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Question Paper Code : 57490

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

Fifth Semester

Information Technology

IT 6502 – DIGITAL SIGNAL PROCESSING

(Regulations 2013)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. What is a continuous and discrete time signal ?
2. What are time invariant systems ?
3. Compute the DFT of the sequence $x(n) = \{1, 1, 1, 1\}$.
4. Perform circular convolution of two sequence $x(n) = \{1, 2, 3\}$ and $h(n) = \{4, 5, 6\}$.
5. Discuss the need for prewarping.
6. What are the properties of Chebyshev filter ?
7. What are the properties of FIR filter ?
8. What are the desirable characteristics of the windows ?
9. What are the three-quantization errors to finite word length registers in digital filters ?
10. What is meant by “dead band” of the filter ?

PART - B (5 × 16 = 80 Marks)

11. (a) (i) Determine the power and energy of the signal $x(n) = \left(\frac{1}{3}\right)^n u(n)$. (8)
- (ii) Determine whether the system described by the input-output relation is linear or non-linear $y(n) = nx(n)$. (8)

OR

- (b) Determine the z transform and ROC of the signal : (16)
- (i) $x(n) = (a)^n u(n)$
- (ii) $x(n) = \cos n\theta u(n)$

12. (a) Compute the DFT for the sequence $\{1, 1, 1, 1, 1, 1, 1, 0\}$. Using radix-2 DIT-FFT algorithm. (16)

OR

- (b) In a LTI system the input $x(n) = \{3, -1, 0, 1, 3, 2, 0, 1, 2, 1\}$ and the impulse response $h(n) = \{1, 1, 1\}$. Find the output $y(n)$ of the system using overlap save method. (16)

13. (a) Using Bilinear transformation design a high pass filter monotonic in the passband with a cutoff frequency of 1000 Hz and down 10 dB at 350 Hz. The sampling frequency is 5000 Hz. (16)

OR

- (b) Design a digital Chebyshev filter with the following specifications, using IIM

$$0.8 \leq |H(e^{j\omega})| \leq 1, 0 \leq \omega \leq 0.2\pi$$

$$|H(e^{j\omega})| \leq 0.2, 0.6\pi \leq \omega \leq \pi$$

(16)

14. (a) Design a HPF with the following frequency response :

$$H_d(e^{j\omega}) = 1 \text{ for } \pi/4 \leq \omega \leq \pi$$

$$= 0 \text{ for } |\omega| \leq \pi/4$$

of length $N = 11$ using Hanning window.

(16)

OR

- (b) Using frequency sampling method design a bandpass filter with the following specifications; sampling frequency 8 kHz, lower cutoff frequency 1000 Hz and upper cut off frequency 3000 Hz.

(16)

15. (a) Two first order filters are connected in cascaded whose system functions of the individual sections are $H_1(z) = 1 / (1 - 0.5 z^{-1})$ and $H_2(z) = 1 / (1 - 0.4 z^{-1})$. Determine the overall output noise power.

(16)

OR

- (b) Derive the steady state input and output noise power of an analog to digital converter used in a digital signal processing system.

(16)