

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. 07
Describe *Microelectrodes* and *Needle electrodes* in detail.
- (b) Enlist different types of biomedical signals that can be acquired from the human 07
body. Briefly explain each with typical application.
- Q.2** (a) With the help of neat figure, explain the human *cardiovascular and blood* 07
circulation system. Explain the correlation between cardiovascular circulation
and generation of ECG signal.
- (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 07
Hanning (smoothing) FIR filter for removing a high frequency noise from an
ECG signal.
- (b) Draw the pole-zero plot and amplitude response of the filter offered by the 07
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?

OR

- Q.3** (a) A digital filter has the transfer function: $H(z) = z^{61} + 6z^{64} + 2z^{67}$. What is the 07
difference equation for the output, $y(nT)$? Sketch the pole-zero plot and
amplitude response of this filter.
- (b) What is an artificial neural network (ANN)? Discuss the use of an ANN for 07
detecting P, T and QRS waves of an ECG signal.
- Q.4** (a) Explain, with necessary figures, the method for *adaptive artifact cancellation* 07
from EEG signal.
- (b) What is principal component analysis (PCA)? Explain various applications of 07
PCA for biomedical signals.

OR

- Q.4** (a) Define the terms: *Spectral power, Kurtosis, Skewness, Mobility, Activity*. State 07
their significance from an EEG signal point of view.
- (b) What is independent component analysis (ICA)? Discuss various applications 07
of ICA.

- 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**
