Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII(NEW) EXAMINATION – SUMMER 2019

Subject Code:2171708 Date:14/05/2019

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.**

			MARKS
Q.1	**(a)**	Compare merits and demerits of DSP over ASP.	**03**
	(b)	Draw the direct form-I and form-II for the system described by difference equation $Y(n) - 3Y(n-1) + 4\,Y(n-2) = x(n) + 2\,x(n-1)$	**04**
	(c)	Discuss the time domain behavior of causal systems depending upon pole location in z domain.	**07**
Q.2	**(a)**	Calculate the power for complex exponential signal $x(n) = a * e^{jwn}$	**03**
	(b)	Check the system $y(n) = n * x(n)$ for 1. Static- Dynamic 2. Linear- Nonlinear 3. Time Variant- Time Invariant 4. Causal- Anticausal	**04**
	(c)	Determine the response y(n), $n \geq 0$, the system described by the second order difference equation $y(n) - 3\,y(n-1) - 4\,y(n-2) = x(n) + 2\,x(n-1)$ for $x(n) = 4^n * u(n)$ input sequence.	**07**
		OR	
	(c)	Determine the linear convolution for the LTI system $h(n) = \{\underline{1},2,1,-1\}$ and input signal $x(n) = \{1,\underline{2},3\ 1\}$	**07**
Q.3	**(a)**	Derive the Z transform for $X(n) = \cos(wn) * u(n)$	**03**
	(b)	State and prove time scaling and time reversal properties of z transform.	**04**
	(c)	Obtain x(n) from $X(z) = \frac{(1 + 3z^{-1} + \frac{11}{6}z^{-2} + 1/3\ z^{-3})}{(1 + \frac{5}{6}z^{-1} + \frac{1}{6}z^{-2})}$	**07**
		OR	
Q.3	**(a)**	Derive the Z transform for $X(n) = n * u(n)$	**03**
	(b)	State and prove differentiation and initial value theorem properties of z transform.	**04**
	(c)	Determine the inverse z transform of $X(z) = \frac{1}{1 - 1.5\,z^{-1} + 0.5\,z^{-2}}$ for 1) ROC $\lvert z\rvert > 1$ 2) ROC : $\lvert z\rvert < 0.5$ and 3) ROC : $0.5 < \lvert z\rvert < 1$	**07**
Q.4	**(a)**	Compute the Fourier transform and plot the magnitude spectra for $x(n) = u(n) - u(n-4)$	**03**

(b) Derive the symmetry properties for DTFT (Discrete Time Fourier Transform). **04**

(c) Consider the signal **07**

$X(n) = 2 + 2\cos\frac{\pi n}{4} + \cos\frac{\pi n}{2} + \frac{1}{2}\cos\frac{3\pi n}{4}$

1. Determine and sketch its power density spectrum
2. Evaluate the power of the signal

OR

Q.4 **(a)** Determine the signal having following Fourier transform x(w) = $\cos^2 w$. **03**

(b) Draw the energy density spectrum for $x(n) = a^n u(n)$ for **04**

1. a = (0.5)
2. a= (- 0.5)

(c) Determine magnitude and phase spectra of the following periodic signals **07**

1. $x(n) = \cos\frac{2\pi n}{3} + \sin\frac{2\pi n}{5}$
2. $x(n) = \cos\frac{2\pi n}{3} * \sin\frac{2\pi n}{5}$

Q.5 **(a)** Explain in brief about impulse invariance method for IIR filter design. **03**

(b) Obtain circular convolution of $x_1(n) = \{1,2,3,4\}$ $x_2(n) = \{2,1,2,1\}$ **04**

(c) Using decimation in time (DIT) radix-2 algorithm, compute 8 point DFT for the sequence x(n) = cos л n **07**

OR

Q.5 **(a)** Explain in brief about windowing method for FIR filter design. **03**

(b) Calculate 4 point DFT of x(n) = {2,1,2,1} **04**

(c) Using decimation in frequency (DIF) radix-2 algorithm, compute 8 point DFT for the sequence x(n) = cos л n **07**

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