Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-II Examination July 2010

Subject code: 710407 Subject Name: Biomedical Signal Processing

Date: 08 / 07 /2010 Time: 11.00am – 1.30pm

Total Marks: 60

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Explain various types of bioelectric signals acquired from a human body. State the objectives of processing these signals.	**06**
	(b)	Explain the depolarization and repolarization process in a human cell with the aid of necessary sketches.	**06**
Q.2	**(a)**	What is a cardiovascular system? Explain the process of blood circulation in a cardiovascular system with neat drawing.	**06**
	(b)	With neat sketches explain the standard 12-lead ECG recording system.	**06**
		OR	
	(b)	Draw a typical ECG waveform indicating all normal values of time intervals and amplitudes of all the waves. Explain various types of artifacts that affect the ECG signal.	**06**
Q.3	**(a)**	What are ventricular premature beats (VPB)? Draw and explain various types of VPBs.	**06**
	(b)	Describe *linear time-invariant* and *time-variant filtering* techniques to remove baseline wander from an ECG signal.	**06**
		OR	
Q.3	**(a)**	Enlist and explain, in brief, various types of heart arrhythmias. What is *myocardial ischemia* and *myocardial infarction?*	**06**
	(b)	Describe *cubic spline* method to remove base line wander from an ECG signal.	**06**
Q.4	**(a)**	Explain Pan-Tompkins QRS detection algorithm with neat sketches.	**06**
	(b)	Let $y(nT) = [x(nT) + x(nT - T) + x(nT - 2T)]$. Derive the transfer function and draw the pole-zero plot. Also draw the approximate magnitude response of this filter. How this filter will be useful for ECG signal?	**06**
		OR	
Q.4	**(a)**	Explain the 10-20 recording system for EEG signal. State the clinical usage and applications of EEG.	**06**
	(b)	State the advantages and limitations of Integer filters. Describe the process of placement of poles and zeros for designing an Integer filter.	**06**
Q.5	**(a)**	Enlist various types of artifacts that interfere with EEG. Explain the technique based on LMS algorithm to cancel artifact caused by eye movement and blinking.	**06**
	(b)	Explain the steps to find the principal components of a signal. How principal component analysis (PCA) is useful in processing a biomedical signal?	**06**
		OR	
Q.5	**(a)**	Explain the concept of blind source separation (BSS) and independent component analysis (ICA). State the applications of ICA.	**06**
	(b)	State the importance of compressing medical images. Explain LZW coding technique with example.	**06**

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