Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V(New) • EXAMINATION – WINTER 2016

Subject Code:2150307 **Date:02/12/2016**

Subject Name:Digital Signal Processing

Time:10:30 AM to 01:00 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 **Select the most appropriate choice for the following:** **14**

1 Sampling a signal is equivalent to multiplying it with
(A)a sync function (B)a train of impulse
(C)a train of sync functions (D)a rectangular window

2 Aliasing occurs when a signal of bandwidth W is sampled with sampling frequency F
(A)greater than W (B)less than W
(C) greater than 2W (D) less than 2W

3 The typical maximum value of digital relative frequency is
(A)1/4 (B)1 (C)1/2 (D)1/3

4 The discrete time system is linear if
(A)it is homogeneous (B)it is additive
(C)it is additive or homogeneous (D)it is additive and homogeneous

5 The range of values of "a" for which the system with impulse response
$h(n)=a^n u(n)$ is stable is
(A) $|a| > 1$ (B) $|a| < 1$ (C) $|a| > 0$ (D) $|a| < 0$

6 Z transform reduces to Fourier transform when it is evaluated on
(A)a half circle (B)Z circle (C)unit circle
(D)imaginary circle

7 If the sequence x(n) is of finite duration then the ROC is the entire Z plane , except possibly
(A) $Z = 0$ (B) $Z = \infty$ (C) $Z = 0$ and /or $Z = \infty$ (D) $Z = 0$ and $Z = \infty$

8 A system is causal when the current output sample depends on
(A)current input sample (B)current or next and past input samples
(C)current and/or past input samples and/or past output samples
(D)next or past input samples or past output samples

9 The quantization noise can be reduced
(A)by increasing step size
(B)by reducing step size
(C)by reducing number of bits used for quantization
(D)none

10 The following realization minimizes the delay elements
(A)Direct form-I realization (B)Direct form-II realization
(C)Cascade form realization (D)Parallel structure realization

11 When a sequence is circularly shifted in time by 5 units, the magnitude response
(A)increases by 5 (B)remains unchanged
(C)remains constant (D)shifts by 5 units

12 Goertzel algorithm evaluates the
(A)DTFT coefficient (B)DFT coefficient
(C)Z transform coefficient (D) FT coefficient

13 Kaiser window has an adjustable parameter that controls
(A)pass band width (B)main lobe width
(C)stop band attenuation (D) stop band width

14 Butterworth filters have
(A)constant response in pass band and decresing response in stop band
(B)maximally flat response in pass band and monotonically decreasing response in stop band
(C)ripple in pass band and a ripple in stop band
(D)maximally flat response in pass band and ripple in stop band

Q.2 **(a)** Explain the following types of discrete time systems: **03**
(i)linear (ii)causal (iii)time invariant

(b) Explain aliasing in discrete time systems. What is the solution to avoid it? **04**

(c) Obtain the linear convolution of the following sequences: **07**
$x(n) = \delta(n) + 2\delta(n-1) + 3\delta(n-2) + 4\delta(n-4)$
$h(n) = 5\delta(n) + 4\delta(n-1) + 3\delta(n-2)$

OR

(c) What are the advantages and disadvantages of digital signal processing ? **07**

Q.3 **(a)** Obtain the z-transform of the following: **03**
$x(n) = (1/2)^n u(n) + 2^n u(n)$

(b) Prove that convolution of the two sequences in the time domain is equivalent to multiplication of the z-transforms of the two sequences. **04**

(c) Enlist the properties of the RoC of the z-transform. **07**

OR

Q.3 **(a)** Obtain the inverse z-transform of the following: **03**
$X(z) = \log(1 + a z^{-1})$, $|z| > |a|$

(b) Explain the following: **04**
(i)Minimum Phase systems (ii)Maximum Phase systems

(c) Obtain the lattice filter implementation for the all-pole filter **07**

$$H(z) = \frac{1}{1 - 0.2z^{-1} + 0.4z^{-2} + 0.6z^{-3}}$$

Q.4 **(a)** Compare Butterworth and Chebyshev filters. **03**

(b) Enlist the types of FIR linear phase filter with suitable example. **04**

(c) Obtain the DFT of the sequence **07**

$x(n) = \delta(n) - \delta(n-2) + 2\delta(n-3)$

OR

Q.4	**(a)**	State and prove the conjugate symmetry property of DFT.	**03**
	(b)	What is windowing in FIR filter?Give suitable examples of windowing.	**04**
	(c)	Discuss the zero–input limit cycles and limit cycles due to overflow in IIR systems.	**07**
Q.5	**(a)**	Enlist the methods of obtaining convolution of two sequences.	**03**
	(b)	State and prove the periodic convolution property of DFT.	**04**
	(c)	Compare impulse invariance and bilinear transformation methods to design digital filters.	**07**

OR

Q.5	**(a)**	What are the different parts of an ECG wave?	**03**
	(b)	Explain Goertzel algorithm to compute DFT.	**04**
	(c)	Discuss decimation-in-frequency FFT algorithm.	**07**

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