## **GUJARAT TECHNOLOGICAL UNIVERSITY** ME - SEMESTER-I(New course)• EXAMINATION - WINTER- 2015

## **Subject Code: 3715203 Subject Name: Digital Signal Processing** Time:2:30 pm to 5:00 pm **Instructions:**

1. Attempt all questions.

- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- Q.1 Draw the basic block diagram of digital signal processing. Explain the ECG signal and 07 **(a)** seismic signal.
  - Test the system  $y(n) = x(n^2) + x(-n)$  and  $h(n) = a^{1x(n)l}$ , for linearity, time invariance, stability (b) 07 and causality.
- **Q.2** Find the 4 point DFT of  $x(n) = \{1, -1, 2, -2\}$  also verify the result using IDFT. 07 **(a)** 
  - State the convolution property of z transforms. Find the z transform for given, **(b)** 07  $x(n) = n a^{n} u(n-1).$ 
    - OR
  - Define linear convolution. Determine the response of the system characterized by the impulse 07 **(b)** response  $h(n) = \left(\frac{1}{2}\right)^n u(n)$  to the input signal  $x(n) = (3)^n u(n)$ .

## Q.3 **(a)** Obtain the inverse system for 07 $H_1(z) = \frac{1 - 0.5 z^{-1}}{1 - 0.9 z^{-1}} \text{ with ROC } |z| > 0.9 \text{ and}$ $H_2(z) = \frac{z^{-1} - 0.5}{1 - 0.9 z^{-1}} \text{ with ROC } |z| > 0.9$ **(b)** Explain in brief Remez algorithm. 07

- OR **Q.3** Explain sampling of continuous time signals. 07 **(a)** Explain IIR filter design by bilinear transformation method. **(b)** 07 0.4 **(a)** Convert the analog low pass filter specified by: 07  $H_a(s) = \frac{4}{s^2 + 9}$  into a digital filter making use the backward difference for the derivate. Compare IIR filter and FIR filter. **(b)** 07 OR Determine the order of a Butterworth low pass filter satisfying the following specifications: 07 **Q.4 (a)** 
  - $f_p=0.10$  Hz, p=0.5 dB,  $f_s=0.15$  Hz, s=15 dB, f=1 Hz(Use Bilinear Transformation Method) 07
    - Write a brief note on spectral transformation of IIR digital filter. (b)
- Find the 4 point DFT for  $x(n) = \cos\left(\frac{n\pi}{2}\right)$  using DIT FFT algorithm. Q.5 **(a)** 07

Date: 04/01/2016

**Total Marks: 70** 

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(b) What is the significance convolution? For input  $x(n) = \{1,2,0,1\}$  and the impulse response 07  $h(n) = \{2,2,1,1\}$  of a LTI system. Determine the response of the system.

## OR

- Q.5 (a) State and prove the differentiation in the frequency domain property of DTFT. 07
  - (b) Obtain the direct form II and cascade form of realization for the given LTI system governed 07 by the equation:

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

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