Total number of printed pages–5

53 (EC 714) DIPR

2021

DIGITAL IMAGE PROCESSING

Paper : EC 714

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* State Nyquist criteria in 2D sampling. State ideal sampling and practical sampling in image processing. 15

   (b) State a few applications of image proeessing in astronomical science. 5

2. *(a)* Show that in uniform quantization, the mean quantization error = $\frac{\Delta^2}{12}$, where Δ is the step height for quantization. 10

Contd.

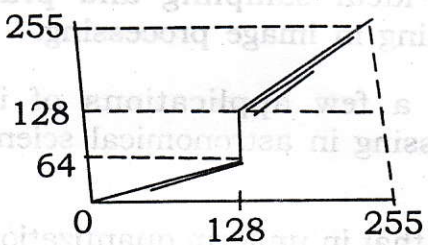
(b) State the differences between correlation and convolution. If $x_1(n)$ and $x_2(n)$ are two sequences, show that the cross-correlation between them is $X_{corr}(x_1(n), x_2(n)) = x_1(n) * x_2(-x)$. 5

(c) Perform convolution between the following sequences : 5

$x_1(n) = [1\,2\,3\,4]$

$x_2(n) = [-1\,-2\,-3\,-4]$

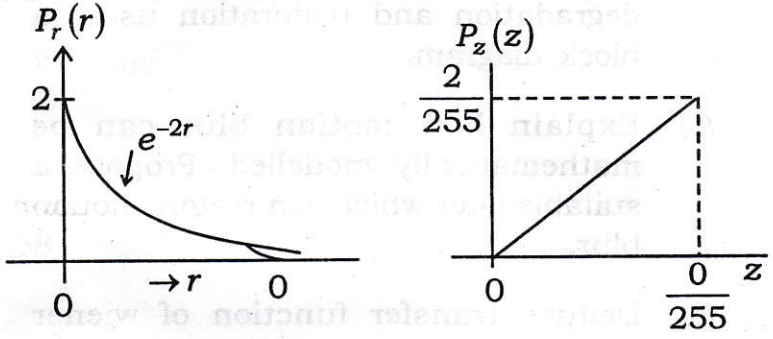
3. (a) State piecewise linear contrast stretching the transfer function of a contrast stretching example is given below. Find the modified image. 3+9



the given image E is

$$\begin{bmatrix} 40 & 42 & 22 \\ 146 & 200 & 20 \\ 70 & 100 & 240 \end{bmatrix}$$

(b) There are two histograms given below. The first histogram is the histogram of the input image and the second histogram is the specified histogram. Find the transfer function of the image transformation. 8



4. (a) What is the speciality of DCT over Fourier transform? Write down the forward and reverse transformation equations of DCT for 2D images. 2+3=5

(b) Describe the advantages of Hadamard transform compared to other orthogonal transformations. Show how H_8 can be obtained from H_4. 2+4=6

(c) Find out the knowcker product $A \ominus B$ 5

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

(d) Name *one* parameter for edge detection and state how such a filter mask you can generate. 4

5. (a) Explain what do you mean by image degradation and restoration using a block diagram. 4

(b) Explain how motion blur can be mathematically modelled. Propose a suitable filter which can restore motion blur. 8

(c) Deduce transfer function of wiener filter. 8

6. (a) Write few applications of image compression. 4

(b) What is the lossless predictive coding? State how the model can be modified to a lossy predictive coding. Explain why lossy predictive coding will result more compression. 10

(c) Define redundancies. What are the different types redundancies present in an image. Differentiate these redundancies briefly. 6

7. Write short notes on : ***(any two)*** 10×2=20

(a) Homomorphic filtering

(b) Fast Fourier transform

(c) K-L transform

(d) JPEG.
