(b) Use the window design method to design a minimum-order high-pass filter with a stop band cut-off frequency $w_s = 0.22\pi$, a passband cut-off frequency $w_p = 0.28\pi$ and a stop band ripple $\delta_s = 0.003$.

(c) Use the Impulsive Invariance method to design a digital filter from an analog prototype that has a system function

$$Ha(s) = \frac{s+a}{(s+a)^2+b^2}$$

5. Answer any two of the following : 10×5=20

(a) Write notes on :

(i) Goertzel algorithm

(ii) Effect of finite register length.

(b) Compute the eight point DFT of the sequence :

$$X(n) = \begin{cases} 1, & 0 \le n \le 7 \\ 0, & otherwise \end{cases}$$

By using the decimation-in-frequency FFT algorithm.

(c) How spectrum analysis of random signals are performed using estimates of the auto-correlation sequence?

—x—

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

PAPER ID : 121657

Roll No. | | | | | | | | | | |

B.Tech

(SEM VI) THEORY EXAMINATION 2015

FUNDAMENTALS OF DIGITAL SIGNAL PROCESSING (EEN 011)

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

Note: 1. Attempt all questions:

2. All question carry equal marks.

1. Answer any **Four** of the following: (5x4=20)

(a) Find the even and odd parts of the signal X(n)=u(n).

(b) A Linear discrete- time system is characterized by its response $h_K(n)$ to a delayed unit sample $\delta(n-k)$. determine whether or not the system $h_K(n) = \delta(2n-k)$ is shift –invariant .

(c) Find the DIFT of $\delta(n)$.

(d) State and Prove the Periodicity and Symmetry properties of DFT.

(e) Find the convolution of two signals:

$X(n) = a^n u(n)$ and $h(n) = u(n)$

(f) How the Discrete Cosine Transform (DCT) is obtained from DFT? Explain.

2. Answer any **Two** of the following : (10x2=20)

(a) Explain the discrete-time processing of analog signals.

(b) State and prove the sampling theorem. If the Nyquist rate for $X_a(t)$ is w_s what will be the Nyquist rate for signal $\frac{dx_a(t)}{dt}$.

(c) (i) Write short note on multi rate signal processing.

(ii) Consider the discrete –time sequence x(n) = cos $\left(\frac{nr}{8}\right)$. Find two different continuous- time signals that would produce the sequence when sampled at a frequency of $f_s = 10\ Hz$.

3. Answer any **Two** of the following: (10x2=20)

(a) If a input to a linear shift- invariant system is

$X(n)=\left(\frac{1}{2}\right)^n u(n) + 2^n u(-n-1)$

The output is

$Y(n)= 6\left(\frac{1}{2}\right)^n u(n) - 6\left(\frac{3}{4}\right)^n (n)$. Find the system function and determine whether or Not the system is stable and/ or casual. Also comment on the realizability of system.

(b) Evaluate the frequency response of the system described by the system function $H(z)= \frac{1}{1-0.8Z^{-1}}$ after deriving expression for frequency response of a system with Rational function.

(c) Comment on the following :

(i) Finite precision numerical effects

(ii) Effects of round of noise in digital filters.

4. Answer any **Two** of the following: (10x2=20)

(a) Design a low-pass Butterworth filter having following specifications:

$f_p = 6kHz, f_s = 10kHz, \ \delta_p = \delta_s = 0.1$