國立清華大學 104 學年度碩士班考試入學試題

系所班組別：生醫工程與環境科學系碩士班 丙組(放射組)

考試科目（代碼）：生醫訊號與系統(2403)

1. (20 pt) (a) Find the frequency response function of a system whose input-output equation is $y'(t) + 10y(t) = 2x(t) + x'(t)$. (b) Determine the steady-state effect of this system on the input signal $x(t) = 3\cos(6\pi t) + \sin(\pi t)$.

2. (20 pt) Consider a 1-D medical imaging system with point spread function (PSF) $h(x)$ composed of two sub-systems with Gaussian PSFs of the form $g(x) = \frac{1}{\sqrt{2\pi}\sigma_1}\exp\left(\frac{-x^2}{2\sigma_1^2}\right)$ and $k(x) = \frac{1}{\sqrt{2\pi}\sigma_2}\exp\left(\frac{-x^2}{2\sigma_2^2}\right)$. What is the PSF of this system?

3. (20 pt) Sole the discrete time problem defined by the equation $y[n] + 2y[n-1] = 3.5u[n]$, with $y[-1] = 0$, and $u[n] = \begin{cases} 0, & n < 0 \\ 1, & n \geq 0 \end{cases}$.

4. (20 pt) Consider the Laplace transform an analog filter with the transfer function $H(s) = a/(s+a)$ and $a = 0.2$. If the filter is sampled at the sampling rate $T = 0.05s$, what is the transfer function (in terms of z-transform) of the equivalent digital filter, $H(z)$?

5. (20 pt) The Radon transform is defined as $g(l,\theta) = \iint_{-\infty}^{\infty} f(x,y)\delta(x\cos\theta + y\sin\theta - l)dxdy$. Given a unit disk function $f(x,y) = \begin{cases} 2 & x^2+y^2 \leq 1 \\ 0 & else \end{cases}$, what is its Randon transform at $\theta = 0$?

*請在【答案卷、卡】作答