(2\pi\frac{t}{T}\right)$, $T > 0$. Assume that we use $m(t)$ to frequency modulate a carrier. The frequency-deviation constant k_f is 10 and the carrier frequency is 10^9 Hz.
- (1) What is the peak frequency deviation of the modulated signal? (6%)
 - (2) Use Carson's rule to determine the transmission bandwidth of the modulated signal. (6%)
3. A superheterodyne FM receiver operates in the radio frequency range 88-108 MHz. This frequency range is denoted as f_{RF} .
- (1) Plot the block diagram of a superheterodyne FM-radio receiver. (6%)
 - (2) The intermediate frequency f_{IF} is set at 10.7 MHz and a local-oscillator frequency f_{LO} is chosen so that $f_{LO} > f_{RF}$. Determine the frequency range of f_{LO} so that FM signals can be demodulated. (6%)
 - (3) What is the range of image frequency f_i ? (6%)
 - (4) Determine the passband and stopband specifications of the RF amplifier. (6%)
4. An analog signal is sampled, quantized, and encoded into a binary PCM wave. The sampling rate $f_s = 8$ KHz and the number of quantization levels $L = 256$. The PCM wave is transmitted over a baseband channel using 4-PAM.
- (1) Determine the transmission bit rate. (10%)
 - (2) Determine the minimum bandwidth required for transmitting the PCM wave. (10%)

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5. Find (1) $\int_{-1}^1 \cos(\pi t) \times \delta(t) dt$ and (2) $\cos(\pi t) * \delta(t - 0.5)$, where $*$ denotes the convolution operation. (10%)
6. Consider a 16-QAM system with symbol error probability $P_E = 10^{-5}$. A Gray code is used for the symbol to bit assignment. What is the approximate bit error probability? (10%)
7. A bit error probability of $P_B = 10^{-3}$ is required for a BPSK system over AWGN channel. What E_b/N_0 is required for the specified P_B ? (10%)

x	$Q(x)$									
	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002