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Total No. of Pages : 03

Total No. of Questions : 09

B.Tech.(ECE/ETE) (2011 Onwards) / (Electronics Engg.) (2012 Onwards)
(Sem.–5)

DIGITAL SIGNAL PROCESSING

Subject Code : BTEC-502
Paper ID : [A2104]

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students has to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students has to attempt any TWO questions.

SECTION-A

1. Write briefly :

(a) Find the convolution of the two sequences

$$x(n) = e^{-n^2} \text{ and } r(n) = 3n^2$$

(b) Find the DTFT of the signal

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

(c) Determine the impulse response for the causal LTI system

$$y(n) - \frac{1}{2} y(n-1) = x(n) + 2x(n-1)$$

(d) Describe the relationship between z-transform and Discrete-time fourier transform with the help as mathematical equations.

(e) Differentiate fixed point representation and floating point representation of coefficients of a filter.

(f) Differentiate FIR and IIR filters. What are parameters on which the choice of FIR or IIR is made during the design of a digital filter?

(g) Briefly describe the characteristics as ADSP processors.

(h) Determine, whether the following signal is periodic. If yes, find the fundamental period : $x(n) = (-1)^{n^2}$.

(i) Explain limit cycles in filters.

(j) Using final-value theorem, find the steady state value of $x(n) = [(0.5)^n - 0.5]\, u(n)$

SECTION-B

2. Explain the Divide and conquer approach for calculation of DFT. Describe radix-2 DIT-FFT algorithm.

3. When the input to an LTI system is

$$x(n) = \left(\frac{1}{3}\right)^n u(n) + 2^n u(-n-1),$$

the corresponding output is

$$y(n) = 5\left(\frac{1}{3}\right)^n u(n) - 5\left(\frac{2}{3}\right)^n u(n)$$

(a) Find the system function H(z) and impulse response $u(n)$.

(b) Write the difference equation relating the input and output.

(c) Is the system stable? Is it causal?

4. The desired frequency response a LPF is

$$H_a(w) = \begin{cases} e^{-j3w} & -\frac{3\pi}{4} \le w \le \frac{3\pi}{4} \\ 0 & \frac{3\pi}{4} \le |w| \le \pi \end{cases}$$

Determine H (w) for M = 7 using a Blackman Window.

5. Describe the Architecture of TMS series processor and explain memory Structure and Interrupts also.

6. Explain Cioertzel Algorithm for computation of DFT.

SECTION-C

7. (a) Determine the inverse z-transform as

$$x(z) = \frac{1}{1024}\left[\frac{1024 - z^{-10}}{1 - \frac{1}{2}z^{-1}}\right] \quad |z| > 0$$

(b) Determine the inverse z-transform of

$x(z) = e^{1/z}$ with ROC are z except $|z| = 0$.

8. (a) Determine the parallel realization of the IIR system.

$$H(z) = \frac{3z(5z-2)}{\left(z+\frac{1}{2}\right)(3z-1)}$$

(b) Describe the effects of coefficient quantization and round-off noise in digital filters. How can they be taken care of in filter design?

9. Using DFT and IDFT, determine the response of the FIR filters with impulse response $x(n) = \{1, 2, 2, 1\}$ to the input sequence $u(n) = \{1, 2, 3\}$
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