

Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 5 – EXAMINATION – SUMMER 2026

Subject Code: 3155204

Date: 25/05/2026

Subject Name: Image Processing

Time: 02:30 PM TO 05:00 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.**

- Q.1**
- (a)** Define the Euclidean, City-block (D_4), and Chessboard (D_8) distance measures between two pixels $p(x, y)$ and $q(s, t)$. **03**
 - (b)** Explain the concepts of Image Sampling and Quantization. **04**
 - (c)** Explain the basic components of a digital image processing system with a block diagram. **07**

- Q.2**
- (a)** What is 'Bit-plane slicing'? Mention its practical application in image processing **03**
 - (b)** Briefly explain the 'Log Transformation' and 'Power-Law (Gamma) Transformation'. **04**
 - (c)** Discuss the 'Inverse Filtering' approach for image restoration and explain why it often performs poorly in the presence of noise **07**

OR

- Q.2**
- (c)** Describe 'Wiener Filtering' (Minimum Mean Square Error Filtering) and how it addresses the limitations of inverse filtering **07**

- Q.3**
- (a)** What are 'Color Models'? Differentiate between RGB and CMY models. **03**
 - (b)** Explain the 'HSI Color Model' and its utility in image processing compared to the RGB model. **04**
 - (c)** A 3*3 image patch has the following intensity values (Range 0-7). Perform Histogram Equalization for this patch and find the new value for the center pixel. **07**

1	1	2
1	2	3
2	3	4

OR

- Q.3**
- (a)** Define 'Salt and Pepper' noise and suggest a suitable spatial filter to remove it. **03**
 - (b)** Explain the process of 'Color Slicing' in the context of color image processing **04**

- (c) Apply the Sobel Edge Detection Operators (G_x and G_y) to the following 3*3 image patch to find the Gradient Magnitude at the center pixel. 07

50	50	50
10	10	10
0	0	0

- Q.4** (a) Define 'Image Pyramids' and their role in multi-resolution processing. 03
(b) What is 'Inter-pixel Redundancy'? How is it exploited in image compression? 04
(c) Explain the 'Image Compression Model' using a detailed block diagram showing the Encoder and Decoder stages. 07

OR

- Q.4** (a) Mention the fundamental difference between 'Lossless' and 'Lossy' compression 03
(b) Briefly explain the concept of 'Sub-band Coding' in the context of wavelets. 04
(c) Describe the 'Discrete Wavelet Transform' (DWT) and explain how it differs from the Fourier Transform for image analysis 07

- Q.5** (a) Explain 'Edge Linking' using the Hough Transform method 03
(b) Define 'Thresholding.' Distinguish between Global and Basic Adaptive Thresholding. 04
(c) Discuss the 'Canny Edge Detector' algorithm. Why is it considered superior to the Sobel operator? 07

OR

- Q.5** (a) What is a 'Gradient' in an image? How is it used for edge detection? 03
(b) Explain the 'Region Growing' algorithm for image segmentation. 04
(c) Elaborate on the 'Region Splitting and Merging' technique for image segmentation 07
