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

(An Autonomous Institution affiliated to VTU, Belgaum)

Fourth Semester, B.E.- Electronics and Communication Engineering

Semester End Examination; June/July - 2015

Fundamentals of Signals

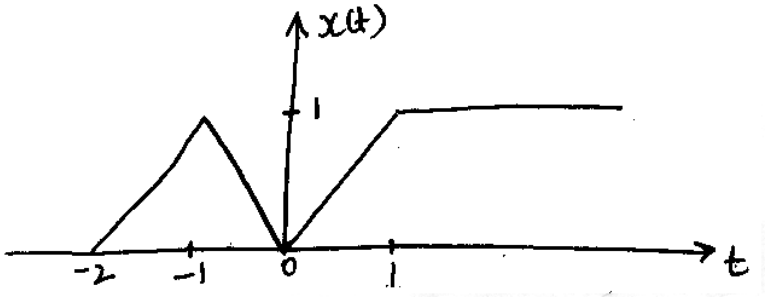
Time: 3 hrs *Max. Marks: 100*

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

UNIT - I

1. a. Mention the classification of signals and explain each with an example. 8

b. Find the Even and Odd part of the signal. 6



c. Determine whether the following signals are periodic or non-periodic. If periodic, find the fundamental period.

(i) $x(t) = \sum_{n=-\infty}^{\infty} e^{-(t-3n)^2}$ 6

(ii) $x(n) = \cos\left(\frac{n\pi}{7}\right) \sin\left(\frac{n\pi}{3}\right)$

(iii) $x(n) = \cos n\,\pi\left[u(n+4) - u(n-5)\right]$

2 a. Show that the product of two even signals or two odd signals is an even signal, while the product of even and odd signal is an odd signal. 6

Determine whether the system is stable, casual, linear time invariant and memory less.

b. (i) $y(t) = \frac{dx(t)}{dt}$ (ii) $y(t) = x(2-t)$ 8

c. Find the energy or power whichever is appropriate for the following signals

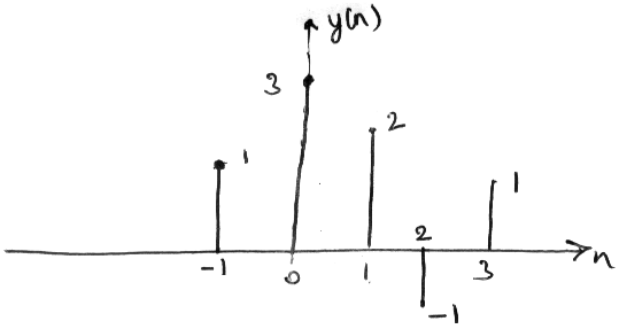
(i) $x(t) = tu(t)$ (ii) $x(n) = e^{j\left(\frac{\pi n}{2} + \frac{\pi}{6}\right)}$ (iii) $x(n) = \left(1/3\right)^n u[n]$ 6

Contd…2

UNIT – II

3 a. Compute the convolution of two sequences $x_1(n)$ and $x_2(n)$ where $x_1(n)=\left(\underset{\Uparrow}{1},2,3\right)$ and $x_2(n)=\left(1,2,\underset{\Uparrow}{3},4\right)$. 5

b. A discrete time LTI system has impulse response $h(n)$ as shown in the figure. Using linearity and time invariance, determine the system output $y[n]$ If the output $x[n]$is $x[n]=u(n)-u(n-3)$ 5



c. Consider an Input and unit Impulse response is given by

(i) $y(n)=u(n)*u(n-3)$ (ii) $y(t)=u(t+1)*u(t-2)$ Evaluate and plot the output signal. 10

4. a. For a discrete LTI system Input and output are related by $y(n)=x(n+1)+5x(n)-7x(n-1)+4x(n-2)$. Find Impulse response of the system and comment on stability, casuality and memory of the system. 8

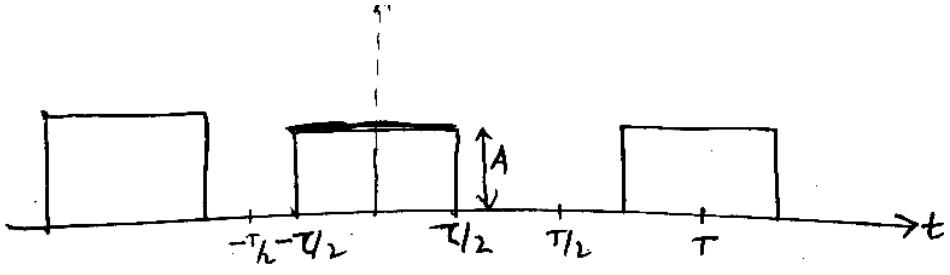
b. For the given difference equation draw DF-I and DF-II structure.

$2y(n)+y(n-1)+\frac{1}{8}y(n-2)=\frac{1}{2}x(n-2)$ 6

c. Find the step response for the following: (i) $h(n)+\left(\frac{1}{2}\right)^n u(n)$ (ii) $h(t)=e^{-|t|}$ 6

UNIT - III

5. a. Determine the Fourier series representation of the waveform shown below.



10

b. State and prove the properties of Fourier series:

(i) Linearity (ii) Convolution (iii) Time shift 10

Contd…3

6. a. State and prove the convolution and modulation properties of Fourier transform. 10

b. Find the Fourier transform of the following signals. 10

(i) $x(t)=e^{-t-1}u(t)$ (ii) $x(t)=e^{-t-j\pi t}u(t)$

UNIT - IV

7 a. State and prove the Parseval's and differentiation property of DTFT. 10

b. Given that $x(n)=\left(1,2,\underset{\uparrow}{3},2,1\right)$ and that $x(n)\overset{DTFT}{\longleftrightarrow}X\left(e^{jw}\right)$ determine the following without calculating $x\left(e^{jw}\right)$ 10

(i) $x\left(e^{j0}\right)$ (ii) $\underline{\left|x\left(e^{jw}\right)\right.}$ (iii) $x\left(e^{j\pi}\right)$

(iv) $\int_{-\pi}^{\pi} x\left(e^{jw}\right)dw$ (v) $\int_{-\pi}^{\pi}\left|x\left(e^{jw}\right)\right|^2 dw$

8 a. State and prove sampling theorem. Define aliasing distortion. 10

b. Compute the DTFT of $x(n)=a^n\cos\omega_0 nu(n);|a|<1$ 5

c. Compare the continuous time Fourier transform and discrete time Fourier transform. 5

UNIT - V

9. a. State and prove time shifting and convolution properties of Z-transform. 8

b. Find the Z-transform for the following sequence, sketch it's ROC: 6

(i) $x(n)=\alpha^{|n|}$ (ii) $x(n)=(n+1)\left(1/2\right)^n u(n+1)$

c. Find the Inverse Z-transform for, $x(z)=\dfrac{z\left(z^2-4z+5\right)}{(z-3)(z-1)(z-2)}$ 6

(i) $2<|z|<3$ (ii) $|z|>3$

10 a. Solve the difference equation using unilateral Z-transform. $y(n+2)+3y(n+1)+2y(n)=0$ with $y(0)=0;\ \ y(1)=1$ 5

b. A stable system described by difference equation; 10

$$y(n)-y(n-1)+\frac{1}{4}y(n-2)=x(n)+\frac{1}{4}x(n-1)-\frac{1}{8}x(n-2)$$

Determine : (i) Impulse response of the system (ii) If $y(n)=\left(\frac{1}{4}\right)^n u(n)+\left(-\frac{1}{2}\right)^n u(n)$

c. If $h(n)=\left(\frac{1}{3}\right)^n u(n)+\left(\frac{1}{2}\right)^{n-2}u(n-1)$. Determine the transfer function and difference equation. 5

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