Graphic Era HILL UNIVERSITY
Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sankhya 12 of 2011)
University under section 2(f) of UGC Act, 1956

End Term (Odd) Semester Examination November 2025

Roll no.....

Name of the Course and semester: **B.Tech 7th Semester**
Name of the Paper: **Digital Image Processing**
Paper Code: **TEC 705**

Time: 3 hour Maximum Marks: 100

Note:

(i) All the questions are compulsory.
(ii) Answer any two sub questions from a, b and c in each main question.
(iii) Total marks for each question is 20 (twenty).
(iv) Each sub-question carries 10 marks.

Q1. (2X10=20 Marks)

a. Explain the basic steps involved in a typical Digital Image Processing System with a neat block diagram **(CO1)**
b. Discuss the process of image sampling and quantization with suitable examples. **(CO1)**
c. An image has 256 × 256 pixels, each pixel can take 64 gray levels, (i) Calculate the number of bits required to store the image, (ii) Calculate the size of the image in kilobytes. **(CO1)**

Q2. (2X10=20 Marks)

a. Explain Histogram Equalization and its role in image contrast improvement. **(CO2)**
b. Differentiate between Smoothing Spatial Filters and Sharpening Spatial Filters. Provide examples of each. **(CO2)**
c. Given a gray-level image with pixel values [52, 55, 61, 59, 79, 61, 76, 61], compute the equalized histogram assuming 8 levels (0–7). **(CO2)**

Q3. (2X10=20 Marks)

a. Explain the Model of Image Degradation/Restoration Process with a neat block diagram. **(CO3)**
b. Compare Inverse Filtering and Wiener Filtering methods for image restoration. **(CO3)**
c. A degraded image is modeled as

$$g(x,y) = f(x,y) * h(x,y) + n(x,y)$$

where $h(x,y)$is a 3×3 averaging filter and $n(x,y)$ is Gaussian noise with variance 0.001. Compute the restored image estimate using the **Wiener filter** conceptually and express the mathematical form. **(CO3)**

Q4. (2X10=20 Marks)

a. Define and explain Erosion and Dilation with examples. **(CO4)**
b. Describe Opening and Closing operations and discuss their practical applications. **(CO4)**
c. Given a binary image, Perform **Erosion** of A by B (A⊖B).

$$A = \begin{bmatrix} 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 \end{bmatrix}, \quad B = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$$

(CO4)

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Q5. (2X10=20 Marks)

a. Explain the Edge Detection process and discuss Sobel and Prewitt operators. **(CO5)**

b. Describe Region-based segmentation techniques and their advantages. **(CO5)**

c. Explain the Chain Code and Shape Number techniques for boundary representation in image segmentation. Discuss their importance in object recognition. **(CO5)**