

GOVERNMENT COLLEGE OF ENGINEERING & CERAMIC TECHNOLOGY
AN AUTONOMOUS INSTITUTE
AFFILIATED TO MAKAUT (FORMELY KNOWN AS WBUT)
Theory / B. Tech / CSE / SEM - V / Code – PE(CS) 501B / 2016-17
Paper Name: Image Processing

Full Marks: 75

Time Allotted: 3 hours

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

GROUP – A

[MCQ Type Questions][Compulsory]

1. Choose the correct alternative of the following questions. Answer all questions. **10 x 1 = 10**

- i) To remove "salt-and-pepper" noise without blurring we use
 - a) Max Filter
 - b) Median Filter
 - c) Min Filter
 - d) Smoothing Filter
- ii) -----Filter cannot be implemented using convolution mechanism.
 - a) Average
 - b) Gaussian
 - c) Median
 - d) Disk
- iii) Both the ----- and ----- filters are used to enhance horizontal edges (or vertical if transposed).
 - a) Prewitt and Sobel
 - b) Sobel and Gaussian
 - c) Prewitt and Laplacian
 - d) Sobel and Laplacian
- iv) What will be the number of bits required to store a 256 X 256 image with 32 gray levels?
 - a) 256 bits.
 - b) 327680 bits.
 - c) 255 bits.
 - d) 256 x 256 x 32 bits.
- v) One of the following functions is not an IPT (image processing toolbox) function used to convert images.
 - a) dither ()
 - b) rgb2gray ()
 - c) gray2rgb ()
 - d) ind2gray ()
- vi) The negative of an image with gray levels in the range [0,L-1] is obtained by using the –Ve transformation, which is given by equation.
 - a) $s=L-1-r$
 - b) $s=L-1+r$
 - c) $s=L-1$
 - d) $s=L-r$
- vii) Transforming the pixel values of an image using the log () transformation is an example of contrast compression of the dark pixels.
 - a) True
 - b) False
- viii) The sum of all elements in the mask of the smoothing averaging spatial filtering must be equal to
 - a) m rows
 - b) n columns
 - c) $m * n$
 - d) 1
- ix) Image restoration usually uses a model that is based on _____.
 - a) Additive noise
 - b) Multiplicative noise
 - c) Division noise
 - d) Subtractive noise
- x) When you store an image in Matlab, you should store it as -----image and when you are processing an image, you convert it to -----
 - a) uint16, double
 - b) double , uint16
 - c) uint8 , double
 - d) double, uint8

GROUP – B
[Short Answer Type Questions]
Answer any four of the following

4 x 5 = 20

2. Briefly explain in your own words the relationship between filtering in the Spatial Domain to its effect in the Frequency Domain. Write the mathematical expression relating the convolution operation in the two domains. [3+2]
3. a) What is the use of dynamic range compression of an image?
 b) What is gamma correction?
 c) A captured image appears very dark because of wrong lens aperture setting. Which enhancement technique is appropriate to enhance such an image? [2+2+1]
4. a) State the condition of transformation function $s=T(r)$.
 b) What do you mean by Point processing?
 c) Give the mask used for high boost filtering [2+2+1]
5. Provide a model of the image degradation and restoration process in block diagram form. Write its mathematical expressions in both spatial and frequency domains. [2.5+2.5]
6. Explain the Gray-level slicing concept, its two methods and plots. [5]
7. a) What is unsharp masking?
 b) Give a 3x3 mask for performing unsharp masking in a single pass through an image. [3+2]

GROUP – C
[Long Answer Type Questions]
Answer any three of the following

3 x 15 = 45

8. a) Determine the
 - i) D_e
 - ii) D_4
 - iii) D_8
 - iv) D_m
 Distances between p and q when $V=\{1,2\}$

					q
	3	2	2	1	1
	2	3	1	2	0
	2	4	1	0	2
	0	1	2	1	3
p	1	0	1	2	1

- b) What are the three attributes of a color?
 - c) Distinguish between digital image and binary image. [2+2+2+3+3+3]
9. a). Explain the concept of Histogram Equalization, consider the following example with 4x4 matrix of a 3-bit image.
 What will be the output matrix? Show the histogram before and after equalization.

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

- b) Discuss about Image subtraction and Image averaging.
 - c) Suppose a digital image is subjected to histogram equalization. What effect will a second pass equalization have over the equalized image? [8+5+2]

10. The following figures show:

- a 3-bit image of size 5-by-5 image in the square, with x and y coordinates specified,
- a Laplacian filter and
- a low-pass filter.

Y \ X	Image				
	1	2	3	4	5
1	3	7	6	2	0
2	2	4	6	1	1
3	4	7	2	5	4
4	3	0	6	2	1
5	5	7	5	1	2

Laplacian mask		
0	1	0
1	-4	1
0	1	0

Low pass filter		
0.01	0.1	0.01
0.1	0.56	0.1
0.01	0.1	0.01

Compute the following:

- The output of a 3×3 mean (average) filter at (3, 3).
- The output of the 3×3 Laplacian filter shown above at (3, 3).
- The output of the 3×3 low-pass filter shown above at (3, 3).
- The histogram of the whole image.
- What are the differences between Enhancement and Restoration?
- What are the types of noise models?

[(2+2+2+3) + 3+3]

11. a) Explain the differences between regular and adaptive thresholding. Give examples of when each type should be used.

b) Suppose an image contains two types of regions, R1 and R2. The a priori probability that a pixel belongs to R1 is P_1 and to R2 is P_2 . Probability density function of intensity in R1 and R2 are Gaussian with mean μ_1 and μ_2 and standard deviations σ_1^2 and σ_2^2 respectively.

Determine the optimum threshold for image segmentation by the gray level thresholding technique. [6+9]

12. a) What do you mean by Morphology?

b) What do you mean by Dilation?

c) What do you mean by Erosion?

d) What do you mean by morphological opening and closing operation on the image?

[3+3+3+6]

13. a) What are the importance of color in image processing?

b) Define colour models.

c) Define pseudo-colouring.

d) What do you understand by Image Compression?

e) What is meant by lossy compression?

f) Draw the image compression model.

[2+2+2+2+2+5]
