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EGS-187

B.E. 6th Semester (CGPA) Elect. and Commun. Engg. (Zero Sem.) Examination - 2018

DIGITAL SIGNAL PROCESSING

Paper–EL–603

Time : 3 Hours] [Maximum Marks : 60

Note : Attempt all questions.

1. (a) Test, whether the system is linear or not. 4

$y[n] = x[n] \cos(w_o n)$

(b) Determine the range of value of a and b for which the L.T.I. system with impulse response.

$$h[n] = \begin{cases} a^n, & n \geq 0 \\ b^n, & n < 0 \end{cases}$$ is stable 6

or

(a) The discrete time system $y[n] = ny[n-1] + x[n]$, $n \geq 0$ is at rest [i.e. $y(-1) = 0$]

Test whether the system is L.T.I. 4

(b) Derive the equation for convolution sum as applicable to discrete time L.T.I. systems. 6

2. (a) Find the z-transform of the following: 4

(i) n^2e^{-2n} (ii) $na^nu(n)$

(b) Prove the properties of time-shifting and time reversing as applicable to z-transform. 6

or

(a) Determine inverse z-transform of 4

$$x[z] = \frac{z}{3z^2 - 4z + 1}$$

(b) Find the z-transform using residue method of the signal: 6

$$x[z] = \frac{1}{(z-1)(z-3)}$$

3. (a) Compare direct form I and direct form II realisation of IIR system. 4

(b) Draw the block diagram representation of the direct form I and II realisation of the system with the following transfer function: 6

$$H[z] = \frac{z^{-1} - 3z^{-2}}{(10 - z^{-1})(1 + 0.5z^{-1} + 0.5z^{-2})}$$

or

(a) Develop a canonic direct form reaslisation of the transfer function.

$$H[z] = \frac{3 + 5z^{-1} - 8z^{-2} + 4z^{-5}}{2 + 3z^{-1} + 6z^{-3}}$$

and determine its transpose configuration. 6

(b) Explain block diagram representation of recursive and non-recursive systems. 4

4. (a) Prove that the multiplication of two DET's is equivalent to the circular convolution of their sequences in time domain. 4

(b) State and prove the following properties of DFT: 6

(i) Even and odd properties

(ii) Circular frequency shift

or

(a) How DFT can be used to perform high speed convolution? Explain giving example. 4

(b) Compute the DFT of the following finite length sequence of length N, (N is even) 6

$$x[n]=\begin{cases}1, & 0\le n\le \frac{N}{2}-1\\ 0, & \frac{N}{2}\le n\le N-1\end{cases}$$

5. (a) What are the desirable and undesirable features of FIR filters? 4

(b) Convert the analog filter into a digital filter whose system function is 6

$$H(S)=\frac{S+0.2}{(S+0.2)^2+9}$$

or

(a) Explain window technique for designing FIR digital filter. 4

(d) Convert the analog filter with system function $H(S) = \frac{S+0.1}{(S+0.1)^2+9}$ into a digital IIR filter using Bilinear transformation (w_r should be $\frac{\pi}{4}$) 6

6. (a) Discuss Bilinear transformation method for designing digital filters. 4

(b) Compute DFT of the sequence $x(n) = \cos\frac{n\pi}{2}$ where $N=4$ using DIF FFT algorithm. 6

or

(a) Why filtering is required in DSP. 4

(b) Determine H (z) using impulse invariant technique for the analog system function. 6

$$H(S) = \frac{1}{(s+0.5)(s^2+0.5s+2)}$$