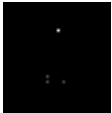
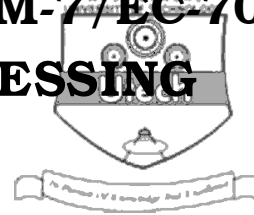


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CS/B.Tech (ECE-OLD)/(Supple)/SEM-7/EC-701(O)/09
DIGITAL SIGNAL PROCESSING
SEMESTER - 7



Time : 3 Hours]

[Full Marks : 70

GROUP - A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : 10 ∞ 1 = 10

i) Laplace transform of $\delta (n)$ equals to

- | | |
|------|---|
| a) 0 | b) • |
| c) 1 | d) cannot be determined. <input type="checkbox"/> |

ii) If $y (n) = n x^2 (n)$, the system is

- | | |
|--------------------------------|--|
| a) linear and time variant | b) linear and time invariant |
| c) non-linear and time variant | d) non-linear and time invariant. <input type="checkbox"/> |

iii) If $x (n) = e^{2n} u (n)$, the signal is

- | |
|---|
| a) energy signal |
| b) power signal |
| c) energy signal but not power signal |
| d) neither energy signal nor power signal. <input type="checkbox"/> |

iv) Speed improvement factor of DFT and FFT with 64 point sequence is

a) 21.33b)

21.43

c) 21.09d)

24.34.



v) FIR filter must be

a) unstable

b) stable

c) both (a) & (b)

d) none of these.

vi) No. of complex multiplications required to perform DFT is

a) $N^2 \log_2 N$

b) $\frac{N^2}{2}$

c) $4N^2$

d) $\frac{N}{2} \log_2 N$.

vii) If $x(n)$ is a sequence of L number of samples and $h(n)$ with M number of samples, the convolution of $x(n)$ and $h(n)$ contain

a) $\text{Max}(L, M)$ samples

b) $L + M - 1$ samples

c) $L + M - 2$ samples

d) $L + M$ samples.

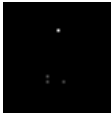
viii) The main advantage of FFT is

a) it reduces the computation time

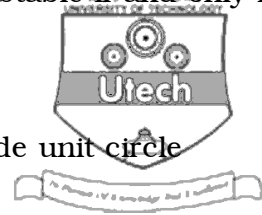
b) it can be used for determining the filter output

c) used to evaluate the Fourier Transform of an digital hardware

d) all of these.



ix) An LTI system having transfer function $H(z)$ is stable if and only if all the poles of $H(z)$ are



- | | | |
|-------------------------|------------------------|--------------------------|
| a) inside unit circle | b) outside unit circle | |
| c) all the unit circles | d) both (a) and (c). | <input type="checkbox"/> |

x) For analyzing digital filter which of the following transforms is used ?

- | | | |
|----------------------|----------------------|--------------------------|
| a) Laplace transform | b) Fourier transform | |
| c) Z-Transform | d) All of these. | <input type="checkbox"/> |

xi) FIR filters are

- | | | |
|--------------|--------------------------|--------------------------|
| a) recursive | b) non-recursive | |
| c) unstable | d) recursive and stable. | <input type="checkbox"/> |

xii) The condition for system stability is

- | | | |
|--|--|--------------------------|
| a) $\sum_{n=-\infty}^{\infty} h(n) < \infty$ | b) $\sum_{n=-\infty}^{\infty} h(n) < 0$ | |
| c) $\sum_{n=-\infty}^{\infty} h(n) > \infty$ | d) $\sum_{n=-\infty}^{\infty} h(n) < \infty$ | <input type="checkbox"/> |

xiii) The condition to avoid aliasing is

- | | | |
|--------------------|--------------------|--------------------------|
| a) $f_s < 2f_m$ | b) $f_s > 2f_m$ | |
| c) $f_s \leq 2f_m$ | d) $f_s \geq 2f_m$ | <input type="checkbox"/> |

xiv) Is it possible to get linear convolution from circular convolution?

a) Yes

b) No

c) May be

d) May not be.



xv) 'Twiddle factor' is used in

a) DFT

b) FFT

c) FIR filter designing

d) Z-transform.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.

3 ∞ 5 = 15

2. Find the cross-correlation of the following two finite length sequences :

$$x(n) = \{1, 2, 1, 1\}, y(n) = \{1, 1, 2, 1\}$$

3. Consider a causal and stable LTI system whose *i/p* $x(n)$ and *o/p* $y(n)$ are related to the second order difference equation :

$$y(n) - \frac{1}{4}y(n-1) - \frac{1}{4}y(n-2) = x(n)$$

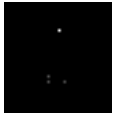
Determine the impulse response $h(n)$ for the system.

4. Find the Z transform of the signal :

$$x(n) = \cos n\theta u(n)$$

5. What is zero padding? What is its use?

6. Define Z-transform. What is meant by region of convergence?



GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following.

3 ∞ 15 = 45

7. By the following specifications as given, determine the order of filter using Chebyshev approximation. Find $H (s)$:

$$\alpha_p = 3 \text{ dB}, \quad \alpha_s = 16 \text{ dB}$$

$$f_p = 1 \text{ kHz} \quad \text{and} \quad f_s = 2 \text{ kHz}.$$

8. a) An analog filter has a transfer function

$$H (S) = 10 / (s^2 + 7s + 10)$$

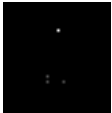
Design a digital filter equivalent to this impulse invariant method.

- b) Determine $H (z)$ that results when the bilinear transform is applied to

$$H_a (S) = (s^2 + 4.525) / (s^2 + 0.692s + 0.504).$$

9. a) What is signal flow graph ?
- b) What do you mean by the transposition theorem and transposed structure ?
- c) Determine the direct form II & transposed direct form II for the given system :

$$y (n) = \frac{1}{2} y (n - 1) - \frac{1}{4} y (n - 2) + x (n) + x (n - 1).$$



10. a) What do you mean by the term 'window' in designing of FIR filter ?

b) Describe briefly about the windowing technique.

c) Name the different window methods available for designing of the FIR filter.

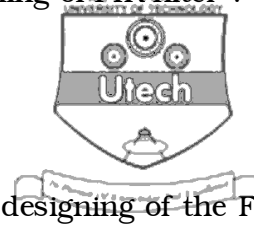
d) Describe in detail about any one type of window method.

11. Find the DFT of a sequence $x(n) = \{ 1, 2, 3, 4, 4, 3, 2, 1 \}$ by using

a) DIT algorithm

OR

b) DIF algorithm.



END