BE8-R4: DIGITAL IMAGE PROCESSING

NOTE:

> 1. **Answer question 1 and any FOUR from questions 2 to 7.**
> 2. **Parts of the same question should be answered together and in the same sequence.**

Time: 3 Hours   **Total Marks: 100**

1.

a)   Define Resolution of an Image. Why is resolution of an image reduced? How can resolution of an image be reduced?

b)   Consider two points $p1=(x1, y1)$, and $p2=(x2, y2)$.   Calculate Euclidean distance, City block Distance and Chessboard Distance between two points.

c)   Explain Contrast Stretching with suitable example.

d)   What will be the shape of histogram for below mentioned images?

   1.   Bright Image   2.   Dark image

e)   Performance of a lossy compression technique is based on error criterion. Which are the commonly used objective error criterions?

f)   Write a short note on: Image Restoration

g)   Differentiate Multi-spectral and Multi-modal images.

(7x4)

2.

a)   Explain Erosion and Dilation morphological operations.

b)   Describe various components of an image processing system.

c)   A common measure of transmission for digit is the baud rate, defined as the Number of bits transmitted per second. Generally, transmission is done in packets consisting of a start bit, a byte of information and a stop bit. Using this approach, answer the following:

   i)   How many minutes would it take to transmit a 512x512 image with 256 grey levels at 300 baud?

   ii)   What would the time be at 9600 baud?

(6+6+6)

3.

a)   Calculate the Huffman Code:

Grey Level	0	1	2	3	4	5	6	7
Number of pixels	20	18	16	15	15	10	4	2

b)   Derive equations for Ideal Bandpass Filter, Butterworth Bandpass Filter and Gausian Bandpass Filter from corresponding Bandreject Filter.

c)   Image acquisition is an important process. This process is a principle source of noise. Describe noise effect of image acquisition by imaging sensors.

(8+6+4)

4.

a)

0	2	0	12	14
4	0	2	12	10
2	2	**14**	10	12
2	0	12	12	10
4	10	12	14	12

Consider 2-dimensional array as a digital image of size 5x5. The centre pixel g(2,2) is marked bold & underline. Perform image smoothing using a 3x3 neighborhood on centre pixel. What will the new grey value for center pixel if we apply:

i)   Mean filter   ii)   Median Filter
iii)   Min Filter   iv)   Max Filter

b)   Generate Arithmetic Code for the String 'GERMAN' using given data

Symbol	Y	E	R	G	N	M	A	F	C
Probability	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1

c)   Describe various filters for noise reduction in spatial domain

(6+6+6)

5.

a)   Encode the following string using LZW compression algorithm.
        ABACACBDACBDBDACBDAACD
        Assume that characters A, B, C and D are placed at position 63, 64, 65 and 66 position.

b)   Write a short note on MPEG-7.

c)   How is filtering in the frequency domain achieved?

(8+6+4)

6.

a)   Linear filtering of an image is accomplished through an operation called *convolution*
        The image is
                A = [17 24 1 8 15
                      23 5 7 14 16
                       4 6 13 20 22
                      10 12 19 21 3
                      11 18 25 2 9]
        and the convolution kernel is
        h = [8 1 6
             3 5 7
             4 9 2]
        Perform 2-Dimensional convolution on the pixel at position (2, 4).

b)   Image zooming can be achieved by either pixel replication or interpolation. Apply pixel replication technique and double the size of original image:

1	2
5	8

c)   Describe Gray-level slicing Method for Enhancement in spatial domain.

(6+6+6)

7.

a)   Write a short note on: Image Fusion using Wavelet Transform.

b)   Define the following terms for satellite image processing:
        i)   Irradiance   ii)   Radiance
        iii)   Absorption   iv)   Scattering
        v)   Transmittance

(8+10)