


VIT

 Vellore Institute of Technology
Chennai • Vellore • Bangalore • Hyderabad • Pune • Sriharikota • Tirunelveli
Final Assessment Test – November 2025

Course: BCSE407L - Computer Vision

Class NBR(s): 3348/3352

Time: Three Hours

Slot: D1+TD1

Max. Marks: 100

- KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
- DON'T WRITE ANYTHING ON THE QUESTION PAPER

COs	CO Statements
CO1	Analyze image formation using digital camera and its principles
CO2	Evaluate feature extraction and feature estimation for image or video
CO3	Apply 3D vision techniques
CO4	Identify the computer vision applications

BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)

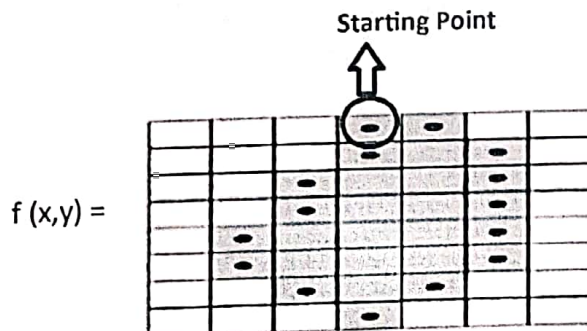
 Answer ALL Questions

(10 X 10 = 100 Marks)

1. Discuss the relationship between the physical properties of a camera, image formation, and the resulting image quality. List out the critical factors to consider when capturing an image for further processing. CO1 BL2
2. a) Explain the concepts of sampling and quantization in digital image processing. How do they affect image quality and resolution? [6] CO1 BL2
- b) Apply down sampling in the following image [4]

3	3	3	3
9	9	9	9
3	3	3	3
9	9	9	9

3. Extract the Chaincode using 4-direction and 8-direction, also find curvature and bending energy using the 8-direction chaincode in the given image $f(x,y)$. Use the starting point mentioned. CO2 BL3



4.

Perform split and merge segmentation on the following image, also discuss the steps involved in it.

CO2 BL4

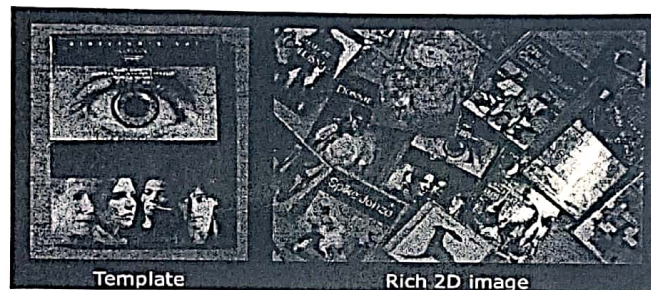
$f(x,y)$ =

6	5	6	6	7	7	6	6
6	7	6	7	5	5	4	7
6	6	4	4	3	2	5	6
5	4	5	4	2	3	4	6
0	3	2	3	3	2	4	7
0	0	0	0	2	2	5	6
1	1	0	1	0	3	4	4
1	0	1	0	2	3	5	4

5.

Identify suitable technique to recognize the following template in the given image and explain the steps involved.

CO2 BL4



6.

Define optical flow and describe its significance in computer vision for analyzing motion patterns in video sequences. Explain the concept of dense and sparse optical flow, highlighting their respective advantages and applications.

CO3 BL3

7.

Given the intrinsic matrix K , rotation matrix R , and camera center X_0 , evaluate the projection of the 3D point $X=[1,2,10,1]$ onto the image plane. Express your answer in inhomogeneous coordinates and interpret the result in terms of pixel location.

CO3 BL5

Intrinsic matrix K :

$$K = \begin{bmatrix} 1000 & 0 & 320 \\ 0 & 1000 & 240 \\ 0 & 0 & 1 \end{bmatrix}$$

(focal length = 1000 pixels, principal point at (320, 240))

Rotation matrix R : (assume identity, no rotation)

$$R = I_3 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

8. How can projective transformations and RANSAC be applied to improve image stitching accuracy in scenes with significant parallax and non-planar surfaces?

CO3 BL2

9.a) When multiple predicted bounding boxes overlap with the ground truth, how does the IoU metric determine the best bounding box, and what strategies can be used to refine the selection process? Explain with necessary equations.

CO3 BL4

OR

9.b) Discuss the essential steps involved in camera calibration using the DLT method. Explain how calibration images are utilized and the process of extracting intrinsic and extrinsic camera parameters.

CO3 BL4

10.a) A hospital deploys a deep learning-based segmentation system to identify tumor boundaries in MRI scans. However, the system struggles with low-contrast regions and irregular shapes. How would you evaluate and improve the segmentation accuracy using techniques like active contours, U-Net architectures, or post-processing filters? Justify your approach with performance metrics and clinical relevance.

CO4 BL4

OR

10.b) An AR headset uses stereo cameras to track head movement for immersive interaction. In dynamic lighting and crowded environments, the tracking becomes jittery. How would you apply stereo vision principles and filtering techniques to stabilize head tracking in real time? Discuss trade-offs between accuracy, latency, and computational load.

CO4 BL4

Y/K/TY