

POKHARA UNIVERSITY

Level: Bachelor

Semester: Fall

Year : 2019

Programme: BE

Full Marks: 100

Course: Image Processing and Pattern Recognition

Pass Marks: 45

Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

- a) Define digital image processing? How is an image transformed into Grey level image? Explain with an example and pseudo code. 8
- b) What is zooming? Illustrate with an example by interpolation and replication. 7
- a) Compute the histogram equalization from the given data. 8

Input Image :- 4x4 Image

Gray Scale=[0,9]

2	3	3	2
4	2	4	3
3	2	3	5
2	4	2	4

- b) Write algorithm of Haar Transform. Compute the Haar Transformation for the order $N=2$. 7
- a) What is histogram equalization? Write the algorithm and pseudo code for histogram equalization with suitable example. 8
- b) List out some importance noise probability density functions used in image processing and sketch their plots. 7
- a) What do you mean by predictive coding in image compression? 7
- b) With necessary figures, explain the opening and closing. Briefly explain the algorithm for lossy predictive coding using feedback. 7
5. a) Construct Huffman code for each gray level and find the compression ratio and coding efficiency. 8

Gray Level	0	1	2	3	4	5	6	7
No. of pixels	113	139	142	145	181	105	50	1323

- b) Explain Segmentation by thresholding with its feature thresholding and Amplitude thresholding. 7
- a) How can you detect edges with gradient filters? Give different first order derivative based (gradient) filters. 7
- b) Given an image, "A" represents its pixel position. If A^* is the starting pixel, write down the 8-chain code and find shape number of it. 8

			A^*	A		
		A			A	
		A		A		
	A				A	
		A	A	A		

Write short notes on: (Any two)

- a) Neural Network ✓
- b) Learning in perception network ✓
- c) Dilation and Erosion ✓

POKHARA UNIVERSITY

Level: Bachelor
 Programme: BE
 Course: Image Processing and Pattern Recognition

Semester: Spring

Year : 2019
 Full Marks: 100
 Pass Marks: 45
 Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) Define digital image. Explain the process of image sampling and quantization in the digital image representation with figures. 8
- b) Write the algorithm and pseudo code for average filtering and apply 2D Average filtering on the given image. Use 3×3 sampling window and Keep border values unchanged. 7

1	4	0	1	3	1
2	2	4	2	2	3
1	0	1	0	1	0
1	2	1	0	2	2
2	5	3	1	2	5
1	1	4	2	5	0

2. a) What is histograms equalization? Write the algorithm and pseudo code for histogram equalization with suitable example. 7
- b) Compute the 2-D discrete Walsh-Hadamard transform of the given image block below: 8

5	6	8	10
6	6	5	7
4	5	3	6
7	8	3	5

3. a) What are the usages of derivative based filters. Derive mask for Laplacian second order derivative based. 7
b) What is Image Restoration? Compare it with image enhancement. 8
4. a) Construct Huffman code for each gray level. 8

Gray (r)	0	1	2	3	4	5	6	7
n(r)	60	100	260	20	150	90	110	234

Where, r = Gray level

$n(r)$ = No. of Pixels having r^{th} gray level

- b) Explain the working principles of lossy predictive coding with necessary block diagram. 7
5. a) What is morphological image processing? With necessary figures, explain the opening and closing. 8
- a) How can you detect edges with gradient filters? Give different first order derivative based (gradient) filters. 7
6. a) What do you mean by image segmentation, give the algorithm for basic adaptive thresholding. 7
b) Explain Minimum Distance Classifier for Pattern Classification with necessary equations and an example. 8
7. Write short notes on: (Any two). 2×5
a) Shape Numbers
b) Pattern with Pattern Class
c) Gray level slicing

POKHARA UNIVERSITY

Level: Bachelor

Semester: Fall

Year : 2020

Programme: BE

Full Marks: 100

Course: Image Processing and Pattern Recognition

Pass Marks: 45

Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) What is a digital image? Explain spatial resolution and intensity level resolution with examples. 7
- b) State different types of Gray Level Transformations. Explain any three of them in brief. 8
2. a) Given below are gray level frequencies of a 3 bit image. Equalize the histogram over the range. 7

Gray Level (I)	0	1	2	3	4	5	6	7
Frequency n(I)	32	160	128	512	192	256	704	64

- b) Perform Haar transform and its Inverse for 4x4 image given below. 8

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

1. a) What are the steps involved in frequency domain filtering? Explain the essential properties of 2-D Discrete Fourier Transform? 7
- b) Compare image enhancement and image restoration. Explain different noise-models in an image with their probability density functions. 8
- a) Construct Huffman coding for each gray level and find compression ratio and coding efficiency: 8

Gray level(r)	0	1	2	3	4	5	6	7
Frequency N_r	500	200	250	100	250	500	150	50

1. Write short notes on Image and Video Compression.
2. Give Definition and Formula for the following image 1 and corresponding equation B.

1	0	0	0	1	1
1	0	1	1	1	1
1	1	1	1	1	1
0	1	1	1	1	1
1	1	1	1	1	1

8

1	0	0	0	1	1
1	0	1	1	1	1
1	1	1	1	1	1
0	1	1	1	1	1
1	1	1	1	1	1

10

3. Explain how global thresholding and region splitting in image 8 segmentation with example.
4. Describe Edge Detection method for Image Segmentation.
5. Define Chain codes. Explain 4 and 8-connectivity segments to explain 4 chain codes with suitable examples.

Write short notes on (Any two)

6. Neural Network in Image Processing
7. Pattern recognition in Image
8. Spatial low pass filter

POKHARA UNIVERSITY

Level: Bachelor

Semester - Spring

Year: 2020

Program: BE

Full Marks: 70

Course: Image Processing and Pattern Recognition

Pass Marks: 31.5

Time: 2 hrs

Candidates are required to answer in their own words as far as practicable.
The figures in the margin indicate full marks.

Attempt all the questions.

Group - A: (5×10=50)

- Q. N. 1 Consider the following image with the new pixel at (2,2) if the smoothing is done using a 3x3 bit neighbourhood finding. 10

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

- a) Mean Filter
b) Weighted average filter
c) Median Filter
d) Min Filter
e) Max Filter

- Q. N. 2 Explain the components of digital image processing. How many images of size 1920×1720 with 8-bit gray value can be stored in a 512 MB storage space? 10

OR

Compare between Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT) with reference to Digital Image Processing. Derive the equations of FFT algorithm for one dimensional case.

- Q. N. 3 Using the concept of Hit, Fit and Miss, and taking a structural element of your choice, explain erosion and dilation with pictorial examples. 10

- Q. N. 4 "Edge linking is used in boundary detection of an image? Justify. Explain the method of edge linking using Hough Transform in detail with suitable figures. 3-7

- Q. N. 5 Differentiate between lossless & lossy compression? Consider the source with 8 message to design Huffman code and efficiency for intensity values in following normalized histogram 4-6

Gray Level (r_k)	0	1	2	3	4	5	6
$P(r_k)$	0.25	0.25	0.125	0.125	0.125	0.0625	0.0625

Group - B: (1×20=20)

- Q N 6
- a) What is time and frequency domain transformation? 2
 - b) Compute the DFT of $f(x) = \{1, -1, 3, 2\}$ 3
 - c) How do you convert spatial domain into frequency domain? 4
 - d) Apply contrast stretching technique on 3-bit gray level image of size 4x4. 6

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

POKHARA UNIVERSITY

Semester: Fall

Level: Bachelor

Programme: BT

Course: Image Processing and Pattern Recognition

Year: 2024

Full Marks: 100

Pass Marks: 45

Time: 3 hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) Define digital image processing? Explain briefly about Components of an Image Processing System. 8
- b) What is Neighborhood Operations in Image Enhancement? Derive Laplacian Filter Mask by using second order partial differential equation. 7

2. a) What is zooming? Illustrate with an example by interpolation and replication. 8
- b) What is histograms equalization? Perform the histogram equalization on the following 8-bit gray level image and also scale the intensity from 1 to 20. 7

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

3. a) What are the steps involved in frequency domain filtering? Explain the essential properties of 2-D Discrete Fourier Transform. 8
- b) What is Image Restoration? Explain any two Noise models along with their equations. 7
4. a) From the following probability distribution construct the Huffman Code for each gray level and find efficiency of the coding. 8

x_i	0	1	2	3	4	5
$p(x_i)$	0.05	0.1	0.25	0.15	0.3	0.15

- b) What do you mean by lossless image compression? Briefly explain predictive coding. 7

5. a) Define structuring elements, dilation and erosion in morphological image processing. Explain opening and closing with suitable examples. 7
- b) What do you mean by image segmentation, give the algorithm for basic adaptive thresholding. 8
6. a) What are two approaches of image's segmentation? Explain the process of image segmentation by region splitting and merging. 8
- b) Define pattern and pattern recognition system; explain the issues with feature selection. 7
7. Write short notes on: (Any two) 2x5
 - a) Template Matching
 - b) Steps of Pattern recognition system
 - c) Bayesian Classifier

POKHARA UNIVERSITY

Level: Bachelor
Semester: Spring
Programme: BE
Course: Image Processing and Pattern Recognition (New)

Year : 2025
Full Marks : 100
Pass Marks : 45
Time : 3 hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) Define sampling and quantization in image acquisition. How adjacency of the pixels affects connectivity and path between the pixels? Explain with suitable examples. 8
- b) List the basic gray level transformation technique. Perform the contrast stretching on the image given below. 7
2. a) What is histograms equalization? Perform the histogram equalization on the following 8-bit gray level image. 8

Gray level	0	1	2	3	4	5	6	7
Frequency	0	40	60	80	50	90	10	0

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

OR

- a) A grayscale image has poor contrast. Describe how histogram equalization improves the image quality. Illustrate with a sample histogram transformation. 7
- b) Explain different noise models in an image with the graphs and their PDF. 7
3. a) Define DFT Transform with its expressions? List out its properties and uses. 8

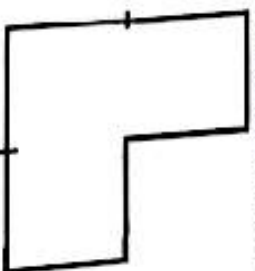
OR

Derive the Kernel for Haar transform of $N=2$ order.

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

- b) Define thresholding. How can we select the efficient threshold value for image segmentation? Mention limitations of single valued thresholding for global thresholding? How adaptive thresholding solve this issue? Explain. 7
4. a) Define Image Compression. Explain Lossless predictive coding with necessary diagram. 8
- b) What is edge detection? Explain the edge detection operators with mask. 7
5. a) Explain Huffman coding. Determine Huffman code for given image data and calculate the efficiency. 8
- b) Define shape number. How does the order of a descriptor determine the efficiency of shape representation? Demonstrate that shape numbers are origin-invariant with the help of given shape. 7

Gray Levels	0	1	2	3	4	5	6	7
Frequency	7	13	23	44	58	28	16	11



6. a) Define pattern and pattern recognition system. explain the steps use in pattern recognition. 8
- b) How SIFT keypoints can be used for feature extraction and classification? Explain. 7
7. Write short notes on: (Any two) 2*5
 - a) Discrete cosine transform
 - b) Image degradation/restoration model
 - c) Hopfield Network

Year : 2025
Full Marks : 100
Pass Marks : 45
Time : 3 hrs.

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks.

Attempt all the questions.

1. a) Derive Digital Image Processing? Explain the elements of Digital Image Processing Systems. 8
- b) Given the following gray level histogram of an image. Compute the gray levels after histogram equalization. 7

M	0	1	2	3	4	5	6	7
Gray Level	100	300	400	500	600	20	180	400

- | | | |
|-------|--|---|
| 2. a) | What do you mean by Image Enhancement in spatial domain? | 7 |
| b) | Compare how pass filter with high pass filter with example.
Define Haar transform. Perform Haar transform on Following Image. | 8 |

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

3. a) How can you detect edges with gradient filters? Give different first order derivative based (gradient) filters. 7
- b) Explain Image Restoration and Degradation Process with necessary diagrams. 8
4. a) Construct Huffman code for each gray level given and find the compression ratio and coding efficiency. 8

Gray Level	0	1	2	3	4	5	6	7
No. of pixels	30	35	38	10	15	10	35	80

- | | | |
|-------|---|---|
| b) | What is interpixel Redundancy? Compress the string "SHAI SHAMSHAIHA!" using LZW coding. | 7 |
| 5. a) | Explain Opening and Closing operations in image Processing with example. | 8 |

- b) Find the Shape Number for the following Boundary Image.

[illegible]

- | | |
|--|-----|
| 6. a) List the Different approaches of Image Segmentation? Explain segmentation by region splitting and merging algorithm. | 8 |
| b) What is an artificial neural network? Explain its architecture and discuss one real-world image processing application. | 7 |
| 7. Write short notes on: (Any two) | 2×5 |
| a) Bit plane slicing | |
| b) Thresholding | |
| c) Pattern Recognition | |