

END SEMESTER EXAMINATION - APRIL 2026**SEMESTER 8 : INTEGRATED M. Sc. PROGRAMME IN COMPUTER SCIENCE - DATA SCIENCE****COURSE: 21UP8CRMCP28 – IMAGE AND VIDEO ANALYTICS***(For Regular 2022 Admission)*

Time: Three Hours

Max. Weightage: 30

PART A**Answer any 8 (Weight - 1 Each)**

1. Explain image sensors. (U, CO 1)
2. Define image pyramid. (R, CO 4)
3. Define motion patterns. (U, CO 3)
4. Define compression ratio. (U, CO 2)
5. Conclude order statistics filters. (R, CO 2)
6. Define convolution and its properties. (U, CO 2)
7. Differentiate between image flow and optical flow. (U, CO 3)
8. Describe the role of deep learning in video analytics. (U, CO 5)
9. Differentiate between object classification and object detection. (U, CO 2)
10. Explain the concept of content-based analysis of digital video. (U, CO 4)

(1 x 8 = Weight)**PART B****Answer any 6 (Weights - 2 Each)**

11. Discuss region-based motion estimation. (U, CO 3)
12. Explain various steps involved in video mining. (U, CO 4)
13. Explain various intensity transformation in spatial domain. (U, CO 2)
14. Explain temporal and spatial event recognition in video analysis. (U, CO 4)
15. Consider the following 3×6 image matrix (U, CO 2)

$$\begin{bmatrix} 24 & 22 & 33 & 25 & 32 & 24 \\ 34 & 255 & 24 & 0 & 26 & 23 \\ 23 & 21 & 32 & 31 & 28 & 26 \end{bmatrix}$$

Apply a 3×3 median filter to the given image. Clearly show the 3×3 neighborhood considered for each valid pixel, compute the median value for every neighborhood, and determine the final filtered output matrix.

16. Define Hadamard transform. Find the Kronecker product $A \otimes B$ of the matrices A and B as given below (U CO 1)

$$A = \begin{bmatrix} 4 & 5 & 6 \\ 1 & 2 & 3 \end{bmatrix} \quad B = \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$$

17. A 4× 4 bits/pixel original image is given by (A, CO 2)

$$\begin{bmatrix} 10 & 12 & 8 & 9 \\ 10 & 12 & 12 & 14 \\ 12 & 13 & 10 & 9 \\ 14 & 12 & 10 & 12 \end{bmatrix}$$

- (a) Apply histogram equalization to the image
(b) Sketch the histogram of the original image and histogram equalized image.
18. Describe change detection techniques in video sequences and its applications. (A,CO 3)
- (2 x 6 = 12 Weight)**

PART C

Answer any 2 (Weights -5 Each)

19. Explain the complete framework of real-time video analytics systems. (A, CO 4)
20. Explain different types of noise present in images and videos. Discuss the techniques used for denoising in both the spatial domain and the frequency domain. (An, CO 2)
21. (a) Explain the process of image sampling and quantization. Discuss the concepts of spatial resolution and intensity resolution, and explain how each affects the quality of a digital image. (U, CO 1)
- (b) Write a note on neighbours of a pixel, adjacency, connectivity, regions and boundaries.
22. Describe human motion recognition techniques used in video analytics. Explain pose estimation, skeleton tracking, and action recognition methods. Discuss their applications in sports analytics, security monitoring, and gesture-based control systems. (U, CO 5)
- (5 x 2 = 10 Weight)**

