SPECIAL SUPPLE B.TECH/CSE/8ᵀᴴ SEM/CSEN 4262/2018

IMAGE PROCESSING
(CSEN 4262)

Time Allotted : 3 hrs   **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

   (i) An image is considered to be a function of f(x, y) where f represents
      (a) height of image   (b) width of image
      (c) amplitude of image   (d) resolution of image.

   (ii) Sampling of an image is required for
      (a) quantization   (b) sharpening
      (c) smoothing   (d) digitization.

   (iii) An image function *f(x, y)* is characterized by *f(x, y) = i(x, y)r(x, y)* where
      (a) $0 < i(x, y) < 1$ & $0 < r(x, y) < \infty$
      (b) $0 < i(x, y) < 1$ & $0 < r(x, y) < 1$
      (c) $0 < i(x, y) < \infty$ & $0 < r(x, y) < \infty$
      (d) $0 < i(x, y) < \infty$ & $0 < r(x, y) < 1$.

   (iv) In 8-distance measurement system distance between centre pixel and a corner pixel is
      (a) 2 unit   (b) $\sqrt{2}$ unit
      (c) 1 unit   (d) 1.5 unit.

   (v) Median filter is used to remove
      (a) salt-and-pepper noise   (b) Speckle noise
      (c) periodic noise   (d) Gaussian noise.

   (vi) Segmentation is a process that partitions image into
      (a) blocks   (b) regions
      (c) pixels   (d) vertices.

(vii) The D_4 distance (city block distance) between p and q with coordinates (x, y), (s, t) is defined as
(a) $|x-s|+|y-t|$
(b) $\max(|x-s|,|y-t|)$
(c) $[(x-s)2+(y-t)2]$ ½
(d) $\min(|x-s|,|y-t|)$.

(viii) An image of size 1024 × 1024 pixels in which the intensity of each pixel is an 8 bit quantity requires the storage space (if not compressed)
(a) 1 KB
(b) 1 MB
(c) 2 KB
(d) 2 MB.

(ix) Image restoration techniques are
(a) objective
(b) subjective
(c) objective and based on mathematical or probabilistic model
(d) subjective and based on mathematical or probabilistic model.

(x) Dilation-Morphological image operation technique is used to
(a) shrink brighter areas of the image
(b) diminishes intensity variation over the image
(c) expands brighter areas of the image
(d) scales pixel intensity uniformly.

Group - B

2. (a) What are the various steps in image processing? Explain briefly.

(b) What do you mean by neighbours of a pixel? Define 4, 8 adjacency of pixels in a gray scale image.

(c) Explain the following terms with respect to digital image capturing:
(i) Sampling
(ii) Quantization

4 + (1 + 3) + (2 + 2) = 12

3. (a) Write down some of the applications of Image processing?

(b) Define city Euclidean distance, block distance and chess board distance.

(c) Explain image addition and subtraction with example. What are the applications of those two?

2 + (2 + 2 + 2) + (2 + 2)=12

Group - C

4. (a) Define histogram?

   (b) Perform histogram equalization of the following image:

   $$
   \begin{matrix}
   1 & 3 & 5 \\
   4 & 4 & 3 \\
   5 & 2 & 2
   \end{matrix}
   $$

   (c) Explain image negative with suitable example.

   2 + 6 + 4 = 12

5. (a) What do you mean by salt and pepper noise? Justify the statement "Median filter is an effective tool to minimise salt-and-pepper noise" through an illustration.

   (b) What is spatial filtering? Differentiate linear spatial filter and non-linear spatial filter.

   (c) Explain high boost filtering.

   (2 + 4) + (1 + 2) + 3 = 12

Group - D

6. (a) Discuss about the model of the image degradation/restoration process.

   (b) Write down short notes on order statistics filters.

   6 + 6 = 12

7. (a) Write down differences between lossless and lossy image compression?

   (b) Calculate the Huffman code for the following symbol whose probability of occurrence is given below:

Symbol	Probability
a	0.4
b	0.3
c	0.2
d	0.1

   Show that the Huffman code is not unique for the above example.

   3 +(6 + 3) = 12

Group - E

8. (a) Explain dilation and erosion process with example?

   (b) Explain the following morphological algorithms
       (i) Thinning
       (ii) Thickening.

   (2 + 2) + (4 + 4) = 12

9. (a) Explain Sobel, Roberts, Prewitt operator for edge detection.

   (b) Explain split and merge algorithm for segmentation.

   6 + 6 = 12