

B.TECH DEGREE EXAMINATIONS: NOV/DEC 2010

Fifth Semester

INFORMATION TECHNOLOGY

U07IT501: Digital Signal Processing

Time: Three Hours**Maximum Marks:100****Answer All the Questions :-****PART A (10 x 1 = 10 Marks)**

- Digital Signal Processor may be _____.
 - programmable digital computer
 - small microprocessor
 - hardwired digital processor
 - any one of the above
- The Z- Transform of $a^n x(n)$ is _____.
 - $aX(Z)$
 - $a^{-1}X(Z)$
 - $X(aZ)$
 - $X(a^{-1}Z)$
- In DFT if N is large, then _____.
 - resolution in time and frequency is high
 - resolution in time and frequency is low
 - resolution in frequency is high
 - resolution in time is high
- The symmetry property of the phase factor is given by _____.
 - $W_N^{K+\frac{N}{2}} = W_N^{K+N}$
 - $W_N^{K+\frac{N}{2}} = -W_N^K$
 - $W_N^{K+N} = -W_N^K$
 - $W_N^{K+N} = W_N^{K+\frac{N}{2}}$
- If α_p is the maximum pass band attenuation, α_s is the minimum stop band attenuation, then the value of A is given by _____.
 - $A = \frac{\log \sqrt{(10^{0.1\alpha_s} - 1)}}{\log \sqrt{(10^{0.1\alpha_p} - 1)}}$
 - $A = \frac{\log(10^{0.1\alpha_s} - 1)}{\log(10^{0.1\alpha_p} - 1)}$
 - $A = \frac{\sqrt{(10^{0.1\alpha_s} - 1)}}{\sqrt{(10^{0.1\alpha_p} - 1)}}$
 - $A = \frac{(10^{0.1\alpha_s} - 1)}{(10^{0.1\alpha_p} - 1)}$
- The frequency transformation from LPF to BPF is given by _____.
 - $S \rightarrow \frac{S}{\Omega_c}$
 - $S \rightarrow \frac{\Omega_c}{S}$
 - $S \rightarrow \frac{S(\Omega_u - \Omega_l)}{S^2 + \Omega_l \Omega_u}$
 - $S \rightarrow \frac{S^2 + \Omega_l \Omega_u}{S(\Omega_u - \Omega_l)}$
- The FIR filter is said to be linear phase anti symmetric if it has _____.
 - Constant group delay
 - Constant phase delay
 - no delay
 - both a and b
- The frequency response of rectangular window is _____.
 - $W_R(e^{j\omega}) = \frac{\sin \frac{\omega N}{2}}{\sin \frac{\omega}{2}}$
 - $W_R(e^{j\omega}) = \frac{\sin \frac{\omega}{2}}{\sin \frac{\omega N}{2}}$
 - $W_R(e^{j\omega}) = \frac{\sin \omega N}{\sin \omega}$
 - $W_R(e^{j\omega}) = \frac{\sin \omega}{\sin \omega N}$

9. $(15.625)_{10} = (\quad)_2$.

A. 101.1111

B. 1111.110

C. 1111.101

D. 110.1111

10. The variance of $e(n)$ in rounding is _____.

A. $\sigma_e^2 = \frac{2^{-2b}}{6}$

B. $\sigma_e^2 = \frac{2^{-2b}}{12}$

C. $\sigma_e^2 = \frac{2^{-b}}{12}$

D. $\sigma_e^2 = \frac{2^{-b}}{6}$

PART B (10 x 2 = 20 Marks)

11. State Sampling theorem.

12. Define static and dynamic system.

13. Define DFT pair.

14. Draw radix -2 butterfly structures for DIT FFT algorithm.

15. Compare Butterworth and Chebyshev filters.

16. What are the disadvantages of Impulse invariant method?

17. Compare FIR and IIR filters

18. What is Gibb's phenomenon?

19. What are the methods used to prevent overflow?

20. List out the types of limit cycle Oscillations.

PART C (5 x 14 = 70 Marks)

21. a) (i) Find the response of the system if the input is $\{1, 4, 6, 2\}$ and impulse response of the system is $\{1, 2, 3, 1\}$. (7)

(ii) Compute the autocorrelation of the signal $x(n) = a^n u(n)$, $0 < a < 1$ (7)

(OR)

b) (i) Determine the Z transform of the signal $x(n) = \begin{cases} \left(\frac{1}{3}\right)^n, & n \geq 0 \\ \left(\frac{1}{2}\right)^n, & n < 0 \end{cases}$. (7)

(ii) Find convolution of $\{5, \mathbf{4}, 3, 2\}$ and $\{1, 0, \mathbf{3}, 2\}$. (7)



22. a) Compute the DFT for the sequence $x(n) = \{1, 2, 3, 4, 4, 3, 2, 1\}$ using DIT-FFT algorithm and plot the spectrum.

(OR)

b) Derive the DFT of the sample data sequence $x(n) = \{1, 1, 2, 2, 3, 3\}$ and compute the corresponding amplitude and phase spectrum.

23. a) Design and realize a digital Butterworth filter using bilinear transformation to meet the following requirements.

$$0.707 \leq |H(e^{j\omega})| \leq 1, \quad 0 \leq |\omega| \leq \pi/2$$

$$|H(e^{j\omega})| \leq 0.2, \quad 3\pi/4 \leq |\omega| \leq \pi$$

(OR)

- b) (i) Realize the system given by difference equation

$$y(n) = -0.1y(n-1) + 0.72y(n-2) + 0.7x(n) - 0.252x(n-2) \text{ in Direct form I and Direct form II} \quad (8)$$

(ii) If $H(S) = \frac{2}{(S+1)(S+2)}$, find $H(Z)$ using impulse invariance method for $T=1$ sec. (6)

24. a) Design an ideal high pass FIR filter with a frequency response

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

$$0, \quad \omega < \pi/4$$

Find the values of $h(n)$ for $N=11$ using Hamming Window

(OR)

- b) Determine $h(n)$ obtained by sampling

$$H_d(e^{j\omega}) = e^{-j(N-1)\omega/2}, \quad 0 \leq \omega \leq \pi/2$$

$$0, \quad \pi/2 \leq \omega \leq \pi \text{ for } N=7$$

25. a) (i) Explain truncation and rounding with suitable examples. (4)

(ii) Determine the dead band of the filter of $y(n) = 0.95y(n-1) + x(n)$ (10)

(OR)

- b) (i) Explain the application of DSP in Speech processing? (7)

(ii) What is a vocoder? Explain with a block diagram? (7)
