(c) Explain using diagrams what will be the result of erosion and dilation, given set A: a square with sides=d and structuring element set B: a square with sides=d/4.

(d) Mention one use of erosion and one use of dilation in morphological processing.

4 + 2 + 2 + 2 + 2 = 12

9. (a) What is meant by edge linking? Explain edge linking using by local processing.

(b) Distinguish between local and global thresholding techniques for image segmentation. Write down the drawbacks of watershed algorithm based image segmentation.

2 + 6 + 2 + 2 = 12

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 any 5 (five) from Group B to E, taking at least one 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) The number of shades of gray in a six-bit image is
(a) 256 (b) 128
(c) 64 (d) 32.

(ii) The smallest discernable change in intensity level is called _____.
(a) color (b) saturation
(c) contrast (d) intensity resolution.

(iii) Smoothing spatial filters are used for
(a) blurring (b) noise reduction
(c) a & b (d) none of these.

(iv) Median filter belongs to which of the following categories?
(a) Linear spatial filter (b) Laplacian filter
(c) Frequency domain filter (d) Order statistic filter.

(v) The D4 distance between the pixels (5, 6) and (15, 20) is
(a) 24 (b) 14
(c) 17.2 (d) 10.

(vi) The effect of low pass filtering in an image is
(a) contrast enhancement (b) sharpening
(c) blurring (d) resizing.

(vii) The operator which detects edge in an image is
(a) logarithm (b) exponential
(c) gradient (d) average.

(viii) Image restoration is used to improve the _____ of the image.
(a) color (b) intensity
(c) quality (d) noise.

(ix) Example of lossy compression is
(a) motion Compensation (b) frame Replenishment
(c) quantization (d) huffman Encoding.

(x) The Laplacian $\nabla^2 f=[f(x+1, y) + f(x-1, y) + f(x, y+1) + f(x, y-1) - 4f(x, y)]$, gives an isotropic result for rotations in increment by what degree?
(a) 90^o (b) 0^o
(c) 45^o (d) None of the mentioned.

Group - B

2. (a) Explain briefly the various steps of image processing.

(b) How many minutes are needed to transmit a 512×512 image with 256 gray levels at 300 baud (bits/second) rate for transmission? The transmission is done using a packet consisting of a start bit, a byte of information and a stop bit.

(c) State and explain any two basic transformations of the Geometric Model (Translation, Scaling, Rotation).

4 + 3 + 5 = 12

3. (a) Define quantization? Explain the process of uniform quantization. Elaborate when non-uniform quantization is useful.

(b) What is the difference between 8-adjacency and m-adjacency? Explain with suitable example.

1 + 4 + 2 + 5 = 12

Group - C

4. (a) Let m be the gray level of input image which has to be transformed to output image gray level l by histogram equalization technique. Consider an image of size 64×64 with 8 different gray levels and their distribution is shown in the following table. Compute the distribution of the gray levels in the output image according to the rule $l = 7c_m$, where, c_m is the cumulative probability and n_m is the number of pixels having gray level m.

m	0	1	2	3	4	5	6	7
n_m	123	78	281	417	639	1054	816	688

(b) 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.

7 + 2 + 3 = 12

5. (a) What is high-boost filter that is used in spatial domain for image sharpening? How does it work?

(b) Describe how filtering is done in frequency domain. (give all the steps from spatial domain to frequency domain and back).

(c) Describe the transfer functions of some of the low pass filters of frequency domain. Why are ideal filters not used?

2 + 3 + 5 + 2 = 12

Group - D

6. (a) What is the difference between image restoration and image enhancement?

(b) Describe the constrained least square error approach of image restoration technique.

(c) What are lossless and lossy compressions of image? What do you mean by transform coding of images?

2+ 6 + 2 + 2 = 12

7. (a) Obtain the Huffman code for the word "COMMITTEE". Determine the average length, entropy and efficiency of the above mentioned word by using Huffman coding.

(b) Why is zig-zag scanning preferred in JPEG standard?

4 + 2 + 2 + 1 + 3 = 12

Group - E

8. (a) Distinguish between local and global thresh-holding techniques for image segmentation. What is the difference between region splitting and region merging techniques of image segmentation?

(b) Given a binary image: set A and a binary image structuring element: set B, define erosion and dilation.