

GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER-VII (NEW) EXAMINATION – WINTER 2024

Subject Code:3171109**Date:19-11-2024****Subject Name: Digital Image and Video Processing****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

MARKS

- Q.1** (a) What will be negative 3x3 digital image for the following 4 bit 3x3 digital image? **03**

9	3	4
4	5	6
1	1	1

- (b) In contrast stretching with piece-wise linear input-output characteristics having corner points (0,0) (50,100) (100,100) (150,200), (200,250) and (255,255). What will be Output pixel value for input pixel 60,75,125 and 200 ? **04**
- (c) Consider image size of 1024x1024 having 65535 colors. What is transmission time required to transmit this image without compression using internet speed of 2 MBPS. What is the storage requirement in bytes for such 100 images? **07**
- Q.2** (a) Grey level image has intensity range from 20 to 150. We need to display this image on a device that has grey level range of 0 to 255. Write equation of the transformation function suitable for the display. **03**
- (b) What is aliasing in digital images? How can it be prevented? **04**
- (c) Describe the process of image restoration and its difference from image enhancement. Provide a detailed example of restoring an image that has been degraded by salt and pepper noise. **07**

OR

- (c) For the given input image $f(x,y)$ and processed image $f^{\wedge}(x,y)$ compute MSE, SNR and PSNR. **07**

$f(x,y)$			$f^{\wedge}(x,y)$		
1	3	5	1	4	6
4	4	3	5	4	2
5	2	2	4	2	1

- Q.3** (a) Explain the effect of applying a 3x3 averaging filter on a pixel with its 8 neighbors in a grayscale image. If the center pixel value is 150, and all its neighbors are 100, what is the new value of the center pixel after filtering? **03**
- (b) Why Sobel edge detection is preferred over Prewitt edge detection in case of noisy image? **04**
- (c) Why second derivative operations are not much preferred for edge detection? What is LOG? How it overcomes problem of Laplacian edge detection operator? **07**

OR

- Q.3** (a) Write 3x3 mask for horizontal line, vertical line and diagonal line edge detection. **03**
(b) What is histogram? What is the purpose of histogram equalization? **04**
(c) What is edge linking? Why edge linking is necessary? Explain methods used for edge linking. **07**

- Q.4** (a) How are colors represented in the RGB color model? Explain with help of example. **03**
(b) Calculate the signal-to-noise ratio (SNR) for an image where the original image has pixel values ranging from 0 to 255, and the noisy version of the image has pixel values ranging from 0 to 255 with additive white Gaussian noise with a standard deviation of 10. **04**
(c) Explain the JPEG image compression standard in detail. Describe the key components of the JPEG compression process including discrete cosine transform (DCT), quantization, and entropy coding. **07**

OR

- Q.4** (a) What is the difference between lossy and lossless image compression techniques? **03**
(b) What will be bit depth of image (bits/pixel) which has spatial resolution 300x400 and size of image is 60,000 Byte **04**
(c) Explain Hough transform. What is the application of Hough transform. What problem occurs for vertical line? How it is solved? **07**

- Q.5** (a) List different types of image file formats. Explain any one file format **03**
(b) Draw mask used for high pass filtering in frequency domain **04**
(c) Describe the basic steps involved in video segmentation algorithms. **07**

OR

- Q.5** (a) Explain the concept of motion compensation in video coding and its role in predicting inter-frame differences. **03**
(b) What are the challenges associated with video segmentation in terms of spatial and temporal coherence. **04**
(c) Explain the process of image decomposition using the wavelet transform. Discuss how the image is decomposed into approximation and detail coefficients at multiple scales, and how this decomposition facilitates multi-resolution analysis. **07**
