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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

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

$\left| H(e^{j\omega}) \right| \leq 0.2, \; 0.6\pi \leq \omega \leq \pi$ **(16)**

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

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

$= 0$ 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 H1 (z) = $1 / (1 - 0.5\ z^{-1})$ and H2 (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)**
