



RM-7737

B. E. IV (Sem. VIII) (EC) Examination

April / May – 2010

Image Processing (Elective - II)

Time : 3 Hours]

[Total Marks : 100

**Instruction :**

(1)

નીચે દર્શાવેલ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી. Fillup strictly the details of signs on your answer book.	Seat No. :
Name of the Examination :	<input type="text"/>
<input type="text" value="B. E. 4 (Sem. 8) (EC)"/>	<input type="text"/>
Name of the Subject :	<input type="text"/>
<input type="text" value="Image Processing (Elective - 2)"/>	<input type="text"/>
Subject Code No. : <input type="text" value="7"/> <input type="text" value="7"/> <input type="text" value="3"/> <input type="text" value="7"/>	<input type="text"/>
Section No. (1, 2,.....) : <input type="text" value="1&amp;2"/>	<input type="text"/>
	Student's Signature

- (2) Answers to the **two** sections must be tied separately.
- (3) Assume suitable data wherever **necessary**.
- (4) Figures to the **right** indicate full marks.
- (5) Attempt all questions.

**SECTION - I**

- 1 Answer the following questions : 18
  - (i) Consider an image of size M \*M. How many bits are required to store this image? 1
  - (ii) Define Boundry of a Region. 1
  - (iii) Which filter can be used to blurr the image? 1
  - (iv) Find out Relative data redundancy and compression ratio for data n1 = 3 and n2 = 2.7. 2
  - (v) What is the use of mapper in the source encoder? 1
  - (vi) Explain Shanon's second theorem for noisy coding. 1
  - (vii) LZW compression can be applied on which image file formats? 1
  - (viii) Give the name of the methods for zooming the image and explain any one. 5
  - (ix) Explain 4-adjacency, 8-adjacency and M-adjacency with example. 5
- 2 Attempt any **two** : 16
  - (a) A Gaussian lowpass filter in the freq. domain has the transfer function.

$$H(u, v) = Ae^{-\left(u^2 + v^2\right) / 2 \sigma^2}$$

Show that the corresponding filter in the spatial domain has the form

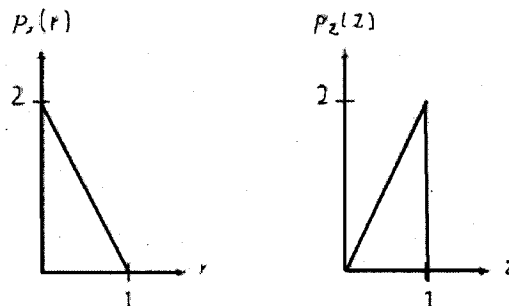
$$h(x, y) = A 2 \pi \sigma^2 e^{-2 \pi^2 \sigma^2 (x^2 + y^2)}$$

- (b) Explain the Laplacian method in the frequency domain.
- (c) Prove that when  $(-1)^{x+y}$  is multiply with  $F(x,y)$  then it will shift the origin of  $F(x,y)$  to the frequency coordinates  $(M/2, N/2)$

- 3** Attempt any two : **16**
- (a) Classify the Data Redundancy and Explain the Coding Redundancy with example.
  - (b) Decode the LZW encoded stream of [39 39 126 126 256 258 260 259 257 126]. Code book must be reproduced as the output is decoded.
  - (c) Explain loss less predictive coding.

### SECTION - II

- 4** (a) Attempt the following : **9**
- (i) Explain the concept of log transformation and power law transformation with its usefulness.
  - (ii) What is histogram and explain concept of histogram processing.
  - (iii) Discuss the limiting effect of repeatedly applying  $3 \times 3$  lowpass spatial filter to a digital image. You may ignore border effects.
- (b) Explain an importance of spatial filtering. Explain **5**  
the following spatial filters :
- (i) Average filter (ii) High boost filter
- (c) An image has the gray level PDF  $P_r(r)$  shown in the **6**  
following diagram. It is desired to transform the gray levels of this image so that they will have the specified  $P_z(z)$  shown. Assume continuous quantities and find the transformation (in terms of  $r$  and  $z$ ) that will accomplish this.



**Fig. 1**

5 Attempt any two :

(a) Prove the (a) validity of duality theorem

$$(A \cdot B)^C = (A^C \circ \hat{B}) \quad (b) \quad (A \cdot B) \cdot B = (A \cdot B)$$

(b) Let A denote the set shown shaded in the following figure. Refer to the SE shown (black dot shows the origin). Sketch the result of following morphological operation.

(i)  $(A \oplus B^1) \oplus B^3$     (ii)  $(A \ominus B^4) \oplus B^2$ .

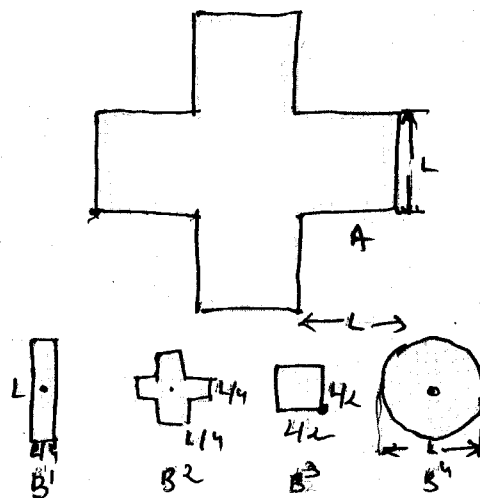


Fig. 2

(c) Explain an importance of erosion operation with necessary example. What is the limiting effect of repeatedly eroding an image? Assume that a trival (one point) SE is not used.

6 Attempt any two :

(a) Show that the sobel and prewitt gradient masks give isotropic results only for horizontal and vertical edges, and for edges oriented at  $\pm 45^\circ$ .

(b) A binary image contains straight lines oriented horizontally, vertically, at  $45^\circ$  and at  $-45^\circ$ . Give a set of  $3 \times 3$  masks that can be used to detect 1-pixel-long breaks in these lines. Assume that the gray level of the lines is 1 and that the gray level of the background is 0.

(c) What is Hough transform? Explain its importance for edge linking.