

Roll Number: _____

Thapar Institute of Engineering and Technology (TIET), Patiala
Department of Computer Science & Engineering (CSED)
MID SEMESTER EXAMINATION

B. E. (Third Year): Semester-V (2023-24) (COE/CSE)	Course Code: UCS532 Course Name: Computer Vision
September 25, 2023	Monday, 03:00 – 05:00 PM
Time: 02.00 Hrs, Max. Marks: 35	Name of Faculty: Dr. Shailendra Tiwari

Note: Attempt all questions in sequence. Assume suitable values for missing data.

Q. 1	(a) Give at least four practical real-time applications of computer vision. Also, elaborate on two key challenges that contribute to the complexity of computer vision? [6]
	(b) As most of you may know images are formed when a light source hits the surface of an object and the light is reflected onto an image plane which is then captured through optics on to a sensor plane. Could you enumerate at least four factors that affects the image formation process? [4]
Q. 2	(a) Consider a 5×5 image $f(x, y)$ as an input of three bit intensity level as shown below in Fig. 1. Find the output $g(x, y)$ as a Histogram Equalized image. [5]
	 <p style="text-align: center;">Fig. 1</p>
Q. 3	(b) Fig. 2 is an example of 3×3 Laplacian of Gaussian filter (LOG). Could you elucidate the process by which this filter was derived? [5]
	$\begin{bmatrix} 0 & 1 & 0 \\ 1 & -4 & 1 \\ 0 & 1 & 0 \end{bmatrix}$ <p style="text-align: center;">Fig. 2</p>
Q. 4	(a) Consider the filter $f = [1, 2, 1]$ and the 1D image $I = [0, 1, 2, 3, 3, 3, 1, 3, 6]$. What is the result by convolving $f * I$? Pad the image with zeros at the boundaries if necessary. [4]
	(b) To what extent does the Fourier Transform Convolution Theorem enhance cost efficiency, taking into consideration an image size of $N \times N$ and a kernel size of $k \times k$? Show your response using Big-O notation to indicate the time complexity. [2]
	(c) Find the gradient of a function $f(x, y) = 3x^2 + 2y + 6$ at $(1, -1)$. [4]
Q. 4	Compute the spatial coefficient value $f(x)$ for a given 1D Fourier Transform $F(u) = [11, -3 + 2j, -1, -3 - 2j]$. [5]

The schedule of showing the evaluated answer sheets will be shown on the course website <https://ada-lms.thapar.edu/moodle/course/view.php?id=1824>