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

(An Autonomous Institution affiliated to VTU, Belagavi)

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

Semester End Examination; June - 2017

Signals and Systems

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. Give proof of the statement "the sum of two odd functions is odd". 4

b. Determine mathematically if the signal $x(t)=\sin\left(3t-\frac{\pi}{2}\right)$ is even, odd or neither. Sketch the waveform to verify the result. 4

c. For the signal $x(t)$ of Fig. Q 1(c) plot $-2x(2t)+2$

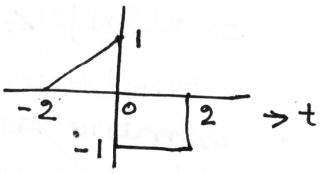

Fig Q 1(c) 4

d. Determine the power and energy of
i) $x(t)=e^{-2t}u(t)$
ii) $x[n]=\cos\frac{\pi}{4}n$ 8

2 a. Determine whether the system described by $y(t)=\cos\left[x(t-1)\right]$ is

i) Memory less ii) Invertible iii) Causal
iv) Stable v) Time invariant vi) Linear. Justify. 10

b. Determine whether the system described by $y[n]=x\left[n^2\right]$ is

i) Memory less ii) Invertible iii) Causal
iv) Stable v) Time invariant vi) Linear. Justify. 10

UNIT - II

3 a. Perform the convolution of the following signals by graphical method

$x_1(t)*x_2(t)=y(t)$

$x_1(t)$ and $x_2(t)$ are shown in Fig. Q 3 (a).

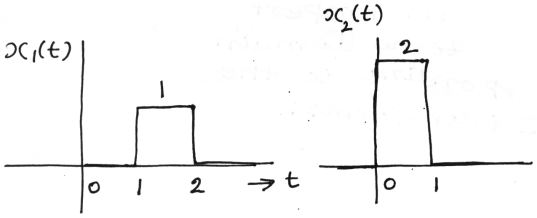

Fig Q 3 a) 10

Contd...2

b. Determine the output of LTI system whose input and unit sample response are given as follows $x(n)=b^n u(n)$ $h(n)=a^n u(n)$ 10

4 a. Evaluate the continuous time convolution integral given below $x(t)=e^{-2t}$, $h(t)=u(t+2)$ 10

b. Given:

$x_1[n]=\delta[n-1]+\delta[n]+\delta[n+2]$

$x_2[n]=\delta[n-2]+\delta[n]$

find $x_1[n]*x_2[n]$ 10

UNIT - III

5 a. Determine the forced response and natural response for the system described by the difference equation given input.

$y[n]-\frac{2}{5}y[n-1]=2x[n]$

$x[n]=2u[n]$ where $x[n]$ is input 10

b. Draw the direct form - I and direct form - II for the difference equation $y[n]-\frac{1}{2}y[n-1]=2x[n]$. Where $y[n]$ is output and $x[n]$ is input. 10

6. a Consider the Fourier series for the periodic function:

$x(t)=\sin 4t+\cos 8t+7$. Find the Fourier coefficients of the exponential form for the signal. 5

b. Determine the exponential form of Fourier series for the periodic waveform shown in Fig. Q 6(b) and plot magnitude and phase spectra.

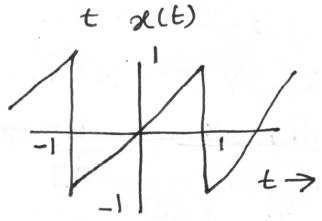

Fig Q 6 b) 10

c. What are the conditions to be satisfied for the Fourier representation of a signal? 5

UNIT - IV

7 a. State and prove linearity, time shifting and symmetry properties of DTFT. 10

b. Use partial fraction expansion and linearity to determine the inverse Fourier transform given,

$$X(jw)=\frac{5jw+12}{(jw)^2+5jw+6}$$ 5

c. Use the table of transforms and properties to find the inverse FTS of the signal,

$$X(jw)=\frac{jw}{(2+jw)^2}$$ 5

Contd…3

8 a. Find the Fourier transform of the sequence $x[n] = a^{+n}u[-n-1], |a| > 1$. 5

b. Find the inverse DTFT of, 5

$$x(\Omega) = \frac{3 - \frac{5}{4}e^{-j\Omega}}{\frac{1}{8}e^{-j2\Omega} - \frac{3}{4}e^{-j\Omega} + 1}$$

c. Find the FT of the function:

i) $\frac{d}{dt}g(t)$ ii) $\frac{1}{2\pi(t^2+1)}$ iii) $\frac{4\cos(2t)}{t^2+1}$ 10

Given the $FT\ G(jw) = \frac{2}{w^2+1}$ for $g(t) = e^{-|t|}$

UNIT - V

9 a. Determine the constraint on $|z|$ for the sum given by $\sum_{n=1}^{\infty}\left(\frac{1}{2}\right)^{-n+1} z^n$ to coverage. 5

b. Consider the signal, $x[n] = \left(\frac{1}{5}\right)^n u[n-3]$ Evaluate the Z transform of this signal and specify the corresponding ROC (region of convergence). 5

c. Given the following five facts about a discrete time signal x[n] with z transform X(z) :

(i) X[n] is real and right sided (ii) X(z) has exactly two poles

(iii) X(z) has two zeros at the origin (iv) X(z) has a pole at $z = \frac{1}{2}e^{j\pi/3}$ 10

(v) $X(1) = 8/3$

Determine X(z) and specify its ROC.

10 a. State and prove; i) Time shifting ii) Time reversal. 5

b. Use the method of partial fractions to obtain the time- domain signal corresponding to Z-transforms : 5

$$X(z) = \frac{8z^2 + 4z}{4z^2 - 4z + 1}, |z| > 1/2$$

c. A causal discrete time LII system is described by

$$y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = 2x(n)$$ 10

(i) Determine system function H(z)

(ii) Find Impulse response h(n).

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