大葉大學 九十二 學年度 **碩士在職專班** 招生考試試題紙					
系 所 別	組 別	考 試 科 目（中 文 名 稱）	考 試 日 期	節 次	備 註
電信工程研究所 碩士在職專班	乙組	通訊原理	4 月 13 日	第 一 節 08:30～10:00	共二頁

註：考生可否攜帶計算機或其他資料作答，請在備註欄註明（如未註明，一律不准攜帶）

註：可不按序作答，但請標明題號

1. Given that, the average power and the time-average autocorrelation function of a real signal are defined by $P_m = \lim_{T\to\infty}\frac{1}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} m^2(t)dt$, and $R_m(\tau) = \lim_{T\to\infty}\frac{1}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} m(t)m(t+\tau)dt$, respectively. The variable τ in the time-average autocorrelation function is a time-shifted. Now, if there were two functions assigned as $m(t) = 2\sin(\omega_0 t + 0.5\pi)$ and $g(t) = \delta(t)$ (unit impulse function). Determine that

   (a). Time-average autocorrelation function $R_m(\tau)$.

   (b). Power spectral density $S_m(f)$.

   (c). Average power of *m(t)*.

   (d). The spectrum of $y(t) = m(t) * g(t)$, where the symbol $*$ denotes convolution operation. **(32 points)**

2. The Shannon-Hartley Law is defined as

   $$C_c = B\log_2(1+\frac{S}{N})$$

   where B is the channel bandwidth in hertz and $\frac{S}{N}$ is the signal-to-noise ratio. Can you illustrate some words or figures about this formula in order to prove that you have understood it well? **(18 points)**

3. Show that the Fourier transform of $\phi(t) = \exp(-\pi t^2)$ is $\Phi(f) = \exp[-\pi f^2]$. **(10points)**

4. (a). Show that the signal $s(t) = \exp(-kt)u(t)$, where $k > 0$, and $u(t) = \begin{cases} 0, & t<0 \\ 1, & t>0 \\ unfefined, & t=0 \end{cases}$, is an energy signal.

   (b). What's the value of energy of *s(t)* in (a)? (c). How can it become a power signal? **(10 points)**

5. A system shown in figure 1. Assume that $h(t)=\delta(t-0.5)$, and $f(t)=5\cos 2\pi t$.

   What is the output y(t)

   (a). when $t_a < 0.5 < t_b$.

   (b). when $t_a = t_b = 0.5$. **(20 points)**

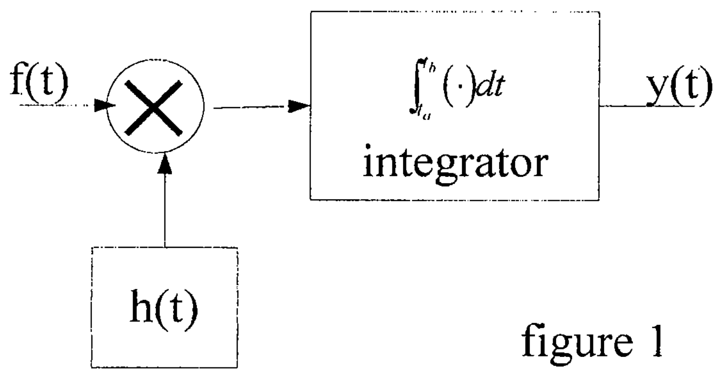

figure 1

6. The triangular signal is defined as $\Lambda(\frac{t}{10}) @ \begin{cases} 1-\frac{|t|}{10}, & |t|<10 \\ 0, & \text{otherwise} \end{cases}$, and shown in figure 2.

   Find the expression and sketch the waveform of (a). $\frac{d\Lambda(t/10)}{dt}$. (b) $\frac{d^2\Lambda(t/10)}{dt^2}$.

   (10 points)

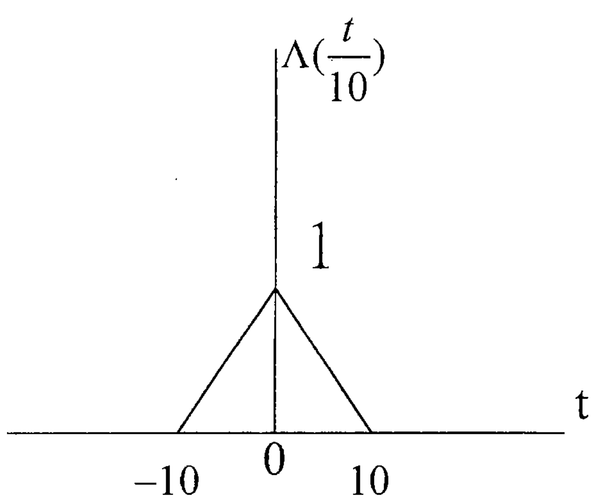

figure 2