Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**ME SEMESTER II EXAMINATION – SUMMER 2017**

**Subject Code: 2724107** **Date:30/05/2017**

**Subject Name: Biomedical Signal Processing**

**Time:02:30 PM to 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.**

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|---|---|---|---|
| **Q.1** | **(a)** | Define Bioelectrical signal. Explain resting and action potential with necessary diagrams. | **07** |
| | **(b)** | Draw a typical ECG waveform with usual amplitude and time durations. Explain the physiology behind the development of various waves of ECG. | **07** |
| **Q.2** | **(a)** | With neat block diagram, explain Pan Tompkins algorithm used for QRS detection from the ECG signal. | **07** |
| | **(b)** | 1. Describe the Hanning moving average filter with its signal flow graph and pole-zero diagram. | **04** |
| | | 2. A filter operating at a sampling frequency of 200 samples/s has poles at $z = \pm j/2$ and zeros at $z = \pm 1$. What is the magnitude of its amplitude response at 50 Hz? | **03** |
| | | **OR** | |
| | **(b)** | Describe general procedure for IIR filter design using Bilinear Transformation and explain each step mathematically. | **07** |
| **Q.3** | **(a)** | Define the following.<br>1. Myocardial Ischemia<br>2. Myocardial Infarction | **07** |
| | **(b)** | Suggest the algorithm to detect P and T wave from ECG signal. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | Draw and explain standard 12 lead ECG system. | **07** |
| | **(b)** | Derive an expression of the transfer function for removal of power line interference from ECG signal using linear filtering approach. | **07** |
| **Q.4** | **(a)** | Explain EEG signal artifact cancellation using reference signals with necessary equations. | **07** |
| | **(b)** | Enlist the various sleep disorders and explain any two in detail. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | With neat diagram, explain EEG rhythms and waveforms. | **07** |
| | **(b)** | Explain autoregressive (AR) and autoregressive moving average (ARMA) models for predicting the EEG signals. | **07** |
| **Q.5** | **(a)** | How Support Vector Machine (SVM) can classify the data? Explain Binary classification using SVM. What are the advantages of SVM over other classification methods? | **07** |
| | **(b)** | Write an algorithm of Principal Component Analysis (PCA) and explain each step with necessary equations. | **07** |
| | | **OR** | |

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|---|---|---|---|
| **Q.5** | **(a)** | What is pattern classification? Distinguish between supervised and unsupervised learning classification method. | **07** |
| | **(b)** | What is multi-resolution analysis (MRA)? Explain discrete wavelet transform (DWT) and its application for biomedical signal processing. | **07** |

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