Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) - EXAMINATION – SUMMER 2016

Subject Code:2150307 **Date:13/05/2016**

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 basic block diagram of a digital signal processing system. Also list application of the digital signal processing. **04**

(b) Answer the followings. **10**

1) Distinguish between deterministic and random signals.
2) What do you mean by fundamental period of a signal?
3) Distinguish static and dynamic system.
4) Define accumulator system. Check the accumulator system for linearity.
5) What do you mean by correlation?

Q.2 **(a)** The input x(n) and the impulse response h(n) of a LTI system are given by x(n) = {4,2,1,3} and h(n) = {1,2,2,1}. Determine the response of the system using linear convolution. **07**

(b) State the differentiation in frequency theorem of Fourier transforms. Determine the impulse response for a stable linear time invariant system for which the input x(n) and output y(n) satisfy the linear constant coefficient difference equation: **07**

$$y(n) - \frac{1}{2}\, y(n-1) = x(n) - \frac{1}{4}\, x(n-1)$$

OR

(b) Write a short note on concept of sampling and aliasing in sampled system. **07**

Q.3 **(a)** Define Z-transform. Enlist the property of Region of Convergence for z-transform with necessary illustration. **07**

(b) State and prove convolution property in the z domain. Find the Z-transform of **07**

$$x(n) = -n\, a^n u(-n-1).$$

OR

Q.3 **(a)** Define FFT. Find 4 point DFT of the sequence x(n) { 2,1,4,3} by DIF FFT algorithm also plot the magnitude and phase plot. **07**

(b) Realize the IIR system described by H(z) in direct form I and direct form II **07**

$$H(z) = \frac{1 + 2z^{-1} + z^{-2}}{1 - 0.75z^{-1} + 0.125z^{-2}}$$

Q.4 **(a)** Write a short note on Goertzel algorithm. **07**

(b) Plot the pole zero pattern and determine system stability. **07**

$$y(n) = y(n-1) - 0.8\, y(n-2) + x(n) + x(n-2)$$

OR

Q.4 **(a)** Determine the order of a Butterworth low pass filter satisfying the following specifications: **07**

$f_p = 0.10$ Hz, $\alpha_p = 0.5$ dB

$f_s = 0.15$ Hz, $\alpha_s = 15$ dB; f = 1Hz using bilinear transformation method.

(b) Write design steps for the low pass digital Butterworth IIR filter. **07**

Q.5 **(a)** List the advantages of digital filter. For given analog transfer function **07**

$$H_a(s) = \frac{2}{(s+1)(s+3)}$$

Determine H(z) if T= 1 s & T=0.5 s using impulse invariant method.

(b) Explain IIR filter design by bilinear transformation method. **07**

OR

Q.5 **(a)** Compare IIR and FIR filter. **07**

(b) Write a brief note on motion artifacts from ECG signal. **07**

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