Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E –IIst SEMESTER–EXAMINATION – JULY- 2012

Subject code: 1710407 **Date: 12/07/2012**

Subject Name: Biomedical Signal Processing

Time: 10:30 am – 13:00 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)**	What is an *action potential*? Describe the processes by which an action potential is developed in human cells.	**07**
	(b)	With the help of neat figure explain the human cardiovascular and blood circulation system.	**07**
Q.2	**(a)**	Explain the structure of a *neuron*. With neat figures explain various EEG rhythms.	**07**
	(b)	Enlist the types of *surface electrodes*. Explain *any two* in detail.	**07**
		OR	
	(b)	With neat figures describe the *microelectrodes* and *needle electrodes.*	**07**
Q.3	**(a)**	The impulse response of a filter is given by the series of values {3, 2, 1, 0, -1, 0, 0 and 1}. What is its transfer function? Draw the pole-zero plot and amplitude response of it.	**07**
	(b)	What is an *integer filter*? Describe the generalized procedure to place the poles and zeros used for designing an integer filter.	**07**
		OR	
Q.3	**(a)**	Design an FIR digital filter to approximate an ideal *low-pass filter* with pass-band gain of unity, cut-off frequency of 850 Hz and sampling frequency of 5000 Hz. The length of the impulse response should be 5. Use a *rectangular window*.	**07**
	(b)	Describe the *Hanning moving average filter*. Discuss its application for biomedical signals.	**07**
Q.4	**(a)**	Enlist various methods employed to remove *baseline wander* from an ECG signal. Describe the *cubic spline* method in detail.	**07**
	(b)	Explain the methods to remove artifacts caused by eye movements from an EEG signal.	**07**
		OR	
Q.4	**(a)**	Explain an *artificial neural network (ANN)*-based QRS complex detection from an ECG signal.	**07**
Q.4	**(b)**	i. Define the following terms: *skewness, kurtosis, activity, complexity*	**04**
		ii. How does the *wavelet transform* differ from *Fourier transform* and *short term Fourier transform (STFT)?*	**03**
Q.5	**(a)**	Discuss the applications of auto-regressive (AR) and auto-regressive moving average (ARMA) models for the EEG signals.	**07**
	(b)	Explain the *Hamming window* and *Kaiser window* used for designing digital filters.	**07**
		OR	
Q.5	**(a)**	Explain the concept of *principal component analysis (PCA)* with the help of an example.	**07**
	(b)	i. Describe the applications of *independent component analysis (ICA)* for biomedical signals.	**03**
		ii. Differentiate between the JPEG and JPEG 2000 standards used for image compression.	**04**

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