Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–VI • EXAMINATION – WINTER 2013**

**Subject Code: 160305 Date: 04-12-2013**

**Subject Name: Biomedical 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.**

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|---|---|---|---|
| **Q.1** | **(a)** | Explain overview of DSP processor Texas Instrument's TMS320. List applications of DSP processors. | **07** |
| | **(b)** | Define signal. Give classification of signals and explain any two in detail with example. | **07** |
| **Q.2** | **(a)** | (i) Enlist various Properties of minimum- phase systems? | **03** |
| | | (ii) Explain digital signal processing technique used for arrhythmia detection. | **04** |
| | **(b)** | Effects of coefficient Quantization in IIR systems and FIR systems. | **07** |
| | | **OR** | |
| | **(b)** | With suitable example explain the round-off noise in a first order system. | **07** |
| **Q.3** | **(a)** | Consider the design of a low pass type I linear phase FIR filter by means of the parks McClellan algorithm. Use the alteration theorem to argue that the approximation must decrease monotonically in the don't care region between the pass band and stop band approximation intervals. Hint:- show that all the local maxima and minima of the trigonometric polynomial must be in either the pass band or the stop band to satisfy the alteration theorem. | **07** |
| | **(b)** | Explain following properties of Discrete Fourier series 1. Shift of a sequence 2.Duality 3. Periodic convolution | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | Draw the block diagram representation in direct form ,cascade form and parallel form for a discrete-time LTI system expressed by the following transfer function: $H(z)= \frac{1}{\left(1+\frac{1}{3}z^{-1}\right)\left(1-\frac{1}{6}z^{-1}\right)}$ | **07** |
| | **(b)** | write a short note on : frequency response for rational system functions | **07** |
| **Q.4** | **(a)** | Consider two sequences x[n] and h[n] of length 4 given by $x[n] = \cos(\frac{\pi}{2}n)$ n=0,1,2,3 $h[n] = (\frac{1}{2})^n$ n=0,1,2,3 (1) Calculate y[n] = x[n]⊗h[n] by doing the circular convolution directly. (2) Calculate y[n] by DFT. | **07** |
| | **(b)** | Write a short note on: Goertzel Algorithm | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | find the frequency response $H(e^{jw})$ and impulse response h(n) of a causal discrete-time LTI system which is characterized by the difference equation given as under: $y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = 2x(n)$ | **07** |
| | **(b)** | Compare decimation-in-time and decimation –in-frequency FFT algorithms. | **07** |
| **Q.5** | **(a)** | Discuss the Bilinear transformation of IIR filter design? | **07** |
| | **(b)** | What is Heart Rate Variability (HRV)? How HRV analysis can be done in frequency domain? | **07** |
| | | **OR** | |
| **Q.5** | **(a)** | Consider a sequence x[n]={1,1,-1,-1,-1,1,1,-1} determine the DFT X[k] of x[n] using the decimation-in-time FFT algorithm | **07** |
| | **(b)** | Discuss window function used in FIR filter design along with important frequency domain characteristics? | **07** |

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