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NEW SCHEME

USN | | | | | | | | | | |

Third Semester B.E. Degree Examination, January/February 2005

EC / TE / ML / IT / BM / EE

Signals and Systems

Time: 3 hrs.] [Max.Marks : 100

Note: *1. Answer any FIVE full questions.*
2 .Assume missing data if any suitably.
3.Mention the assumtions made.

1. (a) Sketch the following signals and determine their even and odd components and sketch them.

(i) r(t+2) - r(t+1) - r(t-2) + r(t-3)

(ii) $u(n+2) - 3u(n-1) + 2u(n-5)$. **(6+6=12 Marks)**

b) Given the signal $x(t)$ as shown in fig 1.b, sketch the following:

i) x(-2t+3)

ii) $x(\frac{t}{2} - 2)$ **(4 Marks)**

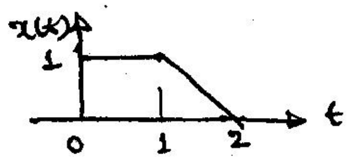

Fig.1(b)

(c) Check the system given below for linearity. Give reasons for your answer.

$\frac{dy(t)}{dt} + 10y(t) + 5 = x(t)$ **(4 Marks)**

2. (a) Check whether the following singnals are periodic or not. If periodic, determine their fundametal period.

i) $x(n) = Cos(\frac{\pi n}{7})sin(\frac{\pi n}{5})$

ii) $x(t) = (2cos^2(\frac{\pi t}{2}) - 1)Sin\pi t cos\pi t$ **(6 Marks)**

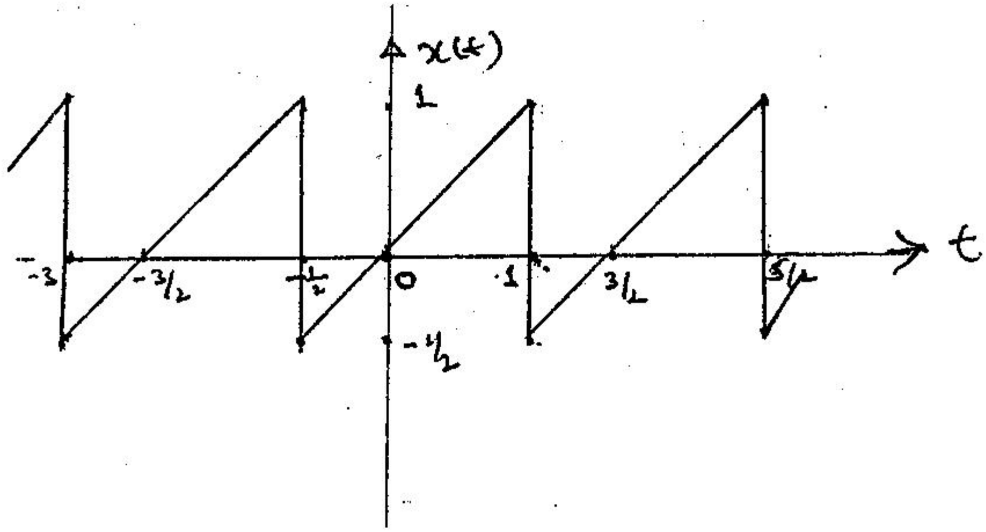

Fig2(b)

(c) Determine the output y(t) of a LTI system with impulse response $h(t) = u(t+1) - 2u(t) + u(t-1)$ and input $x(t) = \quad 1 \mid t \mid \leq 2.$

$$= \quad 0 \mid t \mid > 2$$

Sketch the signals $x(t), h(t) and y(t)$. **(10 Marks)**

3. (a) Determine the complete response of jthe system described by

$\frac{d^2y(t)}{dt^2} + 2\frac{dy(t)}{dt} + y(t) = x(t) + 2\frac{dx(t)}{dt}$ for the input $x(t) = 2e^{-t}$ u(t) with initial conditions y(o)=1. $\frac{dy(t)}{dt} |_{t=0} = 1$. Comment on the stability of the system

(10 Marks)

(b) Draw the direct form I & II realization for the following system.

i) y(n) $-\frac{1}{2}y(n-1) + \frac{1}{4}y(n-2) = x(n) + 2x(n-1)$

ii) $2\frac{d^3y(t)}{dt^3} + \frac{dy(t)}{dt} + 3y(t) = x(t)$ **(10 Marks)**

4. (a) Derive the DTFS representation for a discrete time periodic signal $x(n)$ using the mean square error (MSE) criterion. **(10 Marks)**

(b) Determine the signal $x(n)$ given its Fourier representation as

$x(j\omega) = j\frac{d}{d\omega}[\frac{1}{2+j(w-\frac{\pi}{2})}]$ **(5 Marks)**

(c) Starting from signal $x(t)$ definded as

$$x(t) = 1 \quad \mid t \mid \leq 1$$
$$= 0 \quad \mid t \mid > 1$$

Contd.... 3

(4 Marks)

Determine fourier transform of signal g(t) shown fig 4(c). Express g(t) in term of x(t).

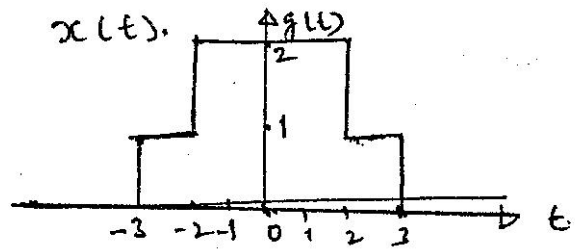

Fig 4(c)

(5 Marks)

5. (a) Determine the time domain signal given:

i) $x(j\omega) = e^{\ |\omega|}$

ii) $x(e^{j\Omega}) = \frac{6}{e^{-j2\Omega} - 5e^{-j\Omega} + 6}$

iii) $x(j\omega) = \frac{4 sin^2 \omega}{\omega^2}$ (12 Marks)

(b) Show that a real and odd continous time non periodic signal has purely imaginary Fourier transform. (4 Marks)

(c) Explain the reconstruction of CT signals implemented with zero-order device. (4 Marks)

6. (a) Consider the system depicted in fig 6a. The FT of the input signal is given by

$$x(j\omega) = \begin{cases} (1 \quad (|\frac{\omega}{\pi}|) & |\omega| \leq \pi \\ 0 & |\omega| > \pi \end{cases}$$

The signals $\omega(t)$ and $h(t)$ are given by $\omega(t) = cos5\pi t, h(t) = \frac{Sin6\pi t}{\pi t}$ and $y(j\omega) \longleftrightarrow$ y(t) Determine and sketch $y(j\omega)$. (10 Marks)

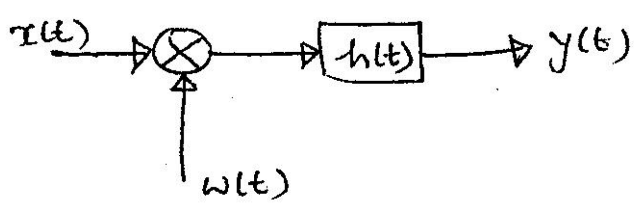

Fig 6(a)

(b) Find both the DTFS and DTFT representation for the periodic signal. (10 Marks)

$$x(n) = 2cos(\frac{3\pi n}{8} + \frac{\pi}{3}) + 4sin(\frac{\pi}{2}n)$$

7. (a) Specify the properties of ROC (4 Marks)

(b) Determine the Z-transform of the following signals.

(10 Marks)

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(10 Marks)

(10 Marks)

using the

(10 Marks)

(5 Marks)

i) $x(n) = \alpha^{|n|}$

ii) $x(n) = n(\frac{1}{3})^{n+3}u(n+3)$

iii) $x(n) = n(\frac{1}{2})^{n}u(n) * (\delta(n) - \frac{1}{2}\delta(n-1))$ (4+6+6=16 Marks)

8. (a) A casual stable discrete time system is defined by

$y(n) = \frac{5}{6}y(n-1) - \frac{1}{6}y(n-2) + x(n) - 2x(n-1)$. Determine:

i) System function H(Z) and magnitude response at zero frequency.

ii) Impulse response of the system.

iii) output $y(n)$ for $x(n) = (\delta(n) - \frac{1}{3}\delta(n-1))$ (12 Marks)

(b) State and prove differentiation property of Z-transform. Determine the signal $x(n)$, given. (8 Marks)

$$X(Z) = \frac{\frac{5}{2}}{(1-\frac{1}{2}Z^{-1})\,(1+\frac{1}{3}Z^{-1})} \qquad |Z| > \frac{1}{2}.$$

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