CE5-R3: IMAGE PROCESSING AND COMPUTER VISION

NOTE:

1. **Answer question 1 and any FOUR questions from 2 to 7.**
2. **Parts of the same question should be answered together and in the same sequence.**

Time: 3 Hours **Total Marks: 100**

1.

a) What is the major disadvantage of Laplacian operator for edge detection and what is the remedy to that.
b) "Erosion and dilation are duals with respect to complement operation." Comment.
c) Depict RGB color model.
d) How can degree of lossiness varied in JPEG.
e) Explain global and local optical flow estimation.
f) What are the advantages of Discrete Cosine Transformation (DCT).
g) "Quad-tree representation of image with large homogeneous regions is less expensive." Why?

(7x4)

2.

a) What are the different categories of images for the purpose of compression, give examples.
b) Discuss run length encoding compression. How is compression ratio defined in this case?
c) What is data redundancy?
d) Derive mean square signal-to-noise ratio fidelity criterion.

(5+5+4+4)

3.

a) Explain various steps in digitization of an image.
b) What is geometric transformation? Give one method for pixel co-ordinate transformation.
c) What is brightness interpolation? Give one method for brightness interpolation.

(6+5+7)

4.

a) What is an edge? Explain the role of gradient in edge detection.
b) Give different types of gradient-based edge detectors.
c) Give Canny edge detector algorithm.
d) What are the criteria based on which Canny edge detector performs optimally?

(4+3+8+3)

5.

a) Discuss algorithm for region convex hull construction.
b) Discuss region decomposition as shape description process.
c) Discuss different image understanding control strategies.

(5+5+8)

6.

a) Discuss filtering in the context of image processing?
b) Give pseudocode for average filtering.
c) In what respect median filtering is superior to mean filtering?
d) Discuss Gaussian filtering with its advantages.

(4+4+3+7)

7.

a) Explain the separability property of Fourier transform in context of digital image processing.
b) If g(x) and f(x) are the functions as given below,

$$f(x)=\begin{cases}1, & 0 \le x \le 1\\ 0, & Otherwise\end{cases} \quad \text{and} \quad g(x)=\begin{cases}\frac{1}{2}, & 0 \le x \le 1\\ 0, & Otherwise\end{cases}$$

Find the convolution of f(x) and g(x).
c) Explain contour following technique in the context of boundary detection. What is the effect of noise in this technique?

(8+6+4)