VIT
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act 1956)

REG.NO.:

SLOT: D1+TD1

SCHOOL OF COMPUTER SCIENCE AND ENGINEERING
CONTINUOUS ASSESSMENT TEST - II
FALL SEMESTER 2025-2026

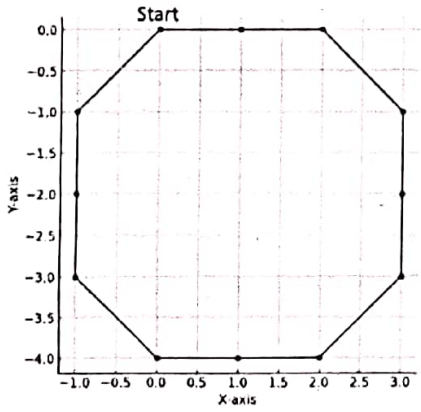
Programme Name & Branch	:	**B. Tech Computer Science and Engineering**
Course Code and Course Name	:	**BCSE407L Computer Vision**
Faculty Name(s)	:	**Dr. Balaji GN; Dr. Anindita Kundu**
Class Number(s)	:	**VL2025260103348; VL2025260103352**
Date of Examination	:	**08-10-2025**
Exam Duration	:	**90 minutes** **Maximum Marks: 50**

General instruction(s):

- Answer All Questions
- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)
- Course Outcomes (Type the CO statements covered in this question paper. Use the CO number as per the syllabus copy)

  2. Evaluate feature extraction and feature estimation for image or video

  3. Apply 3D vision techniques

Q. No	Question	Module	Marks	CO	BL
1	A computer vision system extracts the boundary of an object and represents it using a **chain code sequence.** (a) Determine the chain code of the following object by assuming 8-neighbourhood. Start from the point marked as "Start" and go clockwise. Consider the following nomenclature:  (b) Convert this chain code into a **differential chain code (curvature)** representation and compute the **bending energy** of the boundary. (c) Analyse what the bending energy value obtained, implies about the smoothness or irregularity of the shape.	2	3+5+2	2	4

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2.	Consider the following object (image) of size 3 × 3, where x is the row index (1 to 3), and y is the column index (1 to 3). $F(x,y) = \begin{bmatrix} 2 & 1 & 0 \\ 3 & 2 & 1 \\ 1 & 4 & 2 \end{bmatrix}$ Find: (a) Mass of the object, Moment w.r.t. x-axis and y-axis (b) Centroid of the object (c) Moment of inertia about x-axis, y-axis and Moment of inertia about origin	2	4+2+4	2	3
3.	Consider the rectangle with corners labeled P1, P2, P3, P4 whose coordinates (in the image coordinate system) are: P1 = (1,1), P2 = (4,1), P3 = (4,3), P4 = (1,3). The image undergoes the following transformations in this order: (1) **Translation** by the vector (tx ,ty)=(3,–2). (2) **Rotation** about the origin by θ=45◦ (counterclockwise). (3) **Skew (x-shear)** with shear factor $sh_x = 0.5$ (4) Compute the coordinates of each corner after each step (after translation, after rotation, and after the final shear).	4	4+4+2	2	3
4.	Consider the 3×3 grayscale image patch shown below. Compute the Harris response considering Sobel kernels and with k = 0.04. Based on the sign and magnitude of R, state whether the center is a corner, an edge, or a flat region and justify. $I = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 255 & 255 \\ 0 & 255 & 255 \end{bmatrix}$	4	10	2	3

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5	A robotics research lab is developing an autonomous drone that navigates indoor environments. To enable accurate navigation, the drone's camera needs to be calibrated so that 3D positions of objects in the room can be accurately projected onto the 2D camera images. The lab has placed a calibration object—a cube with edges of 0.5 meters—at a known location in the room. Several 3D points on the cube's corners are measured in the world coordinate system, and their corresponding 2D pixel coordinates are recorded from the drone's camera images. (a) Explain how the **intrinsic parameters** (focal length, principal point, skew) of the drone camera can be estimated using the known 3D–2D correspondences. (b) Explain how the **extrinsic parameters** (rotation and translation) can be determined. (c) Discuss why multiple points on the cube are necessary to accurately estimate the camera parameters. (d) Suggest one calibration method that could be used in this scenario and justify your choice.	5	4+2+2+2	3	3

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