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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Third Semester, B.E. - Electronic and Communication Engineering

Semester End Examination; Dec. - 2014

Fundamentals of Signals

Time: 3 hrs *Max. Marks: 100*

***Note** : i) Answer **FIVE** full questions, selecting **ONE** full question from each Unit.*
ii) Assume suitable missing data if any.

Unit - I

1 a. Define a signal, and explain the classification of signals. 8

b. Sketch the following signals. (i) u(n+2)-u(n-3) (ii) u(-n+2). u(n) 6

c. Find whether the following signals are periodic or not. 6

(i) x(t)= 2 cos (10t+1) -sin(4t-1) (ii) x(t) =cos 60πt + sin50πt.

2 a. Find the even and odd components of the following signals 6

(i) x(t)=cos t + sin t+ cost t sin t. (ii) $x(n)=\{-2,1,\underset{\uparrow}{2},-1,3\}$

b. Check whether following systems are static or dynamic, linear or non-linear, casual or non casual, time invariant or time variant. 10

(i) *y(n)= x(n) x(n-1)* (ii) *y(n) = cos{x(n)}* (iii) $y(n)=\log_{10}|x(n)|$ (iv) *y(n) = x(n)u(n)*

c. Find the overall operator of a system whose output signal y(n) is given as 4

$y(n)=\frac{1}{3}(x(n)+x(n-1)+x(n-2))$ and draw the block diagram representation.

Unit - II

3 a. An LT1 system has impulse response $h(n)=\begin{cases}1, & n=\pm1\\ 2, & n=0\\ 0 & otherwise\end{cases}$

Determine the output of this system in response to the input $x(n)=\begin{cases}2, & n=0\\ 3, & n=1\\ -2, & n=2\\ 0, & otherwise\end{cases}$ 10

b. Determine the step response of the system described by difference equation. 5

y(n) + 4y(n-1) + 4y(n-2) = x(n)

c. Determine the convolution sum of two sequences 5

$x(n)=\{1,\underset{\uparrow}{4},3,2\}$

$h(n)=\{\underset{\uparrow}{1},3,2,1\}$

Contd... 2

4 a. Test if the following systems are stable or not (i) $y(n) = \cos x(n)$ (ii) $y(n) = \sum_{k=-\infty}^{n+1} x(k)$ 8

b. Find the convolution of the following signals

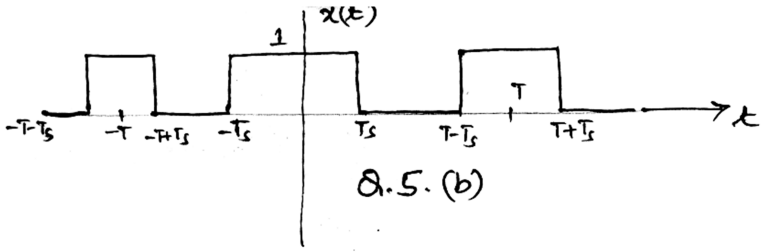
(i) $x(n) = Cos\pi n\, u(n), h(n) = \left(\frac{1}{2}\right)^n u(n)$ (ii) $x(n) = \left(\frac{1}{3}\right)^{-n} u(-n-1),\ h(n) = u(n-1)$ 12

(iii) $x(n) = \left(\frac{1}{2}\right)^n u(n);\ h(n) = u(n) - u(n-10)$

Unit - III

5 a. Find the DTFS representation for $x(n) = \cos\left(\pi/8\, n + \phi\right)$ and draw its magnitude and phase response. 8

b. Determine the Fourier series representation for the square wave depicted in Fig. below.



Q.5. (b) 12

6 a. Find the Fourier transform of x(t) given below and its magnitude and phase spectrum

$$x(t) = \begin{cases} 1, & -T \le t \le T \\ 0 & |t| > T \end{cases}$$

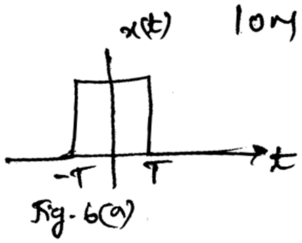


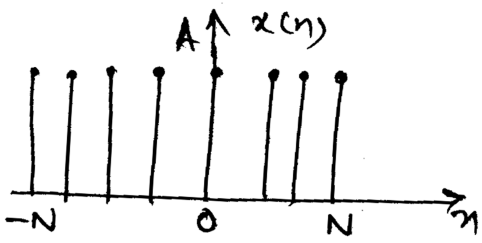
Fig. 6(a) 10

b. Explain any two properties of Fourier transform 6

c. Find the Fourier transform of $x(t) = 1 - e^{-|t|}\cos\Omega_0 t$ 4

Unit - IV

7 a. Find the DTFT of a rectangular pulse given below and draw its magnitude Response.



6

b. Explain the following properties of DTFT
(i) Convolution property (ii) Frequency shifting property (iii) Parseval's theorem. 10

c. State and explain sampling theorem. 4

8 a Find the DTFT of the following : 6
(i) x(n) = {1,-1,2,2} (ii) $x(n) = 2^n u(n)$ (iii) $x(n) = (0.5)^n u(n) + 2^{-n} u(-n-1)$

b. Determine the Nyquist sampling rate and Nyquist sampling intervals for the following Signals. 6
(i) *Sin* $c^2(200\pi t)$ (ii) *Sin* $c(200\pi t)+3sinc^2(120\pi t)$ (iii) *Sin* $c(100\pi t)$ *sinc*$(200\pi t)$

c. Explain the Basic Discrete time signal processing system.. 8

Unit - V

9 a Prove the following properties of Z-transform mentioning ROC. 6
(i) Time shifting property
(ii) Differentiation in the Z domain.

b. Identify the ROC associated with the Z-transforms for each of the following signals 6

$$x(n)=\left(-\frac{1}{2}\right)^n u(-n)+2\left(\frac{1}{4}\right)^n u(n)$$

$$y(n)=\left(-\frac{1}{2}\right)^n u(n)+2\left(\frac{1}{4}\right)^n u(n)$$

$$w(n)=\left(-\frac{1}{2}\right)^n u(-n)+2\left(\frac{1}{4}\right)^n u(-n)$$

c. Find the Z-transform of the signal $x(n)=\left[n\left(-\frac{1}{2}\right)^n u(n)\right]*\left(\frac{1}{4}\right)^{-n} u(-n)$ 8

10 a. Find the Inverse Z-transforms of $x(z)=\frac{z^3-10z^2-4z+4}{2z^2-2z-4}$ *with ROC* $|z|<1$ 8

b. Consider the system described by the difference equation
$y(n)-0.9y(n-1)=x(n)$.Find the output if the input is $x(n)=u(n)$ and the initial condition on the output is $y(-1)=2$ 6

c. A system has the transfer function
$$H(z)=\frac{2}{1-0.9e^{j\pi/4}z^{-1}}+\frac{2}{1-0.9e^{-j\pi/4}z^{-1}}+\frac{3}{1+2z^{-1}}$$ 6
Find the impulse response assuming the system is
(i) stable (ii) Causal (iii) Can this system be stable and casual?

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