(b) What is the design procedure of FIR filter windowing technique ?

(c) Design a band stop half band filter to meet the following specifications :

Stopband edges : $[2, 3]\, kHz$

Passband edge $[1, 4]\, kHz$

$A_p = 1\, dB$, $A_s = 50\, dB$ use Kaiser and Hamming windows.

5 Attempt any two of the following : 10×2=20

(a) Discuss the features and applications of Goertzel algorithm. How DFT can be implemented with convolution.

(b) Explain the term Discrete Convolution and analyze it with proper example. Also illustrate Convolution properties.

(c) How the spectral analysis of non-stationary signals is achieved using Hamming window. What is periodogram Analysis and discuss its applications.

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(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 0300 Roll No.

B. Tech.

(SEM. VII) EXAMINATION, 2008-09

FUNDAMENTAL OF DIGITAL SIGNAL PROCESSING

Time : 3 Hours] *[Total Marks : 100*

Note : (1) *Attempt all questions.*

(2) *Each question carries equal marks.*

(3) *Be precise to your answers.*

1 Attempt any four of the following : 5×4=20

(a) Consider time domain representation of discrete time signals and explain the importance of length and size of the signals in the mathematical representation.

(b) Let $x[n] = \{\overset{\Downarrow}{1}, 2, 0, 0, 4\}$ find its energy and average power.

(c) Let $x[n] = \{1, \overset{\Downarrow}{2}, 5, -1\}$. Generate $x[2n]$ and various interpolated version of $x \uparrow [n/3]$.

(d) In a discrete time system discuss Accumulator and moving average filter.

(e) Explain the term DFT and IDFT. Find DFT of

$$x(n) = \left\{\overset{\Downarrow}{2}, -1, 4, 3\right\}.$$

(f) Illustrate properties of DFT.

2 Attempt any **four** of the following : 5×4=20

(a) How discrete time signals are generated from continous time signals. Let $g_a(t)$ be a continous time signal and the sequence $g[n] = g_a(nT)$ for $-\infty < n < \infty$ with T as sampling frequency of the sampling is done by

$$p(t) = \sum_{-\infty}^{\infty} \delta(t - nT) \text{ such that}$$

$$g_p(t) = g_a(t)\,p(t)$$

prove that $G_p(\Omega) = \sum_{n=-\infty}^{\infty} g_a(nT)e^{-j\Omega nT}$.

(b) Explain and compare discrete time processing of continous time signal and continous time processing of discrete time signals.

(c) Let $x[n] = \{-1, 2, 3, 2\}$, $t_s = 1$. What is the value of the reconstructed signal $x(t)$ at 2.5s that results from step and linear interpolation.

(d) With block diagram explain Digital Processing of Analog signals.

(e) What makes a difference Equation ; LTI or Non-linear or time varying.

(f) Find the impulse response of

$$y[n] - 0.6y[n-1] = 4x[n] \text{ and}$$

$$y[n] - 0.6y[n-1] = 3x[n+1] - x[n].$$

3 Attempt any **two** parts of the following : 10×2=20

(a) Classify and discuss transfer function based on Magnitude characteristics and phase characteristics.

(b) Discuss basic structures of IIR systems for direct and cascade form.

(c) Does $H(z) = 1 + 2z^{-1} + 2z^{-2} + z^{-3}$ describe a linear phase filters ? Explain how FIR comb filters work. What are the effects of round off noise in digital filters ?

4 Attempt any **two** of the following : 10×2=20

(a) Design Discrete-Time IIR filter from continous time filters. Convert the analog filter $H(s) = \frac{1}{s+1}$, with a cut-off frequency of 1 rad/s to a digital filter with a cut-off requency of $f_c = 10\ Hz$ and $s = 60\ Hz$, using impulse in variance and gain matching.