Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – SUMMER 2024

Subject Code:3171003 Date:17-05-2024

Subject Name:Digital Signal Processing

Time:02:30 PM TO 05:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Prove that Accumulator is an unstable system.	**03**
	(b)	Describe properties of ROC for ZT.	**04**
	(c)	Define linear convolution and obtain the same for sequences: **x[n] = δ[n] + 2*δ[n-1] + 3*δ[n-2] + δ[n-3]** & **h[n]= δ[n+1] + 2*δ[n]+ 2*δ[n-1] - δ[n-2].**	**07**
Q.2	**(a)**	State and prove time shifting property of ZT.	**03**
	(b)	Find the impulse response of a stable LTI system represented by the difference equation $\mathbf{y(n) - \frac{1}{2}y(n-1) = x(n) - \frac{1}{4}x(n-1)}$, using DTFT.	**04**
	(c)	If ZT is given as **X(z)** = $\frac{1-\frac{1}{2}z^{-1}}{1+\frac{3}{4}z^{-1}+\frac{1}{8}z^{-2}}$, $\mathbf{\lvert Z\rvert > 1/2}$**,** then determine the sequence x(n).	**07**
		OR	
	(c)	Obtain the particular solution of the difference equation **y(n) = (5/6) y(n-1) - (1/6) y(n-2) + x(n)** with input **$x(n)=2^n$, n≥0** and zero elsewhere.	**07**
Q.3	**(a)**	If a system has **H(z)** = $\frac{(1-0.5z^{-1})}{(1-0.9z^{-1})}$, $\mathbf{\lvert z\rvert \geq 0.9}$**,** then find its inverse system, draw its ROC and check stability of this inverse system.	**03**
	(b)	If a causal LTI system has **H(z)** =$\mathbf{1 - \frac{1}{3}z^{-1} + \frac{1}{6}z^{-2} + z^{-3}}$, then obtain SFG and its transposed SFG of its direct form realization.	**04**
	(c)	Define minimum phase system and obtain minimum phase-all pass decomposition for the system with **H(z) =** $\frac{(1+3z^{-1})}{(1+0.5z^{-1})}$	**07**
		OR	
Q.3	**(a)**	A system function is **H(z)** = $\frac{1}{(1-0.5z^{-1})}$, with ROC $\mathbf{\lvert z\rvert \geq 0.5}$**,** then obtain corresponding difference equation and impulse response.	**03**
	(b)	Discuss types of linear phase FIR systems.	**04**
	(c)	Define all pass system and obtain minimum phase-all pass decomposition for the system with **H(z) =** $\frac{(1-2z^{-1})}{(1+0.3z^{-1})}$	**07**
Q.4	**(a)**	Give advantages and disadvantages of Digital filters.	**03**
	(b)	Compute 4 point DFT of a sequence **x[n] = 1/3*δ[n] +1/3*δ[n-1] + 1/3*δ[n-2].**	**04**

	(c)	If $\mathbf{H(z) = \frac{1+2z^{-1}+z^{-2}}{1-0.75z^{-1}+0.125z^{-2}}}$, then obtain direct form-I and II realizations.	**07**

OR

Q.4	**(a)**	Give comparison of Analog and Digital filters.	**03**
	(b)	Compute 4 point DFT of a sequence $\mathbf{x[n]=2^n\ ,\ 0 \le n \le 3.}$	**04**
	(c)	Discuss structures for linear phase FIR systems.	**07**

Q.5	**(a)**	Give advantages and dis-advantages of FIR filters over IIR filters.	**03**
	(b)	Explain Impulse Invariance method for IIR Fiter design.	**04**
	(c)	Explain signal flow graph of the decimation in time decomposition of an N point DFT computation into two N/2 point computation if N=8.	**07**

OR

Q.5	**(a)**	Explain frequency warping and Pre-warping regarding filter design.	**03**
	(b)	Discuss Kaiser Window method for FIR Fiter design.	**04**
	(c)	How FFT is more efficient than DFT? Discuss Goertzel Algorithm for direct computation of selected values of DFT.	**07**

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