

## Indian Institute of Space Science and Technology Trivandrum

I SEMESTER , 2025

ExamType: Quiz 1

## DEPARTMENT OF AVIONICS

computer vision/ computer vision and advanced image processing

(Time allowed: ONE hours)

**NOTE:** Read all questions first. **There are questions worth 30 marks.** If something is missing in a problem description, clearly mention your assumptions with your solution. If require, use sketches to illustrate your findings.

1. Explain How Laplacian of Gaussian edge detection method works. (4 marks)
2. To decrease the size of an input image with minimal content loss, we should. (1 mark)
  - (a) High-pass filter and down-sample the image
  - (b) Crop the image
  - (c) Apply a hough transform
  - (d) Down-sample the image
  - (e) Low-pass filter and down-sample the image
3. Which of the following factor does not affect the intrinsic parameters of a camera model? (1 mark)
  - (a) Focal length
  - (b) Offset of optical center
  - (c) Exposure
  - (d) Image resolution
4. Describe two difficulties that computer vision algorithms face in dealing with images. i.e. two characteristics of image formation that make it difficult to recover the image content. (3 marks)
5. Write short notes on various lens distrotions. (3 marks)
6. Explain How image formation happens in a camera using drawings and mathematical expressions (3 marks)
7. The image C on the right below was obtained by convolving the image I on the left with a  $2 \times 2$  kernel H whose origin (we also called this the hot spot) is in the bottom right pixel (marked by the  $\nabla$ ). The same option was used in Matlab, so the sizes of I and C are the same.

$$I = \begin{bmatrix} 1 & 0 & 5 & 0 & 2 & 0 \\ 0 & 1 & 0 & 0 & 0 & 9 \\ 0 & 7 & 0 & 3 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 1 \\ 2 & 0 & 2 & 0 & 6 & 0 \end{bmatrix}$$

$$H = \begin{bmatrix} h_{11} & h_{12} \\ h_{21} & h_{22} \end{bmatrix} \nabla$$

$$C = \begin{bmatrix} 3 & 8 & 5 & 2 & 20 & 27 \\ 15 & 22 & 6 & 9 & 9 & 9 \\ 10 & 7 & 3 & 3 & 2 & 3 \\ 7 & 4 & 6 & 12 & 19 & 1 \\ 2 & 2 & 2 & 6 & 6 & 0 \end{bmatrix}$$

Fill in the four values of the kernel. You may want to briefly explain your reasoning if you are not sure about your answer. [Hint: if you are doing a lot of calculations, think again.] (5 marks)

8. Is the following convolution kernel separable? If so, separate it. If not, prove that it is not. (2 marks)

$$H = \begin{bmatrix} 2 & 3 \\ 1 & 1 \end{bmatrix}$$

9. Explain DLT method and highlight its application in computer vision. (5 marks)
10. Write the expressions of convolution and correlation operations of one dimensional and two dimensional sequences. Highlight the basic differences between them. (3 marks)

---