电子科技大学 2019 -2020 学年第 2 学期　期末（A） 试卷

考试科目：信号与系统　考试形式：一页纸开卷　考试日期：2020 年 9 月 2 日

本试卷由八部分构成，共 8 页。考试时长：120 分钟

成绩构成比例：平时成绩 50 %，期末成绩 50 %

题号	一	二	三	四	五	六	七	八	合计
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一、计算题（10 分）

Determine which of these properties hold and which do not hold for the following discrete-time system: $y[n]=\begin{cases}0, & x[n]<0\\ x[n]+x[n-3], & x[n]\geq 0\end{cases}$

where $x[n]$ **denotes the system input and** $y[n]$ **is the system output.**

(a) Memoryless (b) Time invariant (c) Linear (d) Causal (e) Stable

学院 姓名 学号 任课教师 考场教室 座位号

密 封 线 以 内 答 题 无 效

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二、计算题（8 分）

Let $x[n]=(2+e^{j\pi n})\cdot u[n]$

(a) Is $x[n]$ **periodic? If it is, determine the fundamental period.**

(b) Determine and sketch $y[n]=\frac{1}{2}\left(1-e^{j\pi n}\right)x[n]$

(c) Determine and sketch the even and odd parts of $x[n]$

得 分

三、计算题（12 分）

The unit step response $s(t)$ is the output of an LTI system when the input is the unit step signal $u(t)$. Suppose that the unit step response $s(t)$ of an LTI system is as shown in Figure 1.

(a) Determine and sketch unit impulse response $h(t)$ of the system.

(b) Determine whether the system is causal and/or stable.

(c) If the input of the system is as shown in Figure 2, sketch the output $y(t)$.

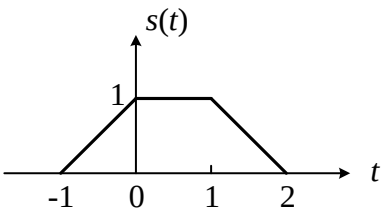

Figure 1

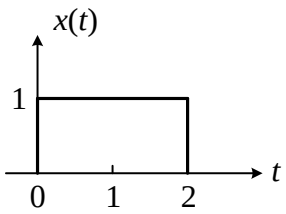

Figure 2

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四、计算题（12 分）

Given the following facts about a periodic signal $x(t)$.

(a) $x(t)$ is real;

(b) The period of $x(t)$ is 4 and its Fourier coefficients are denoted as a_k ;

(c) $a_k = 0$ for $|k| > 1$;

(d) A real signal with Fourier coefficients $b_k = e^{-jk\frac{\pi}{2}} a_k$ is odd;

(e) $\frac{1}{4}\int_{<T>} |x(t)|^2 dt = \frac{1}{2}$.

Determine all possible $x(t)$.

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五、计算题（14 分）

The following figure shows a series connection of an amplitude modulation and the corresponding demodulation. The carrier is given by $p(t)=\cos(\omega_c t)$.

When the input is given by $x(t)=\sum_{k=-\infty}^{+\infty}\delta\left(t-k\frac{4\pi}{3\omega_c}\right)$,

(a) Determine the output $y(t)$.

(b) Sketch the spectrum of $x_1(t)$ **and the spectrum of** $x_2(t)$

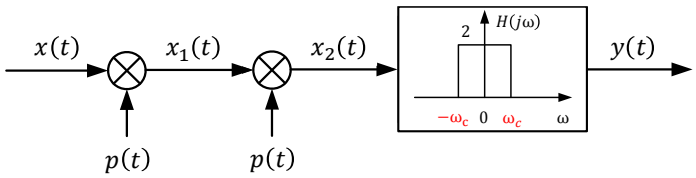

Figure 3

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六、计算题（12 分）

Let $X(j\omega)$ denote the Fourier transform of the signal $x(t)$ shown in Figure 4.

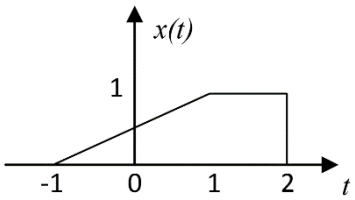

Figure 4

(a) Find $X(j\omega)\big|_{\omega=0}$

(b) Determine the expression of $\mathrm{Re}\{X(j\omega)\}$

(c) Find $\int_{-\infty}^{+\infty} \left|\mathrm{Re}\{X(j\omega)\}\right|^2 d\omega$

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七、计算题（16 分）

Consider the inverse of a causal LTI system $H(s)$ is, $H^{-1}(s)=\dfrac{s^2+3s+2}{2s^2+4s-6}$

(a) Determine the system $H(s)$ and sketch the pole-zero pattern of $H(s)$. Is this system $H(s)$ stable?

(b) Determine the differential equation relating the input $x(t)$ and output $y(t)$ for system $H(s)$.

(c) Draw the block diagram of the system $H(s)$.

(d) Find the impulse response $h(t)$ of the system.

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八、计算题（16 分）

Consider the digital filter structure shown in Figure 5.

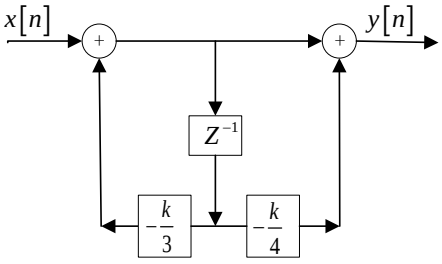

Figure 5

(a) Find $H[z]$ for this causal filter.

(b) For what values of the k is the system stable?

(c) If $k=1$, determine $h[n]$.

(d) If $k=1$ and $x[n]=(\frac{2}{3})^n$, determine $y[n]$ for all n.