CBCS SCHEME

USN | | | | | | | | | | |

18EC733

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024
Digital Image Processing

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Describe the working of sensor strips and discuss the applications in airborne imaging and medical imaging with neat sketches. **(08 Marks)**

b. Define 4, 8 and m connectivity. Compute the lengths of shortest 4, 8 and m paths between the pixels p and q in the image segment shown in Fig.Q1(b) by considering intensity set v = {2, 3,4}.

3	4	1	2
0	1	4	2 (q)
2	2	3	4
3 (p)	0	4	2

Fig.Q1(b) **(06 Marks)**

c. Explain the components of an image processing system with a neat block diagram. **(06 Marks)**

OR

2 a. Describe Ultra Sound (US) imaging with any one example (medical/industry). Also explain the methods of image formation used in US imaging. **(10 Marks)**

b. Demonstrate with experiments, how perceived image quality varies with spatial and gray level resolutions and discuss your observations with a neat graph on NK plane (Isopereference curve). **(10 Marks)**

Module-2

3 a. Explain the following gray level transformations :
i) Gray level slicing
ii) Bit plane slicing. **(08 Marks)**

b. What is meant by histogram matching? Develop a probabilistic model for continuous and discrete functions to demonstrate histogram matching. **(10 Marks)**

c. Discuss local histogram processing. **(02 Marks)**

OR

4 a. Explain image sharpening in the spatial domain using second order derivative filter. (Use Laplacian operator). **(08 Marks)**

b. Determine histogram matched values for the given input image and target histogram as shown in Table Q4(b).

r_i	n_i	$P_z(z_q)$
0	790	0.0
1	1023	0.0
2	850	0.0
3	656	0.15
4	329	0.2
5	245	0.3
6	122	0.2
7	81	0.15

Table Q4(b)

Here $r_i \rightarrow i^{th}$ intensity of input image

$n_i \rightarrow$ number of pixels i^{th} having intensity level.

$P_z(z_e) \rightarrow$ Target histogram

Given $n \rightarrow$ total number of pixels in an input image is 4096. **(12 Marks)**

Module-3

5 a. Define 2D – DFT of an image f(x, y) and its inverse DFT. Also state the following properties of 2D – DFT.

i) Translation
ii) Rotation
iii) Periodicity
iv) 2D convolution. **(08 Marks)**

b. Describe smoothing frequency domain filters, for image enhancement. Also explain the working of following filters for image smoothing in frequency domain :

i) Ideal LPF
ii) Butterworth LPF
iii) Gaussian LPF. **(08 Marks)**

c. Explain selective filtering using band reject filters. **(04 Marks)**

OR

6 a. Explain the basic procedure used for filtering in frequency domain. **(06 Marks)**

b. Explain the working of homomorphic filtering in image processing using mathematical equations and response. **(08 Marks)**

c. State and prove the conjugate symmetry properties of 2D – DFT with respect to an image f(x, y). **(06 Marks)**

Module-4

7 a. Explain the module of the image degradation/restoration process. **(06 Marks)**

b. Describe how the images are restored in the presence of only noise interference. Also explain the following mean filters used for image restoration.

i) Arithmetic mean
ii) Geometric mean
iii) Harmonic mean
iv) Contra harmonic mean. **(10 Marks)**

c. Explain inverse filtering with necessary mathematical equations and examples. **(04 Marks)**

OR

8 a. Explain the following noise Probability Density Functions (PDF) used in image processing.
i) Gaussian
ii) Rayleigh
iii) Gamma
iv) Exponential
v) Uniform
vi) Impulse. **(12 Marks)**

b. What are adoptive filters? Explain adoptive local noise reduction and adoptive median filter with the algorithms. **(08 Marks)**

Module-5

9 a. With a neat sketch, explain color chromaticity diagram. **(08 Marks)**

b. Describe the process of RGB to HSI conversions with mathematical equations. **(06 Marks)**

c. What is meant by mathematical morphology? Explain dilation and erosion operations using mathematical equations. **(06 Marks)**

OR

10 a. Discuss the process of converting HSI to RGB with relevant mathematical expressions. **(10 Marks)**

b. Demonstrate the working operating and closing morphological operations using mathematical equations and real time examples. **(08 Marks)**

c. Write a brief note on Pseudo color image processing. **(02 Marks)**

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