Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – WINTER • 2014

Subject code: 713104N **Date: 05-12-2014**

Subject Name: Bio-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)** Discuss template matching techniques for classifying patterns in the ECG signal. **07**

(b) Determine inverse Z transform for $X(z) = \dfrac{z^{-1}}{1 - 0.25z^{-1} - 0.375z^{-2}}$ **07**

Q.2 **(a)** Write a note on design of low-pass integer filters. **07**

(b) Give example of biomedical signals and explain biomedical signal conversion systems in detail. **07**

OR

(b) Briefly describe linear phase response and piecewise-linear phase response. **07**

Q.3 **(a)** With block diagram explain a typical signal averager. **07**

(b) Design an LPF that approximates **07**

$$H_d(f) = \begin{cases} 1 & 0 \le f \le 1000 \\ 0 & elsewhere \end{cases}$$

Sampling frequency = 8000 sps. Impulse response sequence duration limited to 2.5 ms. Apply hanning window function to improve magnitude response of LPF.

OR

Q.3 **(a)** Explain data reduction using Fan algorithm. **07**

(b) Design an 11 coefficients FIR low pass filter whose cut off frequency f_c equals $2f_s/11$, where f_s is sampling frequency. Plot magnitude response of resulting filter. **07**

Q.4 **(a)** Describe portable arrhythmia monitor in detail. **07**

(b) Convert analog filter with transfer function $H(s) = \dfrac{(s+2)}{(s+1)(s+3)}$ into a digital filter by means of impulse invariance method. **07**

OR

Q.4 **(a)** Write a note on ST-segment analyzer. **07**

(b) Describe principal noise canceler model. **07**

Q.5 **(a)** Using rubber membrane concept, discuss response for movement of poles towards center of unit circle. **07**

(b) Determine Z-transform of the signal $x(n) = n^2 e^{-2n}$. **07**

OR

Q.5 **(a)** Compare characteristics of FIR and IIR filter. **07**

(b) Convert analog filter with transfer function $H(s) = \dfrac{s+0.1}{(s+0.1)^2 + 49}$ into a digital filter by means of bilinear Z-transform method. Take resonant frequency $\omega_r = \pi/2$. **07**

****