亞洲大學

九十五學年度碩士班招生考試試題紙

系　所　別	組 別	考試科目	考試日期	時　　間	備　　註
資訊學院碩士班	--	通訊理論	95.4.30	10:30-12:10	

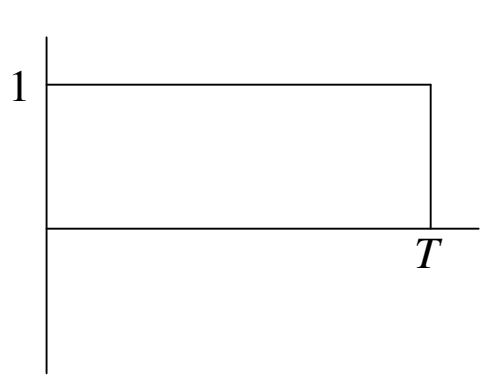
1. Evaluate the following integrals: (10%, 5 points each)

(a) $\int_{-\infty}^{\infty} \delta(t-2)\cos \pi t dt.$　　(b) $\int_{-\infty}^{\infty} e^{-j2\pi ft} dt.$

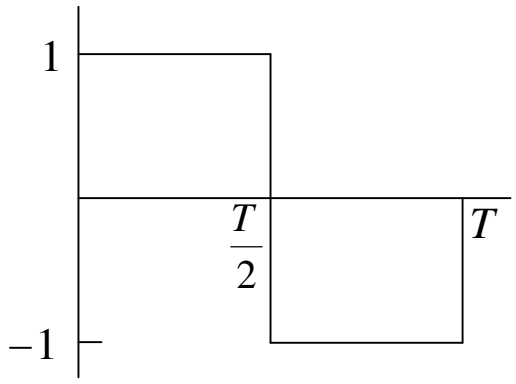
2. The functions $c_1(t)$ and $c_2(t)$ are shown below.

(a) Are $c_1(t)$ and $c_2(t)$ orthogonal? Why? (5%)

(b) Normalize $c_1(t)$ and $c_2(t)$ into $c_1'(t)$ and $c_2'(t)$ so that the new functions each have unity energy. (10%)



$c_1(t)$



$c_2(t)$

3. $u(t) = \sqrt{\frac{2}{T}} \cos(2\pi f_c t + \frac{2\pi n}{M})$, where $n = 0,1,\cdots,M-1$, and $0 \le t \le T$.

Let $\phi_1(t) = \sqrt{\frac{2}{T}} \cos 2\pi f_c t$ and $\phi_2(t) = \sqrt{\frac{2}{T}} \sin 2\pi f_c t$.

Express $u(t)$ in terms of $\phi_1(t)$ and $\phi_2(t)$. (15%)

4. $s(t) = \sum_{n=-\infty}^{\infty} A_n g(t-nT)$, where $A_n = +1$ or -1, and $g(t)$ is defined as

$$g(t) = \begin{cases} 1, & 0 \le t \le T, \\ 0, & \text{elsewhere.} \end{cases}$$

Suppose $s(t)$ is transmitted over a band-limited channel with bandwidth $\frac{1}{2T}$ Hz.

Does the channel introduce intersymbol interference (ISI)? Explain your answer. (15%)

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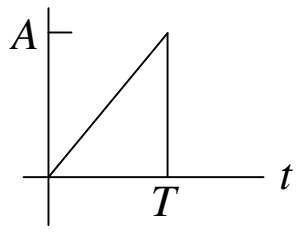
5. $y(t) = A\cos 2\pi f_m t \cdot \cos 2\pi f_c t$, where A is a constant and $f_c >> f_m$. Draw the spectrum of $y(t)$, namely, $Y(f)$. (10%)

6. A source with bandwidth 4000Hz is sampled at the Nyquist rate. Assuming that the resulting sequence can be approximately modeled by a discrete memoryless source with alphabet $A = \{-2,-1,0,1,2\}$ and with corresponding probabilities $\left\{\frac{1}{2},\frac{1}{4},\frac{1}{8},\frac{1}{16},\frac{1}{16}\right\}$, determine the rate of the source in bits/sec. (15%)

7. (a) Suppose you want to "correlate" the signal $s(t)$ shown below using a correlator $\phi_1(t)$ and "match" $s(t)$ using a matched filter $\phi_2(t)$. Draw your answer for $\phi_1(t)$ and $\phi_2(t)$.

   (b) Show that, at time *T*, the outputs of the correlator and matched filter are the same. (20%)



$s(t)$