Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER II (OLD) EXAMINATION – SUMMER 2017

Subject Code: 1720702 **Date:10/05/2017**

Subject Name: Digital Signal Processing

Time:10:30 A.M. to 01:00 P.M. **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)** Explain block diagram of a typical DSP system. Differentiate between digital signal processing and analog signal processing. State various application of DSP. **07**

(b) Define z-transform. Explain and prove the following properties of Z-transform. (1) Time shifting (2) Time reversal. **07**

Q.2 **(a)** Find the Z transform of the following signals and sketch ROC. **07**

(i) x(n) = $\left(-{}^{1}/_{3}\right)^{n} u(n) - \left(-{}^{1}/_{2}\right)^{n} u(-n-1)$

(ii) x(n) = $\left({}^{1}/_{2}\right)^{n} u(n+2) + \left({}^{1}/_{3}\right)^{n} u(-n-1)$

(b) Determine the inverse Z-Transform by power series expansion method **07**

When (a) ROC: |z| > 1 and (b) |z| <0.5

$$X(z) = \frac{1}{(1 - 1.5z^{-1} + 0.5z^{-2})}$$

OR

(b) Determine all possible inverse Z-Transforms by partial fraction expansion method: **07**

$$X(z) = \frac{1}{(1 - 1.5z^{-1} + 0.5z^{-2})}$$

Q.3 **(a)** Determine the impulse response of LTI system described by their constant coefficient differential equation. **07**

y(n) – 3y(n-1) - 4y(n-2) = x(n) +2x(n-1)

(b) Consider the analog resonator having system function **07**

$$H(s) = \frac{s+0.1}{s^2+0.2s+9.01}$$

Convert into digital IIR filter using Bilinear transformation. The digital filter is to have a resonant frequency of $\omega_r = \pi/2$.

OR

Q.3 **(a)** List various kinds of windows used for filter design. Explain any one window in detail with example. **07**

(b) Draw direct form I and II realization of a system described by **07**

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

Q.4 **(a)** List the properties of DFT. Prove any two properties **07**

(b) Compute 8 point DFT of sequence x(n) = {1,1,1,1,1,1} and sketch the spectrum. **07**

OR

Q.4	**(a)**	Discuss decimation in frequency FFT algorithm for radix-2.	**07**
	(b)	Perform the circular convolution of following two sequences $x_1[n] = \{1,3,5,3\}$, $x_2[n] = \{2,3,1,1\}$	**07**
Q.5	**(a)**	Explain comb filter.	**07**
	(b)	Explain the application of DSP in image processing	**07**

OR

Q.5	**(a)**	In which way DSP-processors are different from general purpose processors. With the help of a neat sketch, explain Digital Signal Processor architecture.	**07**
	(b)	Explain the application of DSP in voice processing.	**07**

****