GANPAT UNIVARSITY

B.Tech. Semester -V (BM&I), Regular Examination NOV-DEC 2010.

BME 505: BIOLOGICAL DIGITAL SIGNAL PROCESSING

Time:- 3 Hours **Marks:- 70**

Instructions:

1. **Answer to the questions must be written in separate answer books.**
2. **Figure to the right indicate marks.**
3. **Conventional terms / notations are used.**
4. **All the questions are compulsory.**

SECTION-I

Q-1 [12]

(a) Obtain co-efficient of FIR High pass filter to meet the following specifications given below the window:

Pass band edge frequency: 1.8 KHz Stop band attenuation : >45 dB
Stop band edge frequency: 2.2 KHz Sampling rate : 0.125msec.

(b) By using Kaiser window, Obtain requirements for given High Pass filter specification:

Stop band attenuation : 42 dB Cut-off frequency :1250Hz
Pass band attenuation : 0.02 dB Sampling frequency : 8 KHz
Transition width : 500 Hz

(c) Derive Impulse response of an ideal Low Pass filter.

OR

Q-1 [12]

(a) Design a IIR High pass filter is to be designed to meet the following specifications:

Pass band edge frequency : 0.27(normalized) Stop band deviation : 0.001
Transition width : 0.04(normalized) Pass band deviation : 0.05

i) Sketch tolerance scheme for filter.
ii) Express the filter band edge frequencies in standard unit of KHz, Fs=10 KHz and stop band & pass band attenuation.

(b) Find out Y(n)=x(n)*h(n), h(n)={1, 2, 3},x (n) = {-1,2,0, 2} by mathematical method.

(c) Show that if symmetry condition h(n)=h(N-n-1), for N=8, then the filter has linear phase response.

Q-2 [12]

(a) Define LTI system. & derive equation for Convolution Sum.

(b) Find particular solution for difference equation :
y (n) +0.6y (n-1) =x (n), Where x (n) =u (n).

(c) Perform cross correlation of Y (n) = {-2, 4, -1, 0, 1} & X (n) = {1, -2, 4, -1, 2}.

OR

Q-2 [12]

(a) The analog signal is given x (t) =7cos250Πt+3sin600Πt. Calculate:

1. Nyquist Sampling rate?
2. If the given x(t) is sampled at the rate fs =500Hz. What is the discrete time signal obtained after sampling?
3. What is analog signal y (t) we can reconstruct from the samples if ideal interpolation method is used.

(b) Perform convolution of h (n) = {2, 3, 0, 1} & x (n) = {1, -2, 3} by graphical method.

(c) Discuss Sampling Theorem & Aliasing effect in detail.

Q-3 **[11]**

(a) Obtain co-efficient of IIR Band stop filter using BZT method:

Where, $H(s)= 1/(s^2+\sqrt{4}s+3)$

Pass band : 185-235 Hz

Sampling rate : 0.145msec.

(b) Using Pole-Zero placement method to calculate co-efficient of narrow band pass filter. Obtain the transfer function of a filter.

- A narrow pass band centered at: 145Hz
- A complete rejection at dc & 290 Hz
- A 3dB width of notch : 14Hz
- Sampling frequency : 650 Hz

SECTION-II

Q-4

(a) Give all the applications of DSP. Explain advantages of DSP over ASP. **[06]**

(b) Explain characteristics of continuous time signal and discrete time signal. **[06]**

OR

Q-4

(a) Explain following operations upon signal. **[06]**

1. Time delay & time advance
2. Folding-shifting
3. Time scaling

(b) Determine whether the following system are : **[06]**

(i) Linear or non linear (ii) Time variant or invariant

And also give reason.

1. $y(n) = 8 \sin(x[n])$
2. $y(n) = n\, x[n-5]$
3. $y(n) = 6n\, x^2[n]$

Q-5

(a) Plot magnitude and phase spectrum of the sampled data sequence {2, 0, 0, 1} which was obtained using a sampling frequency of 20KHz, N = 4. Use DFT formula. **[06]**

(b) Explain spectrum leakage. **[02]**

(c) Find IDFT of given sequence x[k] = {6,-1-j, 0, -1+j}. Using DIT FFT algorithm. **[04]**

OR

Q-5

(a) Determine circular convolution of input x (n) = {1, 3, 5, 3} and h (n) = {2, 3, 1, 1}. Use DFT method. **[08]**

(b) Calculate IDFT of x (k) = {3, 2+j, 1, 2-j}. Use DIF FFT algorithm. **[04]**

Q-6

(a) Explain following properties of Z-transform **[06]**

1. Time shifting
2. Differentiation in Z domain(multiplication by 'n')
3. Division by 'n'

(b) Determine IZT for $x[z] = z / (3z^2 - 4z + 1)$, ROC $|z| > |1|$ **[05]**

END OF PAPER