**MARWADI UNIVERSITY**

**Faculty of Engineering**

**[ Information and Communication Technology ]**          **[ B.Tech ]**

SEM: **5**          MU FINAL EXAM          **DECEMBER: 2022**

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**Subject: - (Digital Signal & Image Processing) (01CT0513)**
**Date:- 19/12/2022**

**Total Marks:-100**                                        **Time: -10:30AM to 1:30PM**

**Instructions:**
   1. **All Questions are Compulsory.**
   2. **Make suitable assumptions wherever necessary.**
   3. **Figures to the right indicate full marks. -**

**Question: 1.**

(a) Choose appropriate option from the following questions:                    [10]
1. Which filters exhibit their dependency upon the system design for the stability purpose?
   a. FIR filter
   b. IIR filter
   c. both
   d. None
2. Which window function is also regarded as 'Raised-cosine window'?
   a. Hamming window
   b. Hanning window
   c. both
   d. none
3. The cost of the digital processors is cheaper because
   a. Processor allows time sharing among a number of signals
   b. Hardware is cheaper
   c. less power consumption
   d. None
4. The circular convolution of two sequences in time domain is equivalent to
   a. Multiplication of DFTs of two sequences
   b. Summation of DFTs of two sequences
   c. Difference of DFTs of two sequences
   d. none
5. Which units are generally involved in Multiply and Accumulate (MAC)?
   a. Adder
   b. Multipliers
   c. accumulator
   d. all
6. Decimation is a process in which the sampling rate is _____.
   a. Enhanced
   b. reduced
   c. stable
   d. none
7. The_____ nodes replace the adders present in any signal flow graphs.
   a. summing nodes
   b. branch node
   c. sink node
   d. none
8. What is the gray-level slicing approach?

     a. To brighten the pixels gray-value of interest and preserve the background
     b. To give all gray level of a specific range high value and a low value to all other gray levels
     c. both
     d. none

9. The response for linear spatial filtering is given by the relationship _____
     a. Difference of filter coefficient's product and corresponding image pixel under filter mask
     b. Product of filter coefficient's product and corresponding image pixel under filter mask
     c. Sum of filter coefficient's product and corresponding image pixel under filter mask
     d. None

10. _____ is the process of moving a filter mask over the image and computing the sum of products at each location.
     a. Nonlinear spatial filtering
     b. linear spatial filtering
     c. Convolution
     d. Correlation

(b)     Answer the following questions:              [10]
     1. What do you mean by cross-correlation?
     2. Write the methods to compute convolution sum of two sequences.
     3. What is the condition for z-transform to exist?
     4. Show the relation between DTFT and Z-transform.
     5. What do you mean by 4- adjacency in terms of digital image processing?
     6. Distinguish between causal and non-causal signals.
     7. Define dynamic system.
     8. Define Discrete fourier transform.
     9. State periodicity property of discrete fourier transform.
     10. What do you mean by decimation in time and decimation in frequency?

## Question: 2.

(a) Draw the block diagram of digital signal processing system and explain all the major building blocks of digital processing system in detail.        [08]

(b) What do you mean by convolution? Compare linear and circular convolution. Determine the circular convolution of two finite duration sequences:
x1(n) = {1,2,-1,-2,3,1} and x2(n) = {3,2,1,0,0,0}        [08]

**OR**

(b) What do you mean by discrete correlation? Explain auto and cross correlation. Determine the auto correlation of the finite length sequence x(n) = {2,3,1,4}        [08]

## Question: 3.

(a) Classify various elementary discrete-time signals and explain any four along with their suitable mathematical and graphical representations.

                [08]

(b) Discuss the advantages and limitations of digital filters over analog filters.     [04]

(c) Compare the characteristics of analog processing system with digital processing system.
                [04]

**OR**

(a) Define Z-transform. Mention its advantages. Derive Linearity, time shifting and time reversal properties of z-transform with suitable expressions.        [08]

(b) Give the comparison between impulse invariance method and bilinear transformation method for designing digital IIR filters.        [04]

(c)  Compare the characteristics of various types spatial and frequency domain filtering.
[04]

## Question: 4.

(a) Derive DIT FFT flow graph for N=4 and determine DFT of x(n) = {1,2,3,4}
[08]

(b) 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]

**OR**

(a) Obtain DFT of a sequence x(n) = (1/2,1/2,1/2,1/2,0,0,0,0) using decimation in frequency FFT algorithm. Mention the complete flow graph of algorithm.    [08]

(b) Explain dilation, erosion, opening and closing morphological image processing operations with suitable examples and expression.    [08]

## Question: 5.

(a) Show the relationship between DFT and z-transform. Obtain the value of x(4) for 8 point DFT if x(n) = {1,-1,0,2,1,-2,-1,1}.    [06]

(b) What do you mean by histogram? Explain histogram processing and histogram equalization in brief.    [06]

(c) What are different gray level transformations available in digital image processing? Explain them in brief with suitable assumptions.    [04]

**OR**

(a)  What is cyclic property of twiddle factor?  Calculate the DFT of a sequence x(n) = {1,1,0,0}
[06]

(b) What do you mean by hit-miss-fit in digital image processing? Explain hit or miss transformation with suitable example.    [06]

(c) What do you mean by spatial and gray level resolution? Explain the concept of contrast stretching
.    [04]

## Question: 6.

(a)  Draw the block diagram of generalized DSP processor and explain its major building blocks in brief.    [08]

(b)  Discuss thinning, thickening, skeleton and boundary extraction in brief.    [04]

(c) Discuss the real world applications of digital signal processing.    [04]

**OR**

(a) Compare between Harvard architecture and Von Neumann architecture along with suitable diagram.Also discuss the concept of pipelined CPU.    [08]

(b) Explain smoothing and sharpening in digital image processing.

[04]

(c) Discuss the real world applications of digital image processing. [04]

## ---Best of Luck---

– Bloom'S Taxonomy Report –
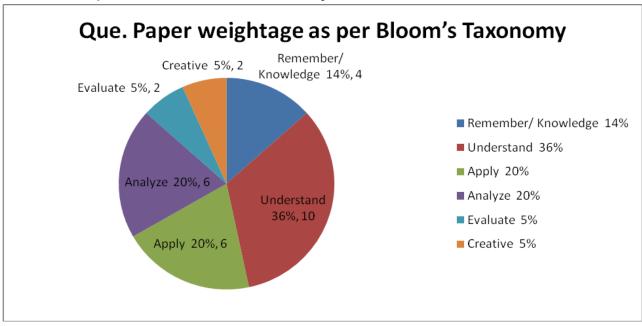
Sub: Digital Signal & Image Processing
Sem. 5
Branch: Information and Communication Technology

## 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 | 34% | 2(A), 3(A), 5(B), 5(C), 6(A) | 34 |
| Apply | 24% | 2(B), 4(A), 4(B) | 24 |
| Analyze | 16% | 3(B),3(C), 6(B), 6(C) | 16 |
| Evaluate | 6% | 5(A) | 6 |
| Higher order Thinking/ Creative | - | - | - |

## Chart/Graph of Bloom's Taxonomy



Que. Paper weightage as per Bloom's Taxonomy

Creative 5%, 2
Evaluate 5%, 2
Remember/ Knowledge 14%, 4
Analyze 20%, 6
Understand 36%, 10
Apply 20%, 6

- Remember/ Knowledge 14%
- Understand 36%
- Apply 20%
- Analyze 20%
- Evaluate 5%
- Creative 5%