Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code: 171003 Date: 16/05/2019

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.**

Q.1 **(a)** Draw the block diagram architecture of TMSC6000 series Digital Signal Processor. Briefly describe each block functions. **07**

(b) Define ROC for z-transform? List the properties of the ROC. **07**

Q.2 **(a)** State and prove Time Shifting and Scaling in z domain properties for z-transform. **07**

(b) State and prove convolution theorem and the correlation theorem for Fourier transform **07**

OR

(b) Determine the z-transform of the following signals. **07**

i) $x(n) = u(n)$ (3-Marks)

ii) $x(n) = (\cos \omega_0 n)u(\mathrm{n})$ (4-Marks)

Q.3 **(a)** Determine the inverse z-transform of $X(z) = \dfrac{1}{1-1.5z^{-1}+0.5z^{-2}}$ if **07**

(i) ROC: $|z| > 1$

(ii) ROC: $|z| < 0.5$

(iii)ROC: $0.5 < |z| < 1$

(b) Determine the range of value of a and b for which the liner time-invariant system with impulse response **07**

$$h(n) = \begin{cases} a^n, & n \geq 0 \\ b^n, & n \leq 0 \end{cases}$$

is stable.

OR

Q.3 **(a)** Determine the spectra of the signals **07**

i) $x(n) = \cos \sqrt{2}\pi n$ (3-marks)

ii) $x(n) = \cos \pi n / 3$ (4-marks)

(b) The impulse response of a linear time invariant system is **07**

$$h(n) = \{1, \underset{\uparrow}{2}, 3, 1\}$$

Determine the response of the system to the input signal

$$x(n) = \{1, \underset{\uparrow}{2}, 1, -1\}$$

Q.4 **(a)** Compute the DFT of the four-point sequence $x(\mathrm{n}) = \{0\ 1\ 2\ 3\}$ **07**

(b) Obtain direct form-I and direct form-II structures for the system **07**

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

OR

Q.4 **(a)** State the Sampling theorem. Consider the analog signal $x_a(t) = 3\cos 2000\pi t + 5\sin 6000\pi t + 10\cos 12000\pi t$. **07**

i) What is the Nyquist rate for this signal?

ii) Assume now that we sample this signal using a sampling rate Fs=5000samples/s. What is the discrete-time signal obtained after sampling?

(b) How many numbers of additions, multiplications and memory locations will be required to realize a system H(z) having M zeros and N poles in (i) Direct-form I and Direct-form-II realization?. (ii) Give direct form-I and Direct form-II structures of second order system realization. **07**

Q.5 **(a)** Perform the circular convolution of the following two sequences: **07**

$$x_1(n) = \left\{\underset{\uparrow}{2}, 1, 2, 1\right\}$$

$$x_2(n) = \left\{\underset{\uparrow}{1}, 2, 3, 4\right\}$$

(b) Classify the discreate time signals. Give one example of each class. **07**

OR

Q.5 **(a)** Differentiate IIR and FIR systems. **07**

(b) Explain the Decimation in Time FFT algorithm. **07**

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