Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII • EXAMINATION – WINTER 2013

Subject Code: 171003 **Date: 07-12-2013**

Subject Name: Digital Signal Processing

Time: 10:30 TO 01:00 **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	State and explain the conditions followed by all LTI (Linear Time Invariant) systems in general giving one example each of LTI and non-LTI systems.	**07**
	(b)	Define impulse response of LTI system. Explain how from the impulse response the frequency response of the LTI system can be determined.	**07**
Q.2	**(a)**	Derive the criterion for sampling a continuous time signal, using Fourier Transform. Also explain the aliasing effect where the criterion is not followed.	**07**
	(b)	Prove that convergence of absolute sum of the impulse response is a sufficient condition for BIBO (bounded input bounded output) stability of a LTI system. Show that this condition is also the necessary condition for BIBO stability.	**07**
		OR	
	(b)	Define ACF (Auto-Correlation Function) of a sequence, explain ACF's main properties and relation with the PSD (Power Spectral Density) of the sequence.	**07**
Q.3	**(a)**	Determine the difference equation and the impulse response of a system with the z-transform, $H(z)=1/(1-0.5z^{-1})$, ROC:$0.5< \|z\|$.	**07**
	(b)	Realize in Direct Form-II: $H(z)=(1+0.7z^{-1}+0.3z^{-2})/(1-0.2z^{-1})$, ROC:$0.2< \|z\|$.	**07**
		OR	
Q.3	**(a)**	Given two sequences x1[n]={1, 1}, and x2[n]={1, 2, 1}, find their z-transforms and sketch their corresponding pole-zero plots and try to relate them.	**07**
	(b)	Derive an inverse system of the system characterized by y[n]=0.5*y[n-1]+x[n], assuming zero initial conditions.	**07**
Q.4	**(a)**	Give the equations for DTFT and inverse DTFT and show that DTFT is a lossless (distortion-free) transform.	**07**
	(b)	Derive and sketch the DTFT of $x[n]= 5\cos (0.1\pi n) + 2\cos(0.2\pi n)$, over the radian-frequency interval $(-3\pi, 3\pi)$.	**07**
		OR	
Q.4	**(a)**	Explain the poly-phase decomposition of a system.	**07**
	(b)	Explain the minimum-phase and all-pass decomposition of a system.	**07**
Q.5	**(a)**	Draw a signal flow graph representation of the DIT (Decimation-In-Time) FFT (Fast Fourier Transform) method for finding 8-point DFT.	**07**
	(b)	Derive the impulse response of an ideal LPF (low pass filter) with cut-off frequency of ω_c (rad), based on the inverse DTFT. Explain the windowing method for designing an FIR filter.	**07**
		OR	
Q.5	**(a)**	Explain the impulse invariance and bilinear transform based methods for designing an IIR filter.	**07**
	(b)	Explain the procedure to design a Butter-worth low-pass filter assuming that suitable specifications are given.	**07**

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