Yuntech EE - Signals and Systems Midterm Examination

Name: _____ ID No.: _____ 94/11/7

1. (20%) Please identify that the flowing signals are continuous-time or discrete-time. (a) Human's speech; (b) a traditional photograph; (c) an MP3 sound track; (d) a digital image.

2. (10%) Please identify that which equation is for **total energy** and the other is for **average power** of a discrete-time signal $x[n]$ over an infinite interval.

$$(a)\ \lim_{N\to\infty}\frac{1}{2N+1}\sum_{n=-N}^{N}|x[n]|^2, \qquad (b)\ \lim_{N\to\infty}\sum_{n=-N}^{N}|x[n]|^2$$

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3. (30%) Please determine (**and also state the reasons**) whether (a) a discrete-time system $y[n] = nx[n]$; (b) a continuous-time system $y(t) = \sin[x(t)]$; and (c) a continuous-time system $y(t) = x(2t)$ is *time-invariant* or not.

4. (20%) Let $x(t) = u(t-3) - u(t-5)$ and $h(t) = e^{-3t}u(t)$. Compute (a) $y(t) = x(t) * h(t)$ and (b) $g(t) = \frac{dx(t)}{dt} * h(t)$.

5. (10%) For each of the following two input-output relationships, determine (**and also state the reasons**) whether the corresponding system is linear, time invariant or both. (a) $y(t) = t^2x(t-1)$; (b) $y[n] = x^2[n-2]$.

6. (10%) Determine (**and also state the reasons**) whether or not each of the following continuous-time and discrete-time signals is periodic. If the signal is periodic, determine its fundamental period. (a) $x(t) = [\cos(2t - \frac{\pi}{3})]^2$; (b) $x[n] = \cos(\frac{n}{8} - \pi)$.

7. (10%) Which of the following impulse response correspond(s) to stable LTI systems? (**Please also state the reasons!**) (a) $h_1(t) = e^{-(1-2j)t}u(t)$; (b) $h_4[n] = 3^n u[-n+10]$.

8. (20%) Compute and plot $y[n] = x[n] * h[n]$, where

$$x[n] = \begin{cases} 1, & 3 \le n \le 8 \\ 0, & \text{otherwise} \end{cases},$$

and

$$h[n] = \begin{cases} 1, & 4 \le n \le 15 \\ 0, & \text{otherwise} \end{cases}.$$