IMAGE PROCESSING
(INFO 4102)

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) Example of lossy compression is:
(a) Motion Compensation (b) Frame Replenishment
(c) Quantization (d) Huffman Encoding.

(ii) Which technique is used for solving tasks such as zooming, shrinking, etc.?
(a) Sampling (b) Quantization
(c) Interpolation (d) Filter.

(iii) A 128 × 128 image with 64 gray levels requires _____ bits of storage.
(a) 8192 (b) 16384 (c) 98304 (d) 64342.

(iv) Which type of enhancement operations is used to modify pixel values according to the value of pixel's neighbors?
(a) Point operations (b) Local operations
(c) Global operations (d) Mask operations.

(v) _____ is the starting pixel of region growing process.
(a) Seed pixel (b) Base pixel
(c) Image pixel (d) Root pixel.

(vi) Which of the following is a second order derivative operator?
(a) Histogram (b) Laplacian
(c) Gaussian (d) Power law.

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

(viii) Which of the following is the valid response when we apply a first order derivative?
(a) Non-zero at flat segments
(b) Zero in flat segments
(c) Zero along ramp
(d) Zero at the onset of gray level step.

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

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

Group – B

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

(b) Explain with suitable example, the image quality and image size in terms of sampling and quantization methods.

6 + 6 = 12

3. (a) Using the following image segment, justify the statement — "median filter is an effective tool to minimize salt and pepper noise".

24	**22**	**33**	**25**	**32**	**24**
34	**255**	**24**	**0**	**26**	**23**
23	**21**	**32**	**31**	**28**	**26**

(b) Find D_4 and D_m for the following 2-D section with v = { 0, 1} between p and q.

	5	**4**	**3**	**1**	**1**
	5	**4**	**0**	**2**	**0**
	3	**2**	**0**	**2**	**4**
	2	**1**	**1**	**3**	**5**
(p)	**1**	**3**	**5**	**1**	**3**

(q)

7 + 5 = 12

Group – C

4. (a) Explain any four properties of 2-D Fourier transforms.

(b) Explain the smoothing of images in frequency domain using:
(i) Ideal lowpass filter
(ii) Butterworth lowpass filter.

6 + 6 = 12

5. Define the following noise density functions: **(4 × 3) = 12**
   (i) Gaussian noise
   (ii) Rayleigh noise
   (iii) Erlang noise
   (iv) Uniform noise.

Group – D

6. (a) What is the significance of Dictionary Based Compression Algorithm? Explain with example.

   (b) On the basis of compressing the raw data CCCCDDDDAACCCBBBBBDDBD compare the efficiency of RLE and Huffman encoding techniques. Explain the reason(s) behind the comparative outcome.

   (c) "Removal of Psycho-visual Redundancy incurs better compression ratio compared to removal of Statistical Redundancy" – Justify the effectiveness of this statement.

   (2 + 1) + (5 + 2) + 2 = 12

7. (a) What is predictive coding? Explain different types of predictive coding with example.

   (b) How DPCM works in the purview of Predictive Coding?

   (c) What are the three types of reference frames used in predictive video encoding?

   (d) What is vector quantization?

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

Group – E

8. Explain Region Splitting and Merging with an example.

   (6 + 6) = 12

9. What derivative operators are useful in image segmentation? Explain their role in segmentation.

   (2 + 10) = 12