Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII(NEW) • EXAMINATION – WINTER 2016

Subject Code:2171003 **Date:25/11/2016**

Subject Name:Digital Signal Processing

Time:10.30 AM to 1.00 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)** State 'differentiation' and 'time convolution' properties for given transform (Discrete Time Fourier Transform(DTFT) **or** Z-transform) . Prove any one of two properties. **07**

(b) List the classification of discrete time signals and also answer following : **07**

i) State whether following discrete time signal is periodic or not.

$$x(n)=\cos(\frac{n}{6})\cos(\frac{n\pi}{6})$$

ii) State whether following discrete time signal is energy signal or power signal or both or none of them.

$$x(n)=nu(n)$$

Q.2 **(a)** Using Z transform find i) impulse response and stability of the system ii) step response described by following equation: **07**

$$y(n)-0.6y(n-1)+0.08y(n-2)=x(n)$$

(b) Determine all possible signals that can have following z-transforms. **07**

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

OR

(b) Using properties of Z-transform ; find z-transform of following signals: **07**

i) $x(n)=u(-n-2)$

ii) $x(n)=2^n u(n-2)$

Q.3 **(a)** State and derive necessary and sufficient condition for a discrete time system to be BIBO stable. **07**

(b) Obtain direct form II realization of the LTI system presented by equation: **07**

$$y(n)=-\frac{13}{12}y(n-1)-\frac{9}{24}y(n-2)-\frac{1}{24}y(n-3)+x(n)+4x(n-1)+3x(n-2)$$

OR

Q.3 **(a)** Explain importance of transforms. Explain with necessary equations, relation of i) z-transform to Discrete Time Fourier transform (DTFT) and ii) z-transform to Discrete Fourier transform (DFT) and compare them. **07**

(b) Find the direct form -I realization of discrete time system represented by transfer function: **07**

$$H(Z)=\frac{2z^3-7z^2+6z-1}{[z-(1/3)][z^2-2Z+(1/4)]}$$

Q.4 **(a)** Enlist the various methods to design IIR filter from analog filters. List desirable properties to convert analog filters into digital filters. Explain any one IIR filter design techniques in brief. **07**

(b) Explain 8-point DFT from two 4 point DFTs using radix-2 Decimation in frequency (DIF) FFT algorithm. **07**

OR

Q.4 **(a)** Find out filter order N and cut off frequency Ω_c in order to design IIR butter worth digital filter using bilinear transformation. Take T =1 s. The design specifications of desired low pass filter are : **07**

$$0.85 \le |H(w)| \le 1; \ldots\ldots\ldots 0 \le \omega \le \frac{\pi}{2}$$

$$|H(w)| \le 0.15; \ldots\ldots\ldots \frac{3\pi}{4} \le \omega \le \pi$$

(b) Explain 8-point DFT from two 4 point DFTs using radix-2 Decimation in Time (DIT) FFT algorithm. **07**

Q.5 **(a)** Define terms i) multi-rate signal processing and ii) down sampling. Explain concept of down sampling with the help of simple example. Explain aliasing effect and concept of anti-aliasing filter. **07**

(b) A filter is to be designed with the following desired frequency response . **07**

$$H_d(e^{jw}) = 0 \ldots . for \ldots \frac{-\pi}{2} \le \omega \le \frac{\pi}{2}$$

$$H_d(e^{jw}) = e^{-2jw} \ldots . for \ldots \frac{\pi}{2} \le \omega \le \pi$$

Determine the filter coefficients h(n) , if the window function is defined as

$$w(n) = 1 \ldots . for \ldots\ldots 0 \le n \le 4$$

$$w(n) = 0 \ldots . othwrwise$$

Also determine frequency response $H(e^{jw})$ of the desired filter.

OR

Q.5 **(a)** Explain concept of forward/backward linear prediction with necessary equations and any one of its application (block diagram only). **07**

(b) Explain pipelining in context of microprocessors. Enlist pipeline phases in different TMS320 processors. **07**

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