



School: School of Engineering and Technology  
 Program: B. Sc. - Data Science  
 Year: 2<sup>nd</sup> Semester: 4<sup>th</sup>  
 Examination: End-Semester Examination  
 Examination year: May - 2023

Course Code: DS213

Course Name: Image Processing

Date: 19/5/2023

Total Marks: 40

Time: 10:00 am to 12:00 pm

Total Pages: 2

**Instructions:**

- Write each answer on a new page.
- Write all the questions in the ascending order (1, 2, 3, ...) as given in the question paper.
- Use of a calculator is permitted.

Q. N.	Question	Marks	CO	BTL
Q. 1.	Select the most appropriate option from the below:			
1.	Which of the following waves has highest wavelength in the Electromagnetic spectrum? (a) Gamma rays (b) Visible light (c) Radio waves (d) X-rays			
2.	Which of the following imaging technique is used in radar? (a) Ultraviolet band imaging (b) Radio wave imaging (c) Infrared imaging (d) Microwave band imaging			
3.	Which of the following distance measures is also called chessboard distance? (a) $D_0$ distance (b) $D_4$ distance (c) $D_8$ distance (d) $D_m$ distance			
4.	What is the purpose of Affine transforms on an image? (a) Scaling (b) Rotating (c) Translation (d) All of above			
5.	Which of the following intensity transformation is useful to produce negative image? (a) Logarithmic (b) Linear (c) Power-law (d) Gamma			
6.	Which of the following filter resembles statistical arithmetic mean? (a) Sobel (b) Gaussian (c) Laplacian (d) Box	10	CO1 CO3 CO4	BTL1
7.	What is the purpose of Butterworth low pass filter? (a) Smoothing in spatial domain (b) Smoothing in frequency domain (c) Sharpening in spatial domain (d) Sharpening in frequency domain			
8.	Which of the following is not a restoration filter? (a) Contra harmonic Mean (b) Median (c) Midpoint (d) Prewitt			
9.	In which segmentation technique, the idea is to partition a set of observations into a specified number of groups? (a) Region segmentation using k-means clustering (b) Region splitting and merging (c) Region growing (d) None of these			
10.	Which of the following color model has color descriptions that are more natural and intuitive to humans? (a) RGB (b) HSI (c) CMY (d) CMYK			

<b>Q. II. Do as directed</b>										
1. How much storage, in megabytes, is required to store $300 \times 500$ having 512 intensity values? Show calculations.	6	C02 C04 C05 C06	BTL1 BTL2 BTL3 BTL4							
2. Write formula of 2D Discrete Fourier transform and its inverse.										
3. Consider that following is a row representing intensity values of some image. Write first and second derivatives of this row. <div style="text-align: center; border: 1px solid black; padding: 5px; display: inline-block;"> <table style="border-collapse: collapse; text-align: center;"> <tr> <td style="border: 1px solid black; padding: 2px 10px;">6</td> <td style="border: 1px solid black; padding: 2px 10px;">6</td> <td style="border: 1px solid black; padding: 2px 10px;">5</td> <td style="border: 1px solid black; padding: 2px 10px;">4</td> <td style="border: 1px solid black; padding: 2px 10px;">3</td> <td style="border: 1px solid black; padding: 2px 10px;">2</td> <td style="border: 1px solid black; padding: 2px 10px;">1</td> <td style="border: 1px solid black; padding: 2px 10px;">1</td> <td style="border: 1px solid black; padding: 2px 10px;">6</td> <td style="border: 1px solid black; padding: 2px 10px;">6</td> </tr> </table> </div>				6	6	5	4	3	2	1
6	6	5	4	3	2	1	1	6	6	
<b>Q. III. Attempt any 6 from the following:</b>										
1. Explain Mathematical modelling of an image. Define reflectance and illuminance, their range.	24	C01 C02 C03 C04 C05 C06 C07 C08	BTL1 BTL2 BTL3 BTL4 BTL5							
2. Explain concepts of image sampling and quantization. Write various ways of representing digital images.										
3. Which smoothing filters are used in the spatial domain? Explain each briefly.										
4. Which sharpening filters are used in the frequency domain? Explain each briefly.										
5. What is image degradation? Draw diagram of image restoration and degradation model. List out noise models and restoration filters that you studied in the class.										
6. How first and second order derivatives are used to determine point, line and edge in an image? Explain with figure different types of edges present in an image.										
7. Explain region growing segmentation technique with their steps.										
8. Explain RGB and HSI model with their details.										

\*\*\*\*\*End of the Question Paper\*\*\*\*\*