

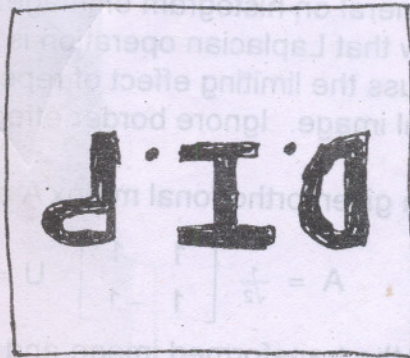
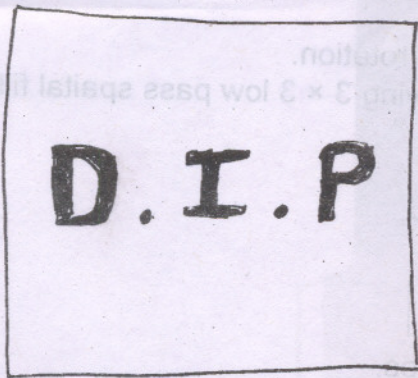
(REVISED COURSE)

(3 Hours)

[Total Marks : 100

- N.B. : (1) Question No. 1 is **compulsory**.
 (2) Attempt any **four** questions from remaining **six**.

1. (a) A CCD camerachip of dimensions 7×7 mm and having a resolution of 1024×1024 elements is focused on a square flat area, located 0.5m away. How many line pairs/mm will this camera be able to resolve. The camera is equipped with a 35 mm lens. 5
- (b) Explain the process of image averaging. 5
- (c) Explain intensity slicing technique used in pseudocolor image processing. 5
- (d) A binary image contains straight lines oriented horizontally, vertically, at 45° and at -45° . Give a set of 3×3 masks that can used to detect 1 – pixel long breaks in these lines. Assume that gray level of the lines is 1 and gray level of background is zero. 5
2. (a) Consider the images shown. The image on right is obtained by— 10
- multiplying image on left by $(-1)^{x+y}$
 - by computing DFT.
 - taking complex conjugate of transform
 - computing inverse of DFT
 - multiplying the real part by $(-1)^{x+y}$.
- Explain (mathematically) why image on right appears as it does.



- (b) Suppose that you are given a set of images generated by an experiment dealing with Stellar events. Each image consists of a set of bright, widely scattered dots corresponding to stars in sparsely occupied section of universe. The problem is that stars are barely visible, due to superimposed illumination resulting from atmospheric dispersion. If these images are modelled as a product of constant illumination component with a set of impulses, give an enhancement procedure based on homomorphic filtering designed to bring out the image components due to stars themselves. 10

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3. (a) Find the edge corresponding to minimum cost path in subimage as shown.

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2	1	0
1	1	7
6	8	2

Assume that edge starts in first column and ends in last column.

- (b) Justify : Poorly illuminated images cannot be segmented easily.

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4. (a) Explain the following boundary descriptors –

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- (i) Statistical Moments
- (ii) Shape numbers.

- (b) What is limiting effect of repeatedly–

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- (i) Dilating an image
- (ii) Eroding an image.

Assume that trivial (one point) structuring element is not used.

5. (a) Explain use of LZW coding for image compression.

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- (b) Describe JPEG 2000 image compression standard.

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6. (a) What would be effect of setting to zero the lower order and higher order bit planes in general on histogram of image.

6

- (b) Show that Laplacian operation is invariant to rotation.

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- (c) Discuss the limiting effect of repeatedly applying 3×3 low pass spatial filter to a digital image. Ignore border effects

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7. (a) For a given orthogonal matrix A and image U,

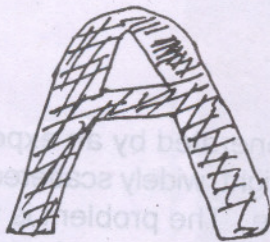
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$$A = \frac{1}{\sqrt{2}} \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix} \quad U = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

Find the transformed image and basis images.

- (b) Find Euler number of following regions.

5



- (c) Explain CMY and CMYK color models.

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