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) What are the stages through which an image passes in an image processing system? Explain.
b) Explain sampling and reconstruction and their practical limitations in detail.
c) Differentiate between spatial and frequency filtering.
d) What are the types of discontinuities/artifacts in a digital image? Discuss with their functions.
e) How is the gradient of a digital image calculated and how is it used to detect an edge.
f) Name the three data redundancies in a digital image. Explain each.
g) What is Affine Transformation? Write the equations relating coordinates after axis rotation by an angle θ (clockwise).

(7x4)

2.

a) Explain the concept of Karhunen-Loeve (K-L) transform.
b) Consider the probability distribution of various data symbols.

Symbol	A1	A2	A3	A4	A5
Probability	0.11	0.2	0.3	0.2	0.19

Explain the Huffman code assignment process for given symbols and what is the average length of coded data?

c) Explain LZW compression technique with suitable example.

(8+5+5)

3.

a) An 8 level gray image is:

$f(x, y) =$

5	0	6	3	6
3	2	3	6	7
5	3	6	5	2
5	2	3	3	5
3	1	5	2	3

Prepare the Histogram of the image.
Perform Histogram Equalization and draw the new Histogram.

b) Describe the RGB Color Model. Contrast it with CMYK color model.
c) What do you understand by Pseudo Color Image Processing?

(8+4+6)

4.

a) Discuss about various noise models.

b) A 5x5 image is

$f(x, y) =$

4	5	6	1	2
4	0	5	0	2
0	6	4	7	5
7	7	1	2	0
5	7	3	2	6

Compute the following:

i) The output after applying 3x3 Arithmetic Mean

ii) The output after applying 3x3 Geometric Mean

iii) The output after applying 3x3 Harmonic Mean

iv) The output after applying 3x3 Contra-Harmonic Mean Q = 1.5 and Q = -1.5

(6+12)

5.

a) What is meant by machband effect?

b) Find the number of bits required to store a 256 X 256 image with 32 gray levels?

c) Explain JPEG image encoding scheme.

d) Explain, briefly image techniques that improve the quality of image.

e) Consider the two image subsets S1 and S2 shown below.

S1				S2			
0	1	1	0	1	0	0	0
1	0	0	1	0	1	0	0
1	0	1	0	0	1	1	(1)
0	(1)	0	0	0	0	0	0

Compute the D_4- and D_8-distances between the two points marked with circles. Also compute the D_m-distance between them given V = {1}.

(3+3+5+3+4)

6.

a) Discuss Minimum Mean Square Error filtering.

b) Explain the term Connectivity and Adjacency with example.

c) Consider a linear filter whose impulse response is the second derivative of the Gaussian Kernel $\exp(-x^2/2\sigma^2)$.Show that regardless of the value of σ, the response of this filter to an edge modeled by step function is a signal whose zero-crossing is at the location of the edge.

(6+4+8)

7. Write short notes on followings:

a) Stereo Imaging.

b) Multi-model and Multi-spectral Image processing.

c) Weiner Filter.

(6+6+6)