Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- VIth SEMESTER–EXAMINATION – MAY- 2012

Subject code: 160305 **Date: 19/05/2012**

Subject Name: Biomedical Signal Processing

Time: 10:30 am – 01:00 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)** Give classification of signals. Distinguish multichannel and multidimensional signal. **07**

(b) Explain generalized block diagram and applications of DSP processors. **07**

Q.2 **(a)** Show that the phase of an allpass filter with *h(n)* real, if plotted as a continuous function of ω, is nonpositive for all ω. **07**

(b) Structure for Discrete time systems **07**

OR

(b) Design a low-pass Butterworth filter that has a *3dB* cutoff frequency of *1.5 kHz* and an attenuation of *40 dB* at *3.0 kHz*. **07**

Q.3 **(a)** An FIR linear phase filter has a unit sample response that is real with $h(n)=0$ for $n<0$ and $n>7$. If $h(0)=1$ and the system function has a zero at $z=0.4e^{J\pi/3}$ and a zero at $z=3$, what is $H(z)$? **07**

(b) Write a short note on: minimum phase system. **07**

OR

Q.3 **(a)** For the system $H(z)=\frac{1+2z^{-1}+z^{-2}}{1-0.75z^{-1}+0.125z^{-2}}$ derive the direct form I and direct form II structures. **07**

(b) Explain basic network structures for FIR systems with examples. **07**

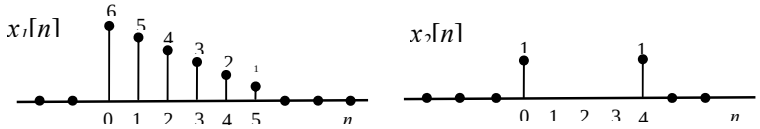
Q.4 **(a)** Show that the frequency response of an Nth order lowpass Butterworth filter is *maximally flat* at $\Omega = 0$ in the sense that the first $2N-1$ derivatives of $|H_a(J\Omega)|^2$ are equal to zero at $\Omega = 0$. **07**

(b) Write short note on Equiripple Linear Phase FIR Filters Design. **07**

OR

Q.4 **(a)** List the properties of discrete Fourier transform and discuss any two with an example. **07**

(b) Find 6-point and 10-point circular convolution for the finite-length sequences given in figure. **07**



Q.5 **(a)** Write short note on Goertzel Algorithm **07**

(b) Compare decimation-in-time and decimation-in-frequency FFT algorithms **07**

OR

Q.5 **(a)** Discuss the process of ECG analysis for arrhythmia detection. **07**

(b) Explain frequency based Heart Rate Variability signal analysis. **07**

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