Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME- SEMESTER II– EXAMINATION – SUMMER 2015

Subject Code: 2724107 **Date: 01/06/2015**

Subject Name: Biomedical Signal Processing

Time: 2:30 PM – 5:00 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)**	Enlist the different types of biomedical signals and explain any one with typical application of it.	**07**
	(b)	Discuss linear time variant filtering technique for removal of baseline wander from an ECG signal.	**07**
Q.2	**(a)**	Enlist all the steps required for Pan Tompkins algorithm and describe it with necessary equations.	**07**
	(b)	Explain Heartbeat Morphologies with appropriate diagram.	**07**
		OR	
	(b)	Describe the ECG waveform along with all its features. How do these features help the physician in knowing the condition of the heart?	**07**
Q.3	**(a)**	What are the various lead systems used in ECG measurement? Explain.	**07**
	(b)	A filter is described by the difference equation y (n) = y (n-1) + ¼ x (n) ï ¼ x (n-4)	
		i) What is its transfer function?	**02**
		ii) Draw the signal flow diagram of a realization of the filter.	**03**
		iii) Draw its pole zero diagram. What is its gain at the folding frequency?	**02**
		OR	
Q.3	**(a)**	Why QRS detection is useful for ECG signal processing? Explain any one application of it.	**07**
	(b)	A biomedical signal sampled at 180 Hz was found to have a significant amount of 60 Hz interference. Design a notch filter with two zeros to remove the interference. What is the effect of the filter if a signal sampled at 500 Hz is applied as the input?	**07**
Q.4	**(a)**	What are the functions of nervous system? Give classification of nervous system.	**07**
	(b)	i) Explain various EEG rhythms with appropriate figures.	**03**
		ii) Enlist the applications of EEG. Explain any one in brief.	**04**
		OR	

Q.4	**(a)**	With the help of neat sketch, explain the structure of a neuron.	**07**
	(b)	What is an auto- regressive (AR) model? Describe an AR modeling approach for predicting an EEG signal.	**07**
Q.5	**(a)**	Discuss the concept of Principle Component Analysis (PCA) with suitable example.	**07**
	(b)	Write a short note on Support Vector Machines (SVM).	**07**

OR

Q.5	**(a)**	Define the following terms in brief.	
		i) Heart sounds	**03**
		ii) Ventricular flutter	**02**
		iii) Ictal EEG	**02**
	(b)	Describe the applications of Wavelets for biomedical signals.	**07**

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