



MARWADI UNIVERSITY

Faculty of **Technology**[**Information & Communication Technology**][**B.Tech**]SEM: **V**

MU FINAL REMEDIAL

MAY: 2023**Subject: - (Digital Signal and Image Processing) (01CT0513)****Date:-16/05/2023****Total Marks:-100****Time: -10:30PM to 1:30PM****Instructions:**

1. All Questions are Compulsory.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Do not write/sign/indication/tick mark anything other than Enroll No. at a specific place on the question paper.

Question: 1.

- (a) Answer the following questions: [10]
1. Which of the following system obeys the principle of superposition?
 - a. Non-linear
 - b. Linear
 - c. Both
 - d. None
 2. An LTI system satisfies the property of _____.
 - a. Linearity
 - b. Time Invariance
 - c. Both
 - d. None
 3. The DTFT is same as the Z-transform when _____.
 - a. $r < 1$
 - b. $r > 1$
 - c. $r = 1$
 - d. none
 4. What is the ROC of z-transform of an two sided infinite sequence?
 - a. $|z| > r_1$
 - b. $|z| < r_1$
 - c. $r_2 < |z| < r_1$
 - d. None
 5. Frequency and time period are _____.
 - a. Proportional to each other
 - b. Inverse of each other
 - c. Same
 - d. None
 6. Analog processors takes _____ as input and produces _____ output.
 - a. digital, analog
 - b. analog, digital
 - c. digital, digital
 - d. analog, analog
 7. Which of the following tool is used in tasks such as zooming, shrinking, rotating, etc.?
 - a. Filters
 - b. Sampling
 - c. Interpolation
 - d. None

8. _____ is the process of moving a filter mask over the image and computing the sum of products at each location.
- Nonlinear spatial filtering
 - Linear spatial filtering
 - Convolution
 - Correlation
9. _____ filter is known as averaging filters.
- Low Pass
 - High Pass
 - Band Pass
 - None
10. Determine the number of complex multiplications for the 8-point Radix-2 FFT.
- 32
 - 12
 - 80
 - 4
- (b) Answer the following questions: [10]
- Differentiate between linear convolution and circular convolution.
 - What do you mean by causal and anti-causal systems?
 - What is DTFT?
 - Mention the general difference equation for IIR systems.
 - Define the periodicity property of discrete fourier transform.
 - What do you mean by DIF and DIT?
 - What is pipelining in DSP processors?
 - Classify the filters based on their frequency response.
 - Differentiate between recursive and non-recursive systems.
 - State various morphological operations in digital image processing.

Question: 2.

(a) Show the graphical, functional, tabular and sequence representations of discrete time signals with suitable examples of each representation. [08]

(b) Calculate the convolution sum of below mentioned problem statements: [08]

$$x(n) = \{4, 2, 1, 3\}, \quad h(n) = \begin{Bmatrix} 1, 2, 2, 1 \\ \uparrow \end{Bmatrix}$$

1.

$$x(n) = 3\delta(n+1) - 2\delta(n) + \delta(n-1) + 4\delta(n-2)$$

2.

$$h(n) = 2\delta(n-1) + 5\delta(n-2) + 3\delta(n-3)$$

OR

(b) Determine the circular convolution of two finite duration sequences:

$$x_1(n) = \{1, 2, -1, -2, 3, 1\} \text{ and } x_2(n) = \{3, 2, 1, 0, 0, 0\}$$

[08]

Question: 3.

(a) Perform the following: [08]

1. Find the cross correlation of two finite length sequences:

$$X(n) = \{2, 3, 1, 4\} \text{ and } y(n) = \{1, 3, 2, 1\}$$

2. Find the circular convolution of $x_1(n) = \{1, 2, 1, 2\}$ and $x_2(n) = \{4, 3, 2, 1\}$ by the tabular method

(b) Discriminate between analog and digital filters. [04]

(c) Compare impulse invariance method and bilinear transformation method for designing IIR filters. [04]

OR

- (a) Compute the eight-point DFT of a sequence $x(n) = \{1/2, 1/2, 1/2, 1/2, 0, 0, 0, 0\}$ using in-place radix-2 decimation in time FFT algorithm with necessary butterfly structure. [08]
- (b) Discuss basic gray level transformations used in digital image processing along with suitable mathematical expressions. [04]
- (c) Compare the characteristics of IIR & FIR filters. [04]

Question: 4.

- (a) Define Z-transform. Mention its advantages. Derive Linearity, time shifting and time reversal properties of z-transform with suitable expressions. [08]
 - (b) Draw the block diagram of digital signal processing system and explain all the major building blocks of digital processing system in detail. [08]
- OR
- (a) Explain dilation, erosion, opening and closing morphological image processing operations with suitable examples and expression. [08]
 - (b) Discuss the advantages of representing the digital filter in block diagram form. Show the direct form-I realization of IIR system along with suitable mathematical expressions. [08]

Question: 5.

- (a) Justify how data level and instruction level parallelism is being obtained by doing architectural modifications among the processor architectures. [06]
 - (b) Discuss various windowing techniques of designing FIR filters. Discuss their advantages and disadvantages as well. [06]
 - (c) Compare the characteristics of Harvard and Von-neumann architectures [04]
- OR
- (a) Discuss boundary extraction and region filling applications with suitable examples, figures and expressions. [06]
 - (b) Discuss image smoothing and sharpening using frequency domain filters. [06]
 - (c) What is MAC in DSP? Discuss desirable features of MAC. Also discuss Data Address Generators in DSP. [04]

Question: 6.

- (a) Derive DIT FFT flow graph for $N=4$ and determine DFT of $x(n) = \{1, 2, 3, 4\}$ [08]
- (b) Compare the characteristics of analog processing system with digital processing system. [04]
- (c) Draw and explain modified Harvard architecture. [04]

OR

- (a) Obtain Direct Form I and II realization of a system described by
 $y(n) - 1/6 y(n-1) + 1/3 y(n-2) = x(n) + 2x(n-2)$. [08]
- (b) Compare the characteristics of various types spatial and frequency domain filtering. [04]
- (c) Discuss the real world applications of digital signal processors. [04]

---Best of Luck---

– Bloom's Taxonomy Report –

Sub: Digital Signal and image processing

Sem. 5

Branch: Information and Communication Technology

Que. Paper weightage as per Bloom's Taxonomy

LEVEL	% of weightage	Question No.	Marks of Que.
Remember/Knowledge	20	1(A), 1(B)	20
Understand	30	2(A),4(A),4(B),5(A)	30
Apply	22	2(B), 3(A),5(B)	22
Analyze	20	3(B),3(C),6(B),6(C),5(C)	20
Evaluate	8	6(A)	8
Higher order Thinking/ Creative			

Chart/Graph of Bloom's Taxonomy

