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M.Tech.(EPDT) (2016 & Onwards) (Sem.–2)

ADVANCED DIGITAL SIGNAL PROCESSING

Subject Code : MTET-203

Paper ID : [74400]

Time : 3 Hrs. Max. Marks : 100

INSTRUCTIONS TO CANDIDATES :

1. **Attempt any FIVE questions in all.**
2. **Each question carries TWENTY marks.**

1. a) Obtain the Z-transform of :

$$x(n) = \begin{cases} a^n, & \text{if } n \geq 0 \\ 0, & otherwise \end{cases}$$

b) Obtain convolution of a unit impulse sequence $\delta(n)$ and unit step sequence $u(n)$.

2. a) Design a low pass digital FIR filter using Kaiser window satisfying the specifications as given below.

Passband cut-off frequency, $f_p = 150\ H_z$

Stopband cut-off frequency, $f_s = 250\ H_z$

Passband ripple, $A_p = 0.1\ dB$

Stopband ripple, $A_s = 40\ dB$

and sampling frequency, $F_s = 1000\ H_z$

b) Discuss the selection criteria for choosing between FIR and IIR filter for an application.

3. a) For the AR process of order two :

$$x(n) = a_1 x(n-1) + a_2 x(n-2) + w(n)$$

where a_1 and a_2 are constants and $w(n)$ is white noise process of zero mean and variance σ^2. Calculate the mean and autocorrelation of $x(n)$.

b) What is spectrum estimation? Discuss performance analysis of estimators.

4. a) Explain maximum likelihood estimator with the help of a diagram.

b) What is use of recursive estimators in digital signal processing? Discuss it with a suitable example.

5. a) The signal $x(n)$ is defined by :

$$x(n) = \begin{cases} a^n, & \text{if } n \geq 0 \\ 0, & n < 0 \end{cases}$$

Obtain the decimated signal with a factor of three and interpolated signal with a factor of three.

b) Discuss applications of sub-band coding in communication systems.

6. Explain in detail the LMS algorithm used in implementation of direct FIR filters.

7. a) Discuss the architecture of TMX320Cxx DSP chip with the help of a suitable block diagram.

b) Differentiate between floating point and fixed point processors.

8. a) Discuss Yule-Walker method for parameter estimation.

b) Draw a flowchart for decimation in time algorithm of Fast Fourier Transform (FFT) and explain it.