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BRAINWARE UNIVERSITY

Term End Examination 2025-2026
Programme – M.Tech.(RA)-2024
Course Name – Image Processing and Robotic Vision
Course Code - MEC30110
(Semester III)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) Describe the primary application of image enhancement.
   a) To improve image quality for human perception.
   b) To reduce file size of images.
   c) To compress the image data.
   d) To encrypt image contents.

(ii) Recall the basic unit of a digital image.
   a) Pixel
   b) Bit
   c) Dot
   d) Matrix

(iii) Recall the technique used to modify contrast in an image.
   a) Contrast stretching
   b) Noise addition
   c) Fourier transform
   d) Histogram binning

(iv) Compare histogram equalization with contrast stretching.
   a) Both change frequency spectrum
   b) Both perform Fourier transform
   c) Histogram equalization redistributes intensity; contrast stretching expands range
   d) Contrast stretching compresses intensity levels

(v) Differentiate between spatial and frequency domain processing.
   a) Spatial uses mathematical transforms; frequency uses convolution
   b) Spatial modifies image pixels directly; frequency transforms the image for filtering
   c) Frequency is always faster
   d) They are identical methods

(vi) Differentiate region growing from region splitting.
   a) Region growing divides the image into blocks.
   b) Region growing starts from seed pixels, splitting divides until criteria are met.
   c) Both operate only in the frequency domain.
   d) Splitting merges boundaries initially.

(vii) Identify the feature type calculated from object shape.
   a) Histogram features
   b) Moments and contours
   c) Color histograms
   d) Edge gradients

(viii) Define region-based segmentation.

a) Segmentation using histogram equalization
b) Division of image into uniform pixel grids
c) Segmentation by grouping similar pixels
d) Edge detection using frequency filters

(ix) Describe the role of supervised learning in image classification.

a) It clusters unlabeled data.
b) It labels data automatically.
c) It uses labeled data to train models.
d) It analyzes frequency features.

(x) Compare supervised and unsupervised learning.

a) Both require labeled data.
b) Supervised uses labeled data; unsupervised finds structure in unlabeled data.
c) Unsupervised requires training labels.
d) Both are the same for clustering tasks.

(xi) Describe the purpose of camera calibration.

a) To convert color spaces
b) To reduce image file size
c) To determine intrinsic and extrinsic camera parameters
d) To enhance resolution

(xii) Identify a key component of robotic vision systems.

a) Sensors, microphones, batteries
b) Cameras, lenses, and lighting
c) Fans, CPU, circuits
d) Chassis, tires, frame

(xiii) Identify the input required for camera calibration.

a) Image noise levels
b) Multiple images of known patterns
c) RGB histogram data
d) Contrast values

(xiv) Differentiate between feature-based and template-based object detection methods.

a) Feature-based detects color only; template-based detects shape.
b) Feature-based uses pixel intensity; template-based uses noise models.
c) Feature-based identifies edges and corners; template-based matches predefined shapes.
d) Template-based always uses machine learning.

(xv) Explain the difference between lossy and lossless compression.

a) Lossy retains all data, lossless discards
b) Lossless removes useful image parts
c) Lossy reduces file size with some data loss, lossless preserves all data
d) Both provide same quality

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Define Laplacian-based edge detection. (3)
3. Describe machine learning in the context of image processing. (3)
4. Describe the term object tracking in robotic vision systems. (3)
5. Explain the impact of image compression standards on robotic vision systems. (3)
6. Explain the concept of sampling and quantization in digital images. (3)

OR

Explain spatial filtering in the context of image enhancement. (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. Discuss the concept of digital image representation. (5)
8. Explain the steps and advantages of region-growing segmentation. (5)
9. Explain the role of neural networks in deep learning. (5)
10. Explain the significance of robotic vision and its applications in automation. (5)
11. Discuss the impact of AI integration in robotic vision systems. (5)
12. Discuss how dilation and erosion are used in morphological image processing. (5)

OR

Analyze the impact of histogram equalization on image contrast and its applications. (5)

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