B.Tech Odd Semester (CBCS) Exam., December—2016

INFORMATION TECHNOLOGY

(7th Semester)

Course No. : IT–701

(Image Processing)

Full Marks : 75
Pass Marks : 30

Time : 3 hours

Note : 1. Attempt **one** question from each Unit.
2. Begin each answer in a new page.
3. Answer parts of a question at a place.
4. Assume reasonable data wherever required.
5. The figures in the margin indicate full marks for the questions.

UNIT—1

1. *(a)* Differentiate between analog image processing and digital image processing.

(b) What is the storage requirement of a 1024×1024, 8-level gray scale image?

(c) Consider a colour 1024×1024 image. If this image is transmitted across a channel of 2 Mbps, what will be the transmission rate?

(d) Compare pseudocolour image and true colour image.

(e) What is meant by contrast? What do you mean by resolution?

2+3+3+3+(2+2)=15

2. *(a)* What are image sampling and quantization? What is the result of a poor quantization effect?

(b) Define contrast and resolution. Write their significance in image quality.

(c) Compare gray image with the binary image.

(d) An image is 2400 pixels wide and 2400 pixels high. The image was scanned at 300 dpi. What is the physical size of the image?

(3+2)+(3+3)+2+2=15

UNIT—2

3. *(a)* Define Euclidean distance, city-block distance and chess-board distance.

(b) Consider two pixels p and q whose coordinates are (0, 0) and (6, 3) respectively. Calculate the D_e, D_4 and D_8 distances between the pixels p and q.

(c) What are the image arithmetic operations? Discuss. 6+3+6=15

4. *(a)* Why are transforming methods essential in image processing? What do you mean by unitary transform?

(b) "A 2D image can be conceived from two 1D transforms." Explain.

(c) What is the DC component of any image? Find DC component of the image

$$f = \begin{matrix} 1 & 11 & 6 \\ 9 & 8 & 7 \\ 4 & 5 & 3 \end{matrix}$$

(d) "The product of two orthogonal matrices is another orthogonal matrix." Prove. (2+2)+3+4+4=15

UNIT—3

5. *(a)* Write down the expressions of image quality metrics :

(i) MSE

(ii) SNR

(iii) PSNR

(b) For a reference image

$$f(x, y) = \begin{matrix} 1 & 3 & 5 \\ 4 & 4 & 3 \\ 5 & 2 & 2 \end{matrix}$$

and

$$f(x, y) = \begin{matrix} 1 & 2 & 4 \\ 4 & 4 & 2 \\ 5 & 2 & 1 \end{matrix}$$

compute MSE, SNR and PSNR.

(c) What is the histogram representation of an image? Why is it helpful in image processing?

(d) What would be the effect on the histogram of an image if lower-order bit planes are set to zero? 6+3+(2+2)+2=15

6. *(a)* Define the term 'image enhancement'.

(b) What are low-pass filter and high-pass filter? What is the use of repeated application of low-pass or high-pass filters to an image?

(c) Is there any advantage of frequency domain filters over spatial filters? Justify your answer.

(d) Describe image smoothing spatial filters. Define and state the utility of median and max filters in this context.

2+(3+2)+3+(3+2)=15

UNIT—4

7. *(a)* Consider an image F with size m n. Write down the equations of sample mean, variance and standard deviation of the image F.

(b) How can you flip the image F vertically and horizontally? Write a program or algorithm to implement the horizontal and vertical flips.

(c) Describe the techniques for detecting the point and line discontinuities in a gray level digital image. 3+(3+3)+6=15

8. *(a)* Briefly define the following noise categories based on distribution :

(i) Gaussian distribution

(ii) Salt-and-pepper noise model

(iii) Gamma distribution

(b) Discuss the advantages and disadvantages of Wiener filter.

(c) How does pseudo-inverse filtering help in image restoration?

(d) Discuss direct estimation technique and indirect estimation technique in blind image restoration. (2×3)+4+2+3=15

UNIT—5

9. *(a)* Consider a one-dimensional image

$f(x)$ [10 10 10 10 40 40 40 40 20 20]

What are the first- and second-order derivatives?

(b) Discuss any two edge detection operators in brief.

(c) Write down the steps of region-growing algorithm.

(d) Consider an image

$$f(x, y) \quad \begin{matrix} 1 & 0 & 7 & 8 & 7 \\ 0 & 1 & 8 & 9 & 8 \\ 0 & 0 & 7 & 9 & 8 \end{matrix}$$

State the result of region-growing algorithm. 2+4+5+4=15

10. *(a)* Explain global processing via Hough transform. Discuss a method for estimating thresholds that produce the minimum average segmentation error.

(b) Discuss in detail the stages of any edge detection algorithm.

(c) Consider an image

$$f(x, y) = \begin{matrix} 1 & 2 & 5 \\ 5 & 5 & 5 \\ 5 & 3 & 2 \end{matrix}$$

Show the output of any edge detection algorithm. (4+4)+4+3=15

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