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Question Paper Code : 57318

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016

Fourth Semester

Electrical and Electronics Engineering

EE 6403 – DISCRETE TIME SYSTEMS AND SIGNAL PROCESSING

(Common to Instrumentation and Control Engineering, Electronics and Instrumentation Engineering)

(Regulations 2013)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. Determine if the system described by the equation $y(n) = x(n) + \frac{1}{x(n-1)}$ is causal or non-causal.
2. What is an Anti-Aliasing filter ?
3. Determine the Z-transform and ROC of the following finite duration signals
 - (i) $x(n) = \{3, 2, 2, 3, 5, 0, 1\}$
 - (ii) $x(n) = \delta(n - k)$
4. Compute the convolution of the two sequences
 $x(n) = \{2, 1, 0, 0.5\}$ and $n(n) = \{2, 2, 1, 1\}$
5. Draw the flow graph of a 4 point radix-2 DIT-FFT butterfly structure for DFT.
6. What are the applications of FFT algorithm ?



7. Obtain the cascade realization for the system function,

$$H(z) = \frac{\left(1 + \frac{1}{4}z^{-1}\right)}{\left(1 + \frac{1}{2}z^{-1}\right)\left(1 + \frac{1}{a}z^{-1} + \frac{1}{4}z^{-2}\right)}$$

8. Mention the advantages of FIR filters over IIR filters.
9. What are the merits and demerits of VLIW architecture ?
10. What are the factors that influence the selection of DSP processor for an application ?

PART - B (5 × 16 = 80 Marks)

11. (a) (i) Determine if the signals, $x_1(n)$ and $x_2(n)$ are power, energy or neither energy nor power signals.

$$x_1(n) = \left(\frac{1}{3}\right)^n u(n) \text{ and } x_2(n) = e^{2n} u(n). \quad (8)$$

- (ii) What is the input signal $x(n)$ that will generate the output sequence

$$y(n) = \{1, 5, 10, 11, 8, 4, 1\} \text{ for a system with impulse response } h(n) = \{1, 2, 1\}. \quad (8)$$

OR

- (b) (i) A signal $x(t) = \sin c(50 \pi t)$ is sampled at a rate of (1) 20 Hz (2) 50 Hz and (3) 75 Hz. For each of these cases, explain if you can recover the signal $x(t)$ from the samples signal. (6)

- (ii) Determine whether or not each of the following signals is periodic. If the signal is periodic, specify its fundamental period.

$$(1) \quad x(n) = e^{j6\pi n} \quad (5)$$

$$(2) \quad x(n) = \cos \frac{\pi}{3} n + \cos \frac{3\pi}{4} n. \quad (5)$$





12. (a) (i) Find $x(n)$ if $X(z) = \frac{1 + \frac{1}{2}z^{-1}}{1 - \frac{1}{2}z^{-1}}$ (6)

(ii) Find the response of the causal system $y(n] - y(n - 1) = x(n) + x(n - 1)$ to the input $x(n) = u(n)$. Test its stability. (10)

OR

(b) Find the impulse response, frequency response, magnitude response and phase response of the second order system.

$$y(n] - y(n - 1) + \frac{3}{16}y(n - 2) = x(n) - \frac{1}{2}x(n - 1). \quad (16)$$

13. (a) (i) Summarize the steps of radix - 2 DIT-FFT algorithm. (8)

(ii) Compute the 4 point DFT of the sequence $x(n) = \{0, 1, 2, 3\}$ using DIT and DIF algorithm. (8)

OR

(b) Find the IDFT of the sequence

$$X(K) = \{4, 1 - j 2.414, 0, 1 - j 0.414, 0, 1 + j 0.414, 0, 1 + j 2.414\}$$

Using DIF algorithm. (16)

14. (a) Design an ideal low pass filter with a frequency response

$$H_d(e^{jw}) = 1 \text{ for } \frac{-\pi}{2} \leq w \leq \frac{\pi}{2} \\ = 0 \text{ for } \frac{\pi}{2} \leq |w| \leq \pi$$

Find the values of $h(n)$ for $N = 11$. Find $H(z)$ and the filter coefficients. (16)

OR

(b) (i) Given the specifications $\alpha_p = 3$ dB, $\alpha_s = 10$ dB, $f_p = 1$ kHz and $f_s = 2$ kHz. Determine the order of the filter using Chebyshev approximation. Find $H(s)$. (8)

(ii) Apply bilinear transformation to

$$H(s) = \frac{2}{(s + 1)(s + 2)} \text{ with } T = 1 \text{ sec and find } H(z). \quad (8)$$





15. (a) (i) Discuss on the addressing modes supported by a DSP processor. (8)
- (ii) Design a DSP based system for the process of Audio signals in an audio recorder system. (8)

OR

- (b) (i) Explain the datapath architecture and the bus structure in a DSP processor with suitable diagram. (8)
- (ii) Elaborate on Radar signal processing using a DSP processor. (8)

