Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – SUMMER 2022

Subject Code:3171003 Date:16/06/2022

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)**	Define the given terms for digital signal processing. (1) static system (2) stable system (3) inverse system	**03**
	(b)	Give the necessary condition for impulse response h(n) of a system to be causal and stable.	**04**
	(c)	Consider a system with impulse response h(n) = {1,2,1,-1} and input signal x(n) = {1,2,3,1}. Find the output signal y(n).Consider first samples of x(n) and h(n) as n=0.	**07**
Q.2	**(a)**	Find cross-correlation of x(n)={1,2,3} and y(n)={3,2,1} . Consider first samples of x(n) and y(n) as n=0.	**03**
	(b)	Prove time shifting property of Z-Transform with an example.	**04**
	(c)	Explain and prove how Z-transforms help for linear convolution of any two sequences.	**07**
		OR	
	(c)	Draw direct form-II structure for the LTI system given by $y(n) = -\frac{3}{8}y(n-1) + \frac{3}{32}y(n-2) + \frac{1}{64}y(n-3) + x(n) + 3x(n-1) + 2x(n-2)$	**07**
Q.3	**(a)**	Compare DTFT and DFT.	**03**
	(b)	Find Z-transform of sequence given by $x(n) = na^n u(n)$	**04**
	(c)	Find inverse Z-transform of following with ROC is 0.2<|z|<0.6. $X(z) = \frac{1}{1 - 0.8z^{-1} + 0.12z^{-2}}$	**07**
		OR	
Q.3	**(a)**	List and explain any three properties of ROC in context of Z-transform.	**03**
	(b)	Differentiate between linear and circular convolution.	**04**
	(c)	Find circular convolution of given sequences. x(n)={1,-1,-2,3,-1} and p(n)={1,2,3}	**07**
Q.4	**(a)**	Explain in brief minimum phase system.	**03**
	(b)	List various steps for designing FIR filter using windowing techniques.	**04**
	(c)	Realize the cascaded system for given difference expression	**07**

$$y(n) = \frac{3}{4}y(n-1) - \frac{1}{8}y(n-2) + x(n) + \frac{1}{3}x(n-1)$$

OR

Q.4 **(a)** Compare FIR and IIR systems. **03**

(b) Discuss advantages of digital filter over analog filter. **04**

(c) For H(s) as given below, find the H(z) with use of impulse invariance method. Take sampling frequency as 5samples/sec. **07**

$H(s) = \frac{1}{(s-1)(s+2)}$

Q.5 **(a)** Prove periodicity property of DFT. **03**

(b) Explain transpose form of structure with necessary diagram. **04**

(c) Draw and explain Radix-2 FFT DIT algorithm with neat diagram. **07**

OR

Q.5 **(a)** Calculate numbers of complex addition and multiplication required when computing 1024 point DFT using direct method. Also do the same if radix -2 FFT is used. **03**

(b) Discuss effect of co-efficient quantization. **04**

(c) Why frequency domain sampling is required? What should be the relation between number of samples (L) of a discrete time signal x(n) and its frequency domain samples (N)? Discuss all case when $L \geq N$, $L=N$ and $N \geq L$. **07**

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