

II Semester M.E. (Control and Instrumentation) Degree Examination, January 2013 2K8 CI 211: DIGITAL SIGNAL PROCESSING AND APPLICATION

Tim	ie:	3 Hours Max. Marks : 1	100
	I	nstruction: Answer any five full questions.	
1.	a)	Show that unit impulse response h(n) of an LTI system can be used to evaluate the following: i) Input-output relation. ii) Frequency response of the system, and	
		iii) Stability.	9
	b)	Using concept of orthogonality, explain how the signals are represented orthogonally. Explain with an example.	11
2.	a)	Find the impulse response of an LTI system, in closed form, if the system function is given by $H(z) = Log_e (1+az^{-1}), z > a$.	10
	b)	Determine the cross-correlation of sequence of $r_{x_1x_2}$ (I) the sequences : $x_1(n) = \{ 1 \ 2 \ 3 \ 4 \}$ $x_2(n) = \{ 4, \ 3 \ 2 \ 1 \}.$	
		$x_2(n) = \{4, 3 2 1\}.$	6
	c)	State any four properties of z-transform.	4
3.	a)	Prove that the sampling of Fourier transform of a sequence $x(n)$ results in N-point DFT, using which both the sequence and the transform can be reconstructed.	10
	b)	State and prove the following properties of DFT: i) Frequency shift. ii) Convolution in time domain. iii) Linearity.	10
4.	a)	Explain symmetric properties of DFT.	10
	b)	Using DFT properties which relates Linear convolution to circular convolution,	

obtain the output of a linear filter given the impulse response $h(n) = \{1, 1, 1\}$

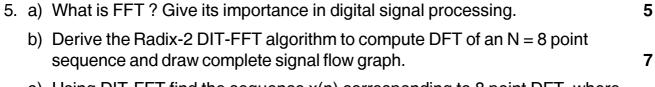
10

P.T.O.

and input to be a long sequence

 $x(n) = \{1, 2, 0, -3, 4, 2, -1, 1, -2, 3, 2, 1, -3\}.$

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c) Using DIT-FFT find the sequence x(n) corresponding to 8 point DFT, where X(K) is given by $X(K) = \{4, 1-j2.414, 0, 1-j0.414, 0, 1+j0.414, 0, 1+j2.414\}$

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- 6. a) Show that DFT can be used to evaluate the convolution of finite duration sequence $x_1(n)$ and $x_2(n)$ of length N_1 and N_2 respectively.
 - b) How can one design digital filters from analog filters?c) Design a digital Butterworth filter H(z) given an equivalent analog filter with

 c) Design a digital Butterworth filter H(z) given an equivalent analog filter with the following specifications:

Pass Band Ripple ≤ 3dB

Stop Band Edge Frequency 750 Hz

Stop Band Attenuation of 15 dB

Pass Band Edge frequency 500 Hz and Sampling rate is 2 kHz.

Design using Bilinear transformation.

- a) Explain the frequency sampling design of FIR filters and realize it in DF structure.
 - b) Write short notes on "Spectral estimation".
 - c) The desired frequency response of LPF if

$$\begin{aligned} H_{d}\left(e^{j\omega}\right) &= e^{-j3\omega} & \frac{-3\pi}{4} \leq \omega \leq \frac{3\pi}{4} \\ &= 0 & \frac{-3\pi}{4} \leq |\omega| \leq \pi \end{aligned}$$

Design using Hamming window M = 7.