

GUJARAT TECHNOLOGICAL UNIVERSITY
B. E. - SEMESTER – VI • EXAMINATION – WINTER 2012

Subject code: 160305**Date: 07/01/2013****Subject Name: Bio-Medical Signal Processing****Time: 02.30 pm - 05.00 pm****Total Marks: 70****Instructions:**

1. Attempt any five questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

Q.1 (a) Discuss the concepts of linearity, time invariance, stability and causality of LTI system? **07**

(b) Discuss the differences between FIR and IIR filters. Comment on the advantages and disadvantages of each in typical implementation? **07**

Q.2 (a) Draw the signal flow graph to obtain FFT using decimation in time approach with necessary equations for $N=8$? **07**

(b) Describe the time domain behavior and effect on the magnitude response of LTI system with respect to poles and zeros locations in z-plane? **07**

OR

(b) i. Discuss the concept of digital frequency and periodicity in discrete time sampled data systems? **04**

ii. Explain term “Magnitude response” and “Phase response” with necessary equations for discrete systems with rational system function? **03**

Q.3 (a) i. Enlist and discuss the effects of finite word length in digital filter? **03**

ii. Explain the procedure with necessary equation to obtain circular convolution of two periodic sequences? **04**

(b) Using DIF FFT flow graph obtain FFT of sequence $x[n]=\{1,2,3,4,4,3,2,1\}$ **07**

OR

Q.3 (a) i. What is “twiddle factor” of DFT? **03**

ii. Explain the difference between DFT and DTFT? **04**

(b) i. Compute the convolution of two signals given by $x[n]=\{1,1,0,1,1\}$ and $h[n]=\{1,-2,-3,4\}$ **03**

ii. Find the inverse DFT of $X[k]=\{1,2,3,4\}$ **04**

Q.4 (a) Discuss the impulse invariance method of IIR filter design? **07**

(b) Design the FIR low pass filter using window technique with pass band gain of unity, cut-off frequency of 850 Hz and working at sampling frequency of 5000 Hz. The length of the impulse response should be 5. **07**

OR

Q.4 (a) Discuss window function used in FIR filter design along with important frequency domain characteristics? **07**

Q.4 (b) Obtain the system function by using bilinear transformation of digital filter **07**

with 3db bandwidth of 0.25π whose analog system response is given by

$$H(s) = \frac{\Omega_c}{s + \Omega_c}$$

- Q.5 (a)** Obtain FIR linear-phase and cascade realization of system given by the system function **07**

$$H[z] = \left(1 - \frac{1}{2}z^{-1} + z^{-2}\right)\left(1 - \frac{1}{4}z^{-1} + z^{-2}\right)$$

- (b)** i. Enlist various properties of Minimum Phase system? **03**
 ii. Explain digital signal processing technique used for arrhythmia detection? **04**

OR

- Q.5 (a)** Obtain structure of cascade and parallel realization of **07**

$$H[z] = \frac{(1 - z^{-1})^3}{\left(1 - \frac{1}{2}z^{-1}\right)\left(1 - \frac{1}{8}z^{-1}\right)}$$

- (b)** i. Briefly describe the distinguishing features of DSP processors? **04**
 ii. Explain “Gibbs Phenomena”? **03**
