Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – WINTER • 2014

Subject code: 1710407 **Date: 05-12-2014**

Subject Name: Biomedical Signal Processing

Time: 02:30 pm - 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.**

Q.1	**(a)**	How is a bioelectrical signal developed in a human body? Give a few examples of such signals stating their diagnostic significance.	**07**
	(b)	A digital filter has the output sequence, y(nT), {1/3. 1/3, 1/3é ..}for an input x(nT) = {1, 0, 0, é .}. Draw the pole-zero plot and amplitude response of it. Describe the application of this filter for an ECG signal.	**07**
Q.2	**(a)**	How does *short term Fourier transform (STFT)* differ from Fourier transform? State the importance of STFT from biomedical signal processing point of view.	**07**
	(b)	Explain 12-lead standard ECG recording system.	**07**
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	(b)	Draw a neat figure of an ECG waveform with accurate time and amplitude values. What is physiological significance of P, QRS and T waves?	**07**
Q.3	**(a)**	How an FIR filter is designed using the *windowing* approach? Describe various windows available for designing such filters.	**07**
	(b)	Enlist various noise and artifacts that affect the ECG signal. Describe, in brief, the techniques to remove them.	**07**
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Q.3	**(a)**	Draw the signal flow graph, pole-zero plot and frequency response of a *Hanning (smoothing) FIR filter* for removing a high frequency noise from an ECG signal.	**07**
	(b)	State the methods to detect QRS complex from an ECG signal. Explain ANN-based QRS detection technique.	**07**
Q.4	**(a)**	Which typical waves represent the EEG signal? Mention various types of artifacts encountered while capturing an EEG signal.	**07**

	(b)	What is an Autoregressive (AR) Model? Discuss the application of AR model for an EEG signal.	**07**

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Q.4	**(a)**	Explain the concept of blind source separation. Discuss the applications of independent component analysis (ICA) in context with biomedical signals.	**07**
Q.4	**(b)**	What is principal component analysis (PCA)? Explain the *dimensionality reduction* property of PCA with an appropriate example.	**07**
Q.5	**(a)**	Explain *Huffman coding* technique used for data compression with appropriate example.	**07**
	(b)	Explain *LZW coding* used for image compression with the aid of an example.	**07**

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Q.5	**(a)**	Explain *Arithmetic coding* technique used for data compression with appropriate example.	**07**
	(b)	What is *multi-resolution analysis (MRA)?* Explain discrete wavelet transform (DWT) and its application for (medical) image compression.	**07**

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