Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – SUMMER • 2013

Subject code: 1710407 **Date: 05-06-2013**

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)**	Draw the electrical equivalent circuit at the *skin surface-electrode* interface. Describe *Microelectrodes* and *Needle electrodes* in detail.	**07**
	(b)	Enlist different types of biomedical signals that can be acquired from the human body. Briefly explain each with typical application.	**07**
Q.2	**(a)**	With the help of neat figure, explain the human *cardiovascular and blood circulation system*. Explain the correlation between cardiovascular circulation and generation of ECG signal.	**07**
	(b)	With neat sketches, explain *standard 12 lead ECG* recording system.	**07**
		OR	
	(b)	With neat figures explain various EEG rhythms. State the applications of EEG.	**07**
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)	Draw the pole-zero plot and amplitude response of the filter offered by the following transfer function: $H(z) = (1 - z_1 z^{-1})(1 - z_2 z^{-1})$ For what application can it be used for an ECG signal?	**07**
		OR	
Q.3	**(a)**	A digital filter has the transfer function: $H(z) = z^{ï 1} + 6z^{ï 4}$ ï $2z^{ï 7}$. What is the difference equation for the output, $y(nT)$? Sketch the pole-zero plot and amplitude response of this filter.	**07**
	(b)	What is an artificial neural network (ANN)? Discuss the use of an ANN for detecting P, T and QRS waves of an ECG signal.	**07**
Q.4	**(a)**	Explain, with necessary figures, the method for *adaptive artifact cancellation* from EEG signal.	**07**
	(b)	What is principal component analysis (PCA)? Explain various applications of PCA for biomedical signals.	**07**
		OR	
Q.4	**(a)**	Define the terms: *Spectral power, Kurtosis, Skewness, Mobility, Activity*. State their significance from an EEG signal point of view.	**07**
	(b)	What is independent component analysis (ICA)? Discuss various applications of ICA.	**07**

Q.5	**(a)**	Explain the concept of *multiresolution analysis (MRA)*. Describe at least two applications of *wavelet transform* for biomedical signals/images.	**07**
	(b)	Explain *autoregressive (AR)* and *autoregressive moving average (ARMA)* models for predicting the EEG signals.	**07**

OR

Q.5	**(a)**	State the necessity of *image compression*. How JPEG and JPEG 2000 image compression standards differ from each other?	**07**
	(b)	Differentiate between *discrete cosine transform (DCT)* and *Walsh-Hadamard transform (WHT)*. State their applications.	**07**

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