台灣聯合大學系統 110 學年度碩士班招生考試試題

類組：電機類　　科目：訊號與系統(300B)　　

※請在答案卷內作答

1. (5%)

The output ($y(t)$) of a continuous-time system is related to its input ($x(t)$) as $y(t) = e^{-t}x(t-2)$, $t>0$. Determine whether the system is (a) stable (2%), (b) causal (1%), (c) linear (1%), and (d) time invariant (1%).

2. (15%)

Determine the output of the continuous- (discrete-) time systems described by the following differential (difference) equations with the given input and initial conditions.

(a) (8%) $\frac{d^2}{dt^2}y(t)+5\frac{d}{dt}y(t)+6y(t)=\frac{d}{dt}x(t), x(t)=e^{-t}u(t), y(0^-)=0, \frac{d}{dt}y(t)\Big|_{t=0^-}=1$

(b) (7%) $y[n]+0.4y[n-1]=0.6x[n], x[n]=(0.5)^n u[n], y[-1]=2$

3. (10%)

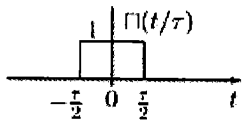
Given the impulse response of an LTI DT system, $h[n]=(0.5)^n u[n]+2(-0.25)^n u[n]$. Determine

(a) the frequency response (5%) and

(b) the linear, constant-coefficient difference equation (5%) of the system.

4. (18%)

(a) (6%) Find the Fourier transform of rectangular function $\sqcap(\frac{t}{\tau})$



(b) (6%) Find the time-domain signal corresponding to the following Fourier representation

$$X(jw)=\frac{2\sin(w-2)}{w-2} * \frac{e^{-j2w}\sin(2w)}{w}$$

(c) (6%) Use Parseval's theorem to evaluate the following quantities:

$$x_1=\int_{-\infty}^{+\infty}\frac{4}{\pi t^2}\sin^2(2t)\,dt$$

5. (12%)

Let $f(t)$ be a periodic signal of period "1" and define the moving-average operator depending on a parameter $h>0$ by

$$y(t)=\frac{1}{2h}\int_{t-h}^{t+h}f(u)du$$

(a) (6%) show that $y(t)$ is also a periodic function of period "1" i.e.,

$$y(t)=y(t-1)$$

(b) (6%) Find the Fourier series for $y(t)$ in terms of the Fourier series for $f(t)$

$f(t)=\sum_k X_k e^{jk(2\pi)t}$.

Hint: $y(t)=f(t)*h(t)$, $h(t)$: *the impulse response of* $\delta(t)$

注意:背面有試題

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6. (6%)

Find the Laplace transforms of the following functions.

(1) $h(t) = e^{-t}u(t)$

(2) $h(t) = te^{-t}u(t)$

7. (6%)

Find the z transforms of the following functions.

(1) $h[n] = 0.5^n u[n]$

(2) $h[n] = (n+1)0.5^n u[n]$

8. (6%)

Find the locations of poles and zeros and discuss the causality and stability of the following s-domain transfer function.

$$H(s) = \frac{2s+3}{s^2+3s+2}$$

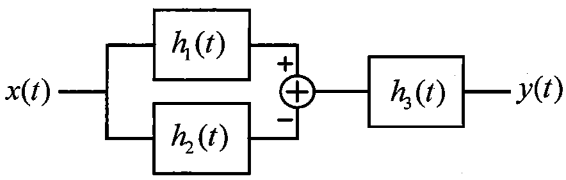
9. (6%)

Find the locations of poles and zeros and discuss the causality and stability of the following z-domain transfer function.

$$H(z) = \frac{2-2z^{-1}}{1-2z^{-1}+0.75z^{-2}}$$

10. (8%)

Find the impulse response (i.e., *h*(t)) and the transfer function (i.e., *H*(s)) of the following CT LTI system. The input signal is *x*(t) and the output signal is *y*(t).



$h_1(t) = \delta(t),\ h_2(t) = e^{-t}u(t), and\ h_3(t) = e^{-t}u(t).$

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11. (8%)

Find the impulse response (i.e., h[n]) and the transfer function (i.e., H(z)) of the following CT LTI system. The input signal is x[n] and the output signal is y[n].