

# 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.*

1. 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
2. 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
3. a) What is histograms 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
4. a) What do you mean by predictive coding in image compression? Briefly explain the algorithm for lossy predictive coding using feedback. 7
- b) With necessary figures, explain the opening and closing. 7
5. a) Construct Huffman code for each gray level and find the compression 8

ratio and coding efficiency.

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
6. 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		

7. Write short notes on: (Any two) 2×5
- a) Neural Network
- b) Learning in perception network
- c) Dilation and Erosion

# POKHARA UNIVERSITY

Level: Bachelor

Semester: Spring

Year : 2018

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.*

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**Attempt all the questions.**

1. a) Define Digital Image Processing. Also discuss the various fundamental steps in DIP with block diagram. 8  
b) Discuss the importance of histogram modelling. Explain the algorithm for histogram equalization. 7
2. a) Explain the term intensity level slicing and bit plane slicing. Explain adaptive median filter with suitable algorithm for its implementation. 7  
b) Write expression for forward and inverse Discrete Fourier Transform (DFT) for 2D signal. What are the properties of DFT? 8
3. a) Define Hadamard Transform and derive the  $8 \times 8$  transform matrix for Hadamard Transform. 8  
b) Explain about the noise restoration model. How the periodic noise occurring in an image can be removed? 7
4. a) Define Redundancy. What are image compression techniques? Source generate the symbol  $s_1, s_2, s_3, s_4, s_5$  randomly with probability  $p_1=0.4, p_2=0.2, p_3=0.2, p_4=0.1$  and  $p_5=0.1$  respectively. Generate the codeword for each symbol using Huffman coding. 8  
b) Discuss the importance of image compression. Explain lossless Predictive coding with block diagram 7
5. a) With necessary figures, explain the opening and closing. 8  
b) How can you detect edges with gradient filters? Give different first order derivative based (gradient) filters. 7

6. a) What do you understand by image segmentation? How discontinuity based segmentation approach is performed in image? Explain. 8
- b) What is pattern and pattern classes? How is an object recognized by minimum distance classifier? 7
7. Write short notes on: (Any two) 2×5
- a) Pattern Recognition
- b) Fourier Descriptor
- c) Bayesian Classifier



# POKHARA UNIVERSITY

Level: Bachelor

Semester: Fall

Year : 2017

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.*

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*Attempt all the questions.*

1. a) What is digital image? How is it represented? Explain briefly about the elements used in image processing? 8  
b) What do you mean by distance measures in image processing system? Explain with types. 7
2. a) Define Point Operation. Explain the technique used by Bit plane intensity level slicing for the purpose of image enhancement. 8  
b) What is histogram? What is the importance of histogram modeling in image processing? Given the following gray level of an image. Compute the gray levels after histogram equalization. 7  

Grey Level	0	1	2	3	4	5	6	7
Frequency	790	1024	850	65	329	245	122	81
3. a) Differentiate between Spatial domain enhancement and Frequency domain enhancement. Mention the properties of Fourier transform 7  
b) Explain different technique used to sharpen an image. Explain Hadamard Transform. 8  
a) Compare different types of Noise in terms of Spatial and frequency Properties. Suggest Corresponding filtering techniques for each type of Noise. 8  
b) Explain the basic concept of differential predictive coding in terms of lossless coding with suitable figure. 7
5. a) Define Dilation, Erosion, Opening and Closing. Choose different objects and structuring elements to show the result of these operations. 8  
b) What is region based segmentation? Explain the types of region segmentation. 7

6. a) Explain edge detection techniques with its assumption. Explain Hough transform for detecting lines with suitable figures. 8
- b) What is pattern recognition? How does pattern/image is recognized by a computer? 7
7. Write short notes on: (Any two) 2×5
- a) Hopfield Network
- b) Run Length Coding
- c) Shape number and chain codes

# POKHARA UNIVERSITY

Level: Bachelor

Semester: Fall

Year : 2020

Programme: BE

Full Marks: 100

Course: Image Processing and Pattern Recognition

Pass Marks: 45

Time : 3hrs.

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*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

3. 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
4. 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



b) Differentiate between lossless and Lossy Compressions. 7

5. a) Find Dilation and Erosion for the following image A and structuring element B. 7

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

A

1
1
1

B

b) Explain basic global thresholding and region splitting in image segmentation with example. 8

6. a) Describe Edge Detection method for Image Segmentation 7

b) Define Chain codes. Explain 4 and 8-connectivity segments to explain chain codes with suitable examples. 8

7. Write short notes on: (Any two) 2×5

a) Neural Network in Image Processing

b) Pattern recognition in Image

c) Spatial low pass filter.



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*Attempt all the questions.*

1. a) What is a digital Image? Explain the fundamental steps in Digital Image Processing. 7  
b) Compute the histogram equalization from the given data. 8  

$r_k$	0	1	2	3	4	5	6	7
$n_k$	5320	1000	500	525	1236	956	128	856
2. a) What is zooming? Illustrate with an example the concept of zooming by interpolation and replication. 7  
b) What are the basic steps for filtering an image in frequency domain? Elaborate with examples. 8
3. a) Calculate Haar transform T from given image matrix F. 7  
F=  

1	0	0	1
1	1	0	1
1	0	1	0
1	0	1	1
- b) Explain the noise degradation and restoration model with necessary diagram in detail. 8
4. a) Define Redundancy. Suppose a source generates the symbols s1, s2, s3, s4, s5 randomly with probability p1=0.4, p2=0.2, p3=0.2, p4=0.1 and p5=0.1 respectively. Generate the code-word for each symbol using Huffman coding and also calculate entropy and efficiency. 8  
b) Explain Lossy Predictive Coding along with required equations and suitable block diagram. 7
5. a) Compare and explain the process of Dilation and Erosion in image processing with necessary equations and suitable figures. 8

- b) Explain image segmentation by Threshold method. 7
6. a) Explain the region growing technique for image segmentation. What are the problems associated with it? 8
- b) What is neural network? Explain how it can be used for pattern recognition. 7
7. Write short notes on: (Any two) 2×5
- a) Pattern recognition system
- b) Shape number
- c) Decision Theoretic Method