國立臺灣科技大學

九十一學年度碩士班招生考試試題

系所組別： 電子工程系乙二組

科　目： 線性系統

總分爲 **100** 分 答題時請標題號

(1) Determine $\int_{-\infty}^{\infty}(\sin y)\delta(x-y^3)dy$ where δ denotes delta function. (5%)

(2) If g(t)=f(t)*h(t), find f(at)*h(at) in terms of g(.), where * denotes convolution. (5%)

(3) Determine $\int_{-\infty}^{\infty}\frac{\sin t}{t}dt$ (5%)

(4) A linear, time-invariant system has output y(t)= $\sin\omega_0 t$ if the input is tu(t), where u(t) denotes unit step function. Find the unit-step response and impulse response of the system. (5%).

(5) (a) Given x[n] a periodic function with period N and its Fourier series coefficients a_k. Is that g(t) = $\sum_{k=-\infty}^{\infty}x[k]\delta(t-kT)$ periodic or not, if yes, find the period. (10%).(b) Find the Fourier series coefficients of g(t), denoted as b_k, express b_k in terms of a_k, and find the period of b_k if it is periodic. (10%)

(6) The correlation of x(t) and h(t) is given as y(t) = $\int_{-\infty}^{\infty}x(\tau)h(t+\tau)d\tau$. Find Y($\omega$) in term of X($\omega$) and H($\omega$), where Y($\omega$), H($\omega$), and X($\omega$) denote the Fourier transform of y(t), h(t), and x(t), respectively.(5%)

(7) If M is an integer and M>1, (a) can x(t)=$\cos\frac{\pi t^2}{M}$ be periodic? If yes, what is the necessary conditions for M and find the period. (5%) (b) Answer the same questions in part (a) if x[n]=$\cos\frac{\pi n^2}{M}$ (10%)

(8) A signal x(t)=$\frac{\sin(3Wt/2)}{\pi t}$ is multiplied by p(t) = cos2Wt + 4cos8Wt, then x(t)p(t) passes through a linear, time-invariant system with H(ω)= $\begin{cases}1 & if\ |\omega|\le\eta\\ 0 & otherwise\end{cases}$

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resulting y(t). Find (a) the total energy of x(t) (5%), (b) Draw the Fourier transform of x(t)p(t) in frequency domain (i.e. in ω-domain) (5%) (c) Find η such that y(t) has 90% total energy of x(t). (5%)

(9) Let x(t) be a signal with Nyquist rate ω_0 determine the Nyquist rate for each of the following signals (a) x(t) + x(t – 1) (b) $\frac{dx(t)}{dt}$ (c) $x^2(t)$ (d) x(t)cos ω_1t, where $\omega_1 > \omega_0$ (e) x(at), where a > 0.(15%)

(10) State and prove the initial- and final-value theorems for Laplace transform. (10%)