U.S.N

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 $-2x(2t)+2$ 4

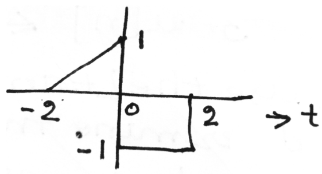

Fig Q 1 c)

d. Determine the power and energy of 8

i) $x(t) = e^{-2t}u(t)$

ii) $x[n] = \cos\frac{\pi}{4}n$

2 a. Determine whether the system described by $y(t) = \cos\left[x(t-1)\right]$ is 10

i) Memory less ii) Invertible iii) Causal

iv) Stable v) Time invariant vi) Linear. Justify.

b. Determine whether the system described by $y[n] = x\left[n^2\right]$ is 10

i) Memory less ii) Invertible iii) Causal

iv) Stable v) Time invariant vi) Linear. Justify.

UNIT - II

3 a. Perform the convolution of the following signals by graphical method 10

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

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

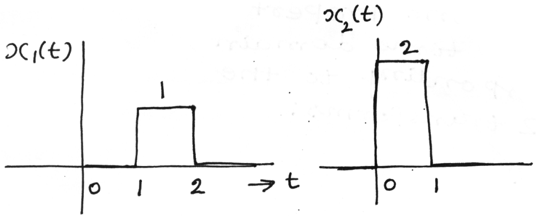

Fig Q 3 a)

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 : 10

$$x_1[n] = \delta[n-1] + \delta[n] + \delta[n+2]$$
$$x_2[n] = \delta[n-2] + \delta[n]$$
find $x_1[n] * x_2[n]$

UNIT - III

5 a. Determine the forced response and natural response for the system described by the difference equation given input. 10

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

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

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

6. a Consider the Fourier series for the periodic function: 5

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

b. Determine the exponential form of Fourier series for the periodic waveform shown in Fig. Q 6(b) and plot magnitude and phase spectra. 10

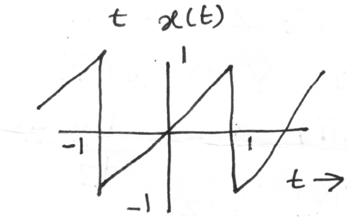

Fig Q 6 b)

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, 5

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

c. Use the table of transforms and properties to find the inverse FTS of the signal, 5

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

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,

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

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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