大同工學院 八十七 學年度研究所招生入學考試試題

考試科目:訊號與系統　　所別:電機工程研究所　　

註:本次考試不可以參考自己的書籍及筆記； 不可以使用字典； 可以使用計算器。

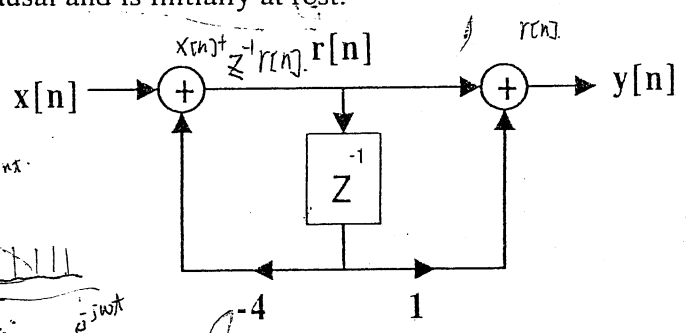
1. (a) Let x(t) and y(t) be periodic signals with fundamental period T_1 and T_2 respectively. Under what conditions is the sum x(t)+y(t) periodic, and what is fundamental period of this signal if it is periodic ?
(b) Let x[n] and y[n] be periodic signals with fundamental period N_1 and N_2, respectively. Under what conditions is the sum x[n]+y[n] periodic, and what is the fundamental period of this signal if it is periodic ? (10%)

2. Consider a system with input x(t) and with output y(t) given by

$$y(t)=\sum_{n=-\infty}^{\infty}x(t)\delta(t-nT)$$

(a) Is this system linear ?
(b) Is this system time-invariant ?
For each part, if your answer is yes, show why this is so. If your answer is no, Produce a counterexample. (10%)

3. Consider the block diagram in figure as shown. The system is causal and is initially at rest.
(a) Find the difference equation relating x[n] and y[n].
(b) For x[n]= δ [n], find r[n] for all n.
(c) Find the system transfer function, H(z)=Y(z)/X(z). (15%)



4. (a) Find the Fourier transform of $x(t)=\sum_{n=-\infty}^{\infty}\delta(t-nT)$
(b) Find the Fourier transform of the unit impulse, x[n]= δ [n].
(c) Find the Fourier transform of $x(t)=\cos\omega_0 t$
(d) Find the Fourier transform of $x[n]=\exp(j\omega_0 n)$.(20%)

5. For a system y[n]=x[n]p[n], where

$x[n]=(-1)^n$ $\quad -\infty<n<\infty$

$p[n]=[1+(-1)^n]/2$ $\quad -\infty<n<\infty$

Determine X(ω), P(ω), and Y(ω). Where X(ω), P(ω), and Y(ω) are the Fourier transforms of x[n], p[n], and y[n], respectively.(15%)

6.Given a sequence x[n] that is zero for n<k. Proof that $z^kX(z)|_{z=\infty}=x[k]$, where X(z) is the z-transform of x[n].(10%)

7. Consider the following state-variable system as follows(a) Find the matrix e^{At} (b) Find the transfer function H(s) of this system. Hint: H(s)=D+ C(sI-A)$^{-1}$B.(20%)

$$\begin{bmatrix}\frac{dx_1}{dt}\\ \frac{dx_2}{dt}\end{bmatrix}=\begin{bmatrix}0 & 1\\ -2 & -3\end{bmatrix}\begin{bmatrix}x_1(t)\\ x_2(t)\end{bmatrix}+\begin{bmatrix}0\\ 1\end{bmatrix}u(t)$$

$$y(t)=\begin{bmatrix}-2 & -6\end{bmatrix}\begin{bmatrix}x_1(t)\\ x_2(t)\end{bmatrix}+[2]u(t)$$