

POKHARA UNIVERSITY

Level: Bachelor

Semester: Fall

Year: 2022

Programme: BCIS

Course: Computer Graphics and Image Processing

Full Marks: 100

Pass Marks: 45

Time: 3 hrs.

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

Section "A"

Very Short Answer Questions

Attempt all the questions. [10×2]

1. How Digital Image processing could be used in Law Enforcement?
2. Explain about Thresholding.
3. Write expression for 2D forward and inverse Discrete Fourier Transform.
4. Explain the effect of noise in edge detection.
5. Define the term Radiance and Luminance.
6. What is image compression? Why is it needed?
7. Why do you apply the Erosion Operation?
8. Describe point detection method?
9. What is Chain code?
10. Find the bit planes of the given image?

6	3	1
5	3	2
6	7	1

Section "B"

Descriptive Answer Questions

Attempt any six questions. [6×10]

11. Explain lossless predictive coding with suitable block diagram. Calculate Huffman code for following symbols.

Symbol	A	B	C	D	E
Probability	0.1	0.15	0.3	0.4	0.05

12. For the given 4X4 image having Gray scales between [0,9] perform histogram equalisation and draw the histogram of image before and after equalisation 4x4 image.

$$\begin{bmatrix} 2 & 3 & 3 & 2 \\ 4 & 2 & 4 & 3 \\ 3 & 2 & 3 & 5 \\ 2 & 4 & 2 & 4 \end{bmatrix}$$

13. a) Derive the H_3 transformation matrix for Hadamard Transform.
b) Compute the DFT of the $x(n) = \{2, 4, -3, 6\}$

14. Explain three Noise probability density functions. How do you remove Periodic Noise by frequency domain filtering, explain?
15. a) Explain full color image processing for smoothing operation.
b) Explain algorithm for Basic Global thresholding with its associated problem.
16. Find opening and closing for the following image A and structuring element B.

$$A = \begin{array}{|c|c|c|c|c|c|} \hline 0 & 0 & 0 & 0 & 0 & 0 \\ \hline 0 & 0 & 1 & 1 & 0 & 0 \\ \hline 0 & 1 & 1 & 1 & 1 & 0 \\ \hline 0 & 0 & 1 & 1 & 0 & 0 \\ \hline 0 & 0 & 0 & 0 & 0 & 0 \\ \hline \end{array}$$

$$B = \begin{array}{|c|} \hline 1 \\ \hline 1^* \\ \hline 1 \\ \hline \end{array}$$

17. Given an image, "A" represents its pixel position. If A^* is the starting pixel, write down the 8-chain code and find the shape number of it.

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

Section "C"

Case Analysis

18. a) Describe intensity Level and Spatial Resolution of an image. [5]
b) Describe feed Forward Neural network and how it is important in image processing. [5]
c) Apply 3×3 Weighted Averaging on following image (only for Bold Pixel). [5]

20	22	30	30
22	20	20	20
22	12	12	20
25	25	20	20
21	17	18	15

- d) Explain image restoration and degradation process. [5]

POKHARA UNIVERSITY

Level: Bachelor

Semester: Spring

Year: 2021

Programme: BCIS

Full Marks: 100

Course: Computer Graphics and Image Processing

Pass Marks: 45

Time: 3 hrs.

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

Section "A"

Very Short Answer Questions

Attempt all the questions. [10×2]

1. Write down the equations for Euclidean distance and City block distance.
2. Why do you perform Image Enhancement operation?
3. Write down the expression for Ideal Low Pass filter with figures.
4. Define White noise.
5. Define the term Hue and Saturation.
6. Why do you apply the Dilation Operation?
7. Write down the Prewitt filter masks for detecting diagonal edges.
8. Obtain the digital negative of the following 8-BPP.

120	120	210
140	19	20
97	170	22

9. What is thresholding?
10. What is Neural Network?

Section "B"

Descriptive Answer Questions

Attempt any six questions. [6×10]

11. How many images of size 2048×1024 16-bits gray value can be stored in a 2024MB storage space? Derive the 4×4 transformation matrix for Haar Transform.
12. What is Image Compression, explain its type briefly? Consider the source with 7 messages to design the Huffman code to calculate the Compression Ratio (C_R) and Redundancy (R_D) for intensity values in following normalized histogram.

Gray Level (r_k)	0	1	2	3	4	5	6
$P(r_k)$	0.26	0.11	0.1	0.2	0.13	0.12	0.08

13. Electromagnetic waves can be visualized as a Sinusoidal waves, justify how? Differentiate DFT and FFT.
14. What do you mean by Morphological Operation? Explain dilation and erosion operation with expression and example. Justify opening and closing are dual transformation.

15. Explain the basic steps of filtering in Frequency Domain briefly. Explain the algorithm for Basic Global Thresholding with its associated problems.
16. Explain how neural network can be used for pattern recognition. Explain about Hamming Net and template matching.
17. Explain Image restoration process with block diagram. Explain about the Order-Statistic Filters to restore the Presence of Noise with expression.

Section "C"

Case Analysis

18. *Read the case situation given below and answer the questions that follow:*
[20]

Assume that you have an Image of size 6×6 . The image has different types of noise and your job is to remove all the noises. In addition to this, you also have to perform the image sharpening and smoothing operation for image enhancement for further analysis. Perform the following operations to achieve desire goals of the given image below.

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

- a) Apply the contrast stretching technique of the 3-bit gray level image of size 6×6 . [4]
- b) Weighted average filter at pixel (3,3) using filter mask 3×3 . [2]
- c) Median filter at pixel (3,3) using filter mask 3×3 . [2]
- d) Mean filter at pixel (3,3) using filter mask 3×3 . [2]
- e) Composite Laplacian filter at pixel (3,3) using filter mask 3×3 . [3]
- f) Obtain the digital negative of the image. [2]
- g) Perform the histogram equalization of the 3-bit gray level image of size 6×6 . [5]

POKHARA UNIVERSITY

Level: Bachelor

Semester: Fall

Year : 2020

Programme: BCIS

Full Marks: 100

Course: Computer Graphics and Image Processing

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.

Section "A"

Very Short Answer Questions

Attempt all the questions.

10×2

1. How do you convert analog to digital image?
2. Explain different level of image processing.
3. How pixel parameters $N_4(p)$, $N_8(p)$, $N_D(p)$ are correlated.
4. Find the bit planes of given 3x3 image.

5	2	0
1	0	7
6	7	5

5. How cons and rods cells interpreted with light?
6. What are elements of visual perception?
7. Explain distance measure.
8. Obtain the digital negative of the following 8-BPP.

180	220	230
160	120	190
0	110	252

9. What is noise in image?
10. Why FFT is faster than DFT?

Section "B"

Descriptive Answer Questions

Attempt any six questions

6×10

11. What is gray level image slicing? Explain the cons and rod cells as reaction of photon.
12. Consider the following image with the new pixel at (2,2) if the smoothing is done using a 3x3 bit neighbourhood finding.

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
13. 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?
14. What do you mean by Morphological Operation? Explain dilation and erosion operation with expression and example. Justify opening and closing are dual transformation.
15. What is convex hull? Write down the recursive relation for Walsh-Hadamard transform for kernel $N=4$.
16. Differentiate between lossless & lossy compression? Consider the source with 8 message to design Huffman code and efficiency for intensity values in following normalized histogram.
- | 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 |
17. What is neural network? Explain minimum distance classifier and template matching for pattern recognition.

Section "C"

Case Analysis

18. Comprehensive Analysis:

- | | |
|---|---|
| a) What is time and frequency domain transformation? | 2 |
| b) Compute the DFT of $f(x) = \{1, -1, 3, 2\}$ | 8 |
| c) How do you convert special domain into frequency domain? | 4 |
| d) Apply contrast stretching technique on 3-bit gray level image of size 4×4 . | 6 |

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

POKHARA UNIVERSITY

Level: Bachelor

Semester: Spring

Year : 2019

Programme: BCIS

Full Marks: 100

Course: Computer Graphics and Image Processing

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.

Section "A"

Very Short Answer Questions

Attempt all the questions.

10×2

1. How do you convert analog to digital image?
2. How pixel parameters $N_4(p), N_8(p), N_D(p)$ are corelated.
3. Find the bit planes of given 3×3 image.

7	6	2
0	1	7
7	2	4

4. What are elements of visual perception?
5. Obtain the digital negative of the following 8-BPP.

200	190	256
150	110	192
168	200	10

6. Define Dilation and Erosion operation.
7. Illustrate the general block diagram for image restoration.
8. Write filter matrices for Prewitt and Sobel filters.
9. What do you mean by Chain Codes?
10. Give two noise models with expression and diagram.

Section "B"

Descriptive Answer Questions

Attempt any six questions

6×10

11. Consider the following image with the new pixel at (2,2) if the smoothing is done using a 3×3 bit neighbourhood finding

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
12. a) Calculate 4×4 matrix for Haar Transform.
b) Apply 3×3 uniform averaging filter in the following image (for bold pixels only)

10	70	60	20	20
40	60	20	30	30
10	5	30	30	30
20	20	50	25	30
20	20	50	25	20

13. What is a Neural Network? Explain with structure of a perceptron and a neural network. Explain Minimum Distance Classifier and Template Matching for pattern recognition.
14. 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?
15. Define segmentation. List the properties of the pixel intensity on which different segmentation techniques are based. Explain different Region-based segmentation methods.
16. Differentiate between lossless & lossy compression?
Consider the source with 8 message to design Huffman code and efficiency for intensity values in following normalized histogram.

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

17. What do you mean by Morphological Operation? Explain dilation and erosion operation with expression and example. Justify opening and closing are dual transformation.

Section "C" Case Analysis

18. Comprehensive Analysis 20
- a) What is time and frequency domain transformation?
b) Compute the DFT of $f(x) = \{1, 0, -1, 2\}$
c) How do you convert spatial domain into frequency domain?
d) Apply contrast stretching technique on 3-bit gray level image of size 4×4 .

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

POKHARA UNIVERSITY

Level: Bachelor

Semester: Spring

Year : 2018

Programme: BCIS

Full Marks: 100

Course: Computer Graphics and Image Processing

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.

Section "A"

Very Short Answer Questions

Attempt all the questions.

10×2

1. What is digital image and digital image processing?
2. How do you convert analog to digital signal?
3. Design the electromagnetic wave theory.
4. Discuss about noise along with its possible types.
5. What is coding redundancy?
6. What is the key difference between Laplace and Fourier transform?
7. Find the bit planes of given 3x3 image.

1	2	3
2	3	1
6	7	3

8. What are the use of opening and closing operation?
9. What do mean by segmentation?
10. Define Hopfield nets.

Section "B"

Descriptive Answer Questions

Attempt any six questions

6×10

11. Describe the levels of image processing. What is the difference between computer graphics and image processing?
12. Consider the following image with the new pixel at (2,2) if the smoothing is done using a 3x3 bit neighbourhood finding.

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

- a) Mean Filter

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

13. Obtain the digital negative with histogram of the following 8-BPP of 145, 200, 34, 222, 252, 180, 195, 0, 15. Write down the recursive relation for Walsh-Hadamard transform for kernel N=4.
14. What is sampling and quantization? Apply the contrast stretching technique on 3-bit gray level image on 4X4.

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

15. What do you mean by Morphological Operation? Explain dilation and erosion operation with expression and example, what is the relationship between dilation and erosion?
16. What is coding redundancy? Construct Huffman code for intensity values in following normalized histogram.

Gray Level (r_k)	0	1	2	3	4	5	6
$P(r_k)$	0.2	0.04	0.06	0.4	0.15	0.05	0.1

17. Explain the steps of good pattern recognition. Explain how neural network can be used in pattern recognition?

Section "C"

18. Comprehensive Analysis

- a) What is frequency domain transformation? 2
- b) Compute the DFT of $f(x) = \{5, -1, 0, 2\}$ 8
- c) Explain the computation complexity of DFT and FFT. 4
- d) Apply contrast stretching technique on 3-bit gray level image of size 4x4. 6

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

B7th

POKHARA UNIVERSITY

Level: Bachelor
Programme: BCIS

Semester –Fall

Year : 2018
Full Marks: 100

Course: Computer Graphics and Image Progressing

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.

Section "A"

Very Short Answer Questions

Attempt all the questions.

10×2

1. Define Digital Image and Digital Image Processing.
2. Introduce Power Law Transform
3. Write expression for 2D forward Discrete Fourier Transform
4. Introduce Gaussian Low Pass filter.
5. What are steps for Image enhancement in Frequency Domain?
6. Define Image Restoration.
7. Write down filter matrix for 3×3 weighted averaging filters
8. What do you mean by Coding Redundancy in an Image?
9. Define Opening and Closing Operation.
10. What do you mean by Segmentation?

Section "B"

6×10

Descriptive Answer Questions

Attempt any six questions

11. Explain Run-Length coding and Loss-less predictive coding techniques for Image Compression.
12. Explain with Dilation and Erosion with suitable expressions and examples. Write down their properties.
13. Explain “Region Growing” and “Region Splitting and Merging” techniques for Image Segmentation.
14. Define Color Image. Describe pseudo color image processing.
15. Explain frequency domain filters to restore image with Periodic Noise.
16. Describe how “Shape Numbers” and “Fourier Descriptor” are useful for representing an object.
17. What do you mean by Neural Network? Explain how neural network can be used for pattern recognition.

2×10

Section "C"
Attempt all questions

18. a. Explain different types of pixel neighborhood in a Digital Image. 5
b. Apply 3x3 Averaging filter in Highlighted pixels in following image 5

10	9	9	20	21
12	9	9	21	21
12	9	8	22	23
12	8	8	22	23
11	7	8	22	23

19. a. Derive equalized histogram for following histogram of an Image. 5

Gray Level	0	1	2	3	4	5	6	7
Frequency	0	25	0	0	100	500	15	0

5

- b. Derive 4x4 transform matrix for Haar Transform.

POKHARA UNIVERSITY

Level: Bachelor
Programme: BCIS

Semester – Spring

Year : 2017
Full Marks: 100

Course: Computer Graphics and Image Processing

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.

Section "A"

Very Short Answer Questions

Attempt all the questions. 10×2

1. Define digital image and digital image processing.
2. Briefly explain Gray Level Slicing Operation?
3. Give two properties of Fourier Transform.
4. Write down steps for Image Enhancement in frequency domain.
5. Explain steps for Image Enhancement in frequency domain.
6. What are different noise models?
7. Differentiate First order derivate based filter with Second order derivative based filter.
8. What are different types of redundancy in an Image?
9. What are use of Opening and Closing operation?
10. How do you detect a point in an Image?

Section "B"

Descriptive Answer Questions

Attempt any six questions

11. Define Colour Image? Why color image is important? Explain different models for colour image representation.
12. What do you mean by coding redundancy? Calculate Huffman Code for intensity values in following normalized histogram.

Gray Level (r_k)	0	1	2	3	4	5	6
$P(r_k)$	0.2	0.04	0.06	0.4	0.15	0.05	0.1

13. What do you mean by Morphological Operations? Explain Dilation and Erosion Operation with expression and example, what is the relationship between Dilation and Erosion?
14. Why segmentation is important? What are different similarities based image segmentation techniques? Explain Basic Global Thresholding

based segmentation with algorithm.

15. Explain Band Reject and Notch filters for removing noise in Frequency Domain.
16. What do you mean by Decision Theoretic Pattern Recognition methods? Explain Minimum Distance Classifier and Template Matching for pattern recognition.
17. Explain a structure of single neuron/node? Explain how neural network can be used for pattern recognition?

Section "C"

Case Analysis

18. a) What are different types of connectivity and Distance Measure used in Image Processing? 5
- b) Apply 3x3 Uniform Averaging filter in following image (for bold pixels only). 5

10	70	60	20	20
40	60	20	30	30
10	5	30	30	30
20	20	50	25	30
20	20	50	25	20

19. a) Derive equalized histogram for following histogram of an Image. 5
- | Gray Level | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|------------|---|---|-----|-----|-----|-----|---|---|
| Frequency | 0 | 0 | 150 | 300 | 400 | 150 | 0 | 0 |

- b) Derive 4 x 4 transform matrix for Haar Transform. 5

ner

POKHARA UNIVERSITY

Level: Bachelor

Semester – Fall

Year : 2017

Programme: BCIS

Full Marks: 100

Course: Computer Graphics and Image Processing

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.

Section "A"

Very Short Answer Questions

Attempt all the questions. 10×2

- v Define digital image processing.
2. What are different types of Neighborhoods of pixels?
3. What are four different application areas of Digital Image Processing?
4. Write filter matrix for Prewit and Sobel filters.
5. What are probability density functions for Gaussian and Exponential noise?
6. Define Dilation and Erosion operation.
7. Write down steps for image enhancement in frequency domain.
8. Define lossless and lossy compression.
9. Define Neural Network.
10. Define pattern and pattern class.

Section "B"

Descriptive Answer Questions

Attempt any six questions

11. What do you mean by histogram and normalized histogram? Derive equalized histogram for following histogram of an Image.

Gray Level	0	1	2	3	4	5	6	7
Frequency	0	0	250	500	300	250	0	0

12. Write down expression for 1-D and 2-D forward and inverse DCT. Calculate transform matrix for Haar Transform for 4-points.
13. What do you mean by inter-pixel redundancy? Explain run length coding
14. Define Opening and Closing Operation. Discuss use of this operation. Write down their properties.
15. What do you mean by segmentation? Explain threshold based segmentation methods.
16. Explain different color models.

17. Describe chain code and signatures for object representation.

18.

Section "C"
Case Analysis

2×10

a) Apply 3x3 Uniform Averaging and Weightage Averaging Filter in following image for bold pixels.

10	70	60	20	20
40	60	20	30	30
10	5	30	30	30
20	20	50	25	30
20	20	50	25	20

b) While capturing an Image, Image is distorted by periodic noise from nearby electrical equipment. You are assigned to design a technique to eliminate that noise. Explain what will be technique you will use to restore image.

POKHARA UNIVERSITY

Level: Bachelor

Semester –Spring

Year : 2016

Programme: BCIS

Full Marks: 100

Course: Computer Graphics and Image Processing

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.

Section "A"

Very Short Answer Questions

 Attempt all the questions.

10×2

1. Give six application areas of Image Processing and Pattern Recognition.
2. What do you mean by Log Transform?
3. Give two properties of Fourier Transform.
4. Describe Ideal Low pass filter.
5. Explain steps for Image Enhancement in frequency domain.
6. Introduce Geometric and Harmonic Mean filters.
7. Write down filter matrix for 3x3 uniform averaging and weighted averaging filters.
8. What are different types of redundancy in an Image?
9. Define Dilation and Erosion operation?
10. How do you detect point in an Image?

Section "B"

Descriptive Answer Questions

Attempt any *six* questions

6×10

-  11. Explain different color models. Describe pseudo color image processing. 6+4
12. Find Huffman code for different intensity levels for image with following Histogram. Calculate Compression Ratio and Relative Redundancy with binary codin0g for the same. 8+2

Gray Level (r_k)	0	1	2	3	4	5	6
Frequency (n_k)	40	230	70	400	150	100	10

13. Define Opening and Closing Operation. Discuss use of these operation. Write down their properties. 3+3+4
14. What do you mean by image segmentation? What are different image segmentation techniques? Explain “Region Growing” segmentation 2+2+6

techniques

15. While capturing an Image, Image is distorted by periodic noise from nearby electrical equipment. You are assigned to design a technique to eliminate that noise. Explain the technique you will use to restore image in detail. 10
16. Explain Chain codes, Signatures and Fourier Descriptor for representing an object. 3+3+4
17. What are the characteristics of Neural Network? Explain how neural network can be used for pattern recognition. 3+7

Section "C"

Comprehensive Questions

Attempt all questions

18. a) Explain block diagram showing steps in Image Processing and Pattern Recognition. 5
- b) Derive filter matrix for Laplacian filter from basic principle of derivatives. 5
19. c) Derive equalized histogram for following histogram of an Image. 5

Gray Level	0	1	2	3	4	5	6	7
Frequency	0	0	350	500	300	150	0	0

- d) Derive 8x8 transform matrix for Hadamard Transform. 5