

B.E. DEGREE EXAMINATIONS: NOV/DEC 2010

Fifth Semester

ELECTRONICS AND COMMUNICATION ENGINEERING

U07EC502: Digital Signal Processing

Time: Three hours

Maximum Marks: 100

Answer all questions:-

PART A (10 x 1 = 10 Marks)

1. Let $x(n) = \{1, 1, 1, 1\}$. Then $X(k)$ be the 4 point DFT of $x(n)$. Then $X(0)$ is
(a) 0 (b) 1 (c) 5 (d) 4
2. Let $X(k) = \{28, -4+j9.656, -4+j4, -4+j1.656, -4, -4-j1.656, -4-j4, A\}$ be the 8 point DFT of a real valued sequence $x(n)$. Then A is
(a) $-4+j9.656$ (b) $-4-j9.656$ (c) $-4+j4$ (d) $-4+j1.656$
3. The oscillation developed in the frequency domain due to the truncation of impulse response is called
(a) gibb's oscillation (b) oscillation (c) aliasing (d) warping
4. The impulse invariant mapping is
(a) many to one (b) one to many (c) one to one (d) many to many
5. In two's complement representation the truncation error is always
(a) positive (b) negative (c) zero (d) infinite
6. _____ realization is less sensitive to process of quantization.
(a) Direct form I (b) Direct form II (c) Cascade (d) Parallel
7. The periodogram is
(a) the squared magnitude of the DTFT of the signal.
(b) the DTFT of the signal.
(c) the magnitude of the DTFT of the signal.
(d) the squared magnitude of the DFT of the signal.
8. The autocorrelation of a white noise is
(a) Impulse (b) Step (c) Pulse (d) Triangular
9. _____ refers to the overlapping of execution of a number of tasks.
(a) Pipelining (b) Multitasking
(c) Multiprocessing (d) Multitasking & multiprocessing

10. Name the architecture has only one bus which is used for both data transfers and instruction fetches.
- (a) von Neumann (b) Harvard (c) Microcontroller (d) Modified harvard

PART B (10 x 2 = 20 Marks)

11. Draw the basic butterfly in DITFFT algorithm.
12. Compute the linear convolution of $x(n) = \{1, 2, 1\}$ and $h(n) = \{1, 1, 1\}$.
13. State the necessary and sufficient conditions for the linear phase of an FIR filter.
14. Find the order N of a low pass Butterworth filter to meet the following specifications
 Pass band ripple = 0.001; Stop band ripple = 0.001
 Pass band edge frequency = 1 rad/sec; Stop band edge frequency = 2 rad/sec.
15. What is a dead band?
16. What is meant by scaling?
17. Determine the frequency resolution of Welch method of power spectrum estimate for a Quality factor of $Q=10$. Assume the overlap as 50% & the length of the sample is 1000.
18. What is the primary limitation of the non parametric spectrum estimation?
19. List the factors that influence the selection of DSPs
20. What is MAC operation?

PART C (5 x 14 = 70 Marks)

21. a) (i) Compute the circular convolution of the sequences. $A(n)=\{4,3,2,1\}$ and $b(n)=\{1,2,3,4\}$.
- (ii) From first principles, obtain the signal flow graph for computing 8-point DFT using radix-2 decimation-in-frequency FFT algorithm.

(OR)

- b) Determine the IDFT of $X(k) = \{28, -4+j9.656, -4+j4, -4+j1.656, -4, -4-j1.656, -4-j4, -4-j9.656\}$ using DIT-FFT algorithm.

22. a) The desired response of a LPF is

$$H_d(e^{j\omega}) = \begin{cases} (e^{-j3\omega}) & -0.75\pi \leq \omega \leq 0.75\pi \\ 0 & 0.75\pi \leq |\omega| \leq \pi \end{cases}$$

Determine $H(e^{j\omega})$ for $M=7$ using Hamming window

(OR)

b) Design a digital chebyshev filter Using bilinear transformation to satisfy the constraints

$$\begin{aligned} 0.707 \leq |H(e^{j\omega})| \leq 1, & \quad 0 \leq \omega \leq 0.2\pi \\ |H(e^{j\omega})| \leq 0.1, & \quad 0.5\pi \leq \omega \leq \pi \end{aligned}$$

23. a) (i) What is truncation error? Discuss its effect on all types of number representation?

(ii) A digital system is characterized by the difference equation $y(n) = 0.9y(n-1) + x(n)$.

With $x(n) = 0$ & initial condition $y(-1) = 12$. Determine the dead band of the system.

(OR)

b) (i) What is the effect of quantization on pole locations?

(ii) The output of an A/D converter is applied to a digital filter with the system function.

$$H(z) = \frac{(0.5z)}{(z - 0.5)}. \text{ Find the output noise from the digital filter, when the input is}$$

quantized to have 8 bits.

24. a) Explain the Power Spectrum estimation using Welch method.

(OR)

b) Explain the periodogram technique of power spectrum estimation. Evaluate its performance. Show how it is improved in modified periodogram method.

25. a) Explain the architecture and important features of Digital Signal Processors.

(OR)

b) Describe the various addressing modes of Digital Signal Processors.
