Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – December 2025

Date: 10- 12- 2025 **Time:** 1.00pm to 04.00pm

School: SOE	**Program:** B. Tech	
Course Code: ECE3029	**Course Name:** Digital Image Processing	
Semester: V	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5	CO6
Marks	2	6	16	28	41	7

Instructions:

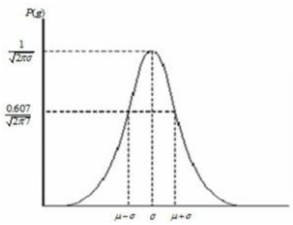
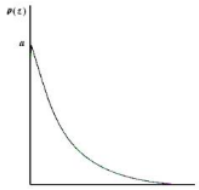
(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1	**Let p and q are two pixels at co-ordinates (10,15) and (15,25) respectively. compute: Chessboard distance**	2 Marks	L2	CO1
2	**Consider two images :** $F_1 = \begin{bmatrix} 1 & 3 & 7 \\ 5 & 15 & 75 \\ 200 & 50 & 150 \end{bmatrix}$ $F_2 = \begin{bmatrix} 50 & 150 & 125 \\ 45 & 55 & 155 \\ 200 & 50 & 75 \end{bmatrix}$ **Perform multiplication on the image matrix**	2 Marks	L2	CO2
3	**In a cathode ray tube device have an intensity to voltage response that is a power law function with exponent value 2.5. Justify what type of image is produced by this display system. Identity the phenomena of correcting input image so that if appears close to the original Image.**	2 Marks	L2	CO3
4	**Determine the given matrix A is unitary matrix or not**	2 Marks	L2	CO3

	$\frac{1}{2}\begin{bmatrix}1-i & -1+i\\ 1+i & 1-i\end{bmatrix}$			
5	**Identify the noise related to the following most common PDF(probability distribution function) found in image processing applications shown below.** **(a)**  **(b)** 	**2 Marks**	**L2**	**CO4**
6	**Differentiate between compression ratio and redundancy**	**2 Marks**	**L2**	**CO4**
7	**What are the different attributes of the color and define them**	**2 Marks**	**L2**	**CO5**
8	**What are the key ethical and privacy considerations in image processing**	**2 Marks**	**L2**	**CO6**
9	**What are the different subband outputs generated in 2D subband coding for image processing, and what does each subband represent?**	**2 Marks**	**L2**	**CO5**
10	**There are three leading color models for image processing namely RGB, CMY, and HSI model. What led to the development of CMYK model?**	**2 Marks**	**L1**	**CO5**

Part B

Answer the Questions. **Total Marks 80**

11.(a)	**With a neat block diagram, explain the basic steps of filtering in the frequency domain**	**6Marks**	**L4**	**CO3**
(b)	**Two pixels are adjacency if they are. neighbors and their gray levels satisfy some specified criterion of similarity. Consider the image segment shown in the figure below. Compute shortest 4 path and 8 path between pixel p and q where, V={1,2}. Specify the co-ordinates of the path** 4(0,0) 2(0,1) 3(0,2) 2(0,3)q 3(1,0) 3(1,1) 1(1,2) 3(1,3) 2(2,0) 3(2,1) 2(2,2) 2(2,3) 2(3,0)p 1(3,1) 2(3,2) 3(3,3)	**4Marks**	**L3**	**CO2**

or

12.(a)	**Histogram is a graphical representation of the intensity distribution of an image. In simple terms, it represents the number of pixels for each intensity value considered. Perform Histogram equalization of the following 8X8 image. The gray level distribution of the image is given below.**	**7Marks**	**L2**	**CO3**

Gray level r_k	0	1	2	3	4	5	6	7
No of pixels n_k	0	0	0	614	819	1230	819	614

(b)	**Computer graphics system requires the user to construct everything directly into a single scene. A chocolate bar image is been built in a convenient place and to a convenient size which are as follows (2,-2) (2,2) (-2,2) (-2,-2). Because of the requirements of a scene, it is first moved to a desired position by (3, 2)**	**3Marks**	**L3**	**CO2**

13.	**An information source produces a sequence of independent symbols having the following probabilities. Construct a binary code using Huffman encoding and find the average length of this code.**	**10 Marks**	**L3**	**CO4**

Symbol	a1	a2	a3	a4	a5	a6	a7
Probability	9/32	3/32	3/32	2/32	9/32	3/32	3/32

or

14.	**Segmentation subdivides an image into its constituent regions or objects and is for non-trivial images and one of the most difficult tasks in image processing. Its accuracy determines the eventual success of failure of the computerized analysis. To extract basic features such as points, edges and lines by abrupt changes in intensity can be detected using derivatives. An image strip given below taken from a glass building of a mall, identifythe cracks by using 1st and 2nd derivative method.** **(i) State the first order and second order derivative equations.** **(ii) Draw the intensity for the image strip** **(iii) Obtain the First Order Derivative and Second order Derivative of the image strip.**	**10Marks**	**L3**	**CO4**

6	6	6	6	5	4	3	2	1	1	1	1	1	1	6	6	6	6	6

$\rightarrow x$

15.(a)	**Explain with a neat block diagram the Image degradation/restoration model.**	**6 Marks**	**L3**	**CO4**

(b)	List 4 different noises that affect images and draw their corresponding PDF	4Marks	L3	CO4

Or

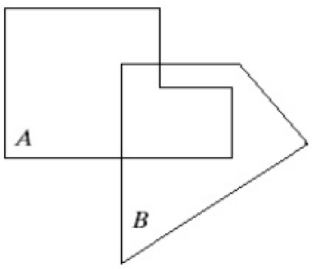
16.	Image Transformation represents a given Image as a Series Summation of a Set of Unitary Matrices/ Orthogonal Basis Images. By applying Inverse Transformation, the original Image can be obtained using the Transformation coefficient Matrix. For a Given Input Image: U and the Orthogonal Transformation matrix: A, i. For A= $\frac{1}{\sqrt{2}}\begin{bmatrix}1 & 1\\ 1 & -1\end{bmatrix}$ and U= $\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}$ Obtain the Transformed Image V. ii. The Basis Images : A*0,0 A*1,1 are : iii. The Basis Images: A*0,1 A*1,0are :	10 Marks	L3	CO4

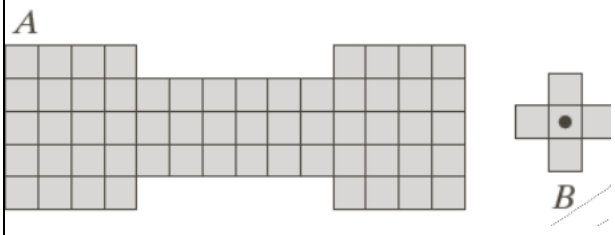
17.(a)	Given the following Huffman codebook: A - 1 B -00 C-011 E - 0100 F - 01010 G - 01011 Using the above codebook, decode the Huffman encoded bit sequence: '01111010110010110110110110 10011'	4Marks	L3	CO4
(b)	Using illumination and reflection model develop a frequency domain procedure for improving the appearance of the image using homomorphic filtering	6Marks	L4	CO3

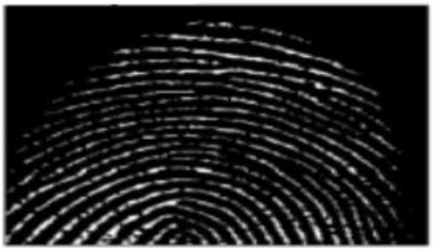
Or

18.(a)	Image segmentation is the process of partitioning a digital image into multiple segments The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. An image can be different regions r1,r2,r3...rn. Determine the conditions for region based image segmentation	4 Marks	L3	CO4
(b)	The purpose of image enhancement is to or to provide 'better' input for other improve the interpretability or perception of information in images for human viewing automated image processing techniques. Say a 3 bit 5x5 size digital image is obtained of a TAJ MAHAL (foreground) with tourists (background) using camera perform intensity level slicing where input intensity r1=3 and r2=5. Perform Intensity level slicing with and without background	6Marks	L4	CO3

	5	1	3	2	7				
	0	3	1	1	6				
	0	1	4	4	2				
	1	6	3	2	5				
	3	3	4	7	5				

19.(a)	**Colour image processing is defined as the application of algorithms and techniques to manipulate and analyze color images, one such method includes for PSEUDO-COLOR IMAGE PROCESSING. Write a brief note on Psuedo color Image Processing.**	**5 Marks**	**L5**	**CO5**
(b)	**Digital image processing has revolutionized how we capture, store, and manipulate visual data. It finds applications across various domains like healthcare, security, entertainment, and social media. However, with the rapid advancements in technology, the ethical and privacy considerations in image processing have become increasingly important. Explain few key areas where privacy violations can occur in Digital Image processing.**	**5 Marks**	**L3**	**CO6**
(c)	**Image pyramid is a kind of multi-scale expression in an image. Explain with neat system block diagram to obtain Approximate Pyramid and Residual Pyramid**	**10 Marks**	**L5**	**CO5**
	Or			
20.(a)	**The theoretical foundations of morphological image processing lies in set theory and the mathematical theory of order. For a given Image obtain AUB and A ∩ B** 	**5Marks**	**L5**	**CO5**
(b)	**Why is medical consent essential in digital image processing, and how does it protect patients when their medical images are captured, stored, and analyzed?**	**5Marks**	**L3**	**CO6**

(c)	**Compute:** **A Dilated by B ($A \oplus B$)** **A Erosion by B ($A \ominus B$)**  	**10Marks**	**L5**	**CO5**

21.(a)	**Colour image processing is defined as the application of algorithms and techniques to manipulate and analyze color images. Write a brief note on RGB color model , CMY color model and CMYK color model**	**6 Marks**	**L5**	**CO5**
(b)	**Draw the diagram of two band subband coding and decoding system, and explain its operation with respect to compression application.**	**10Marks**	**L5**	**CO5**
(c)	**Identity the morphological operation performed Figure A and Figure B on the Original image Explain its operation and uses** Original Image  Figure A Figure B	**4Marks**	**L2**	**CO5**
Or				

<table>
<tr><td>22. (a)</td><td>Define structural Element in Morhological image processing. If A is the Image set and B is the structural element,draw A erosion B
</td><td>4 Marks</td><td>L2</td><td>CO5</td></tr>
<tr><td>(b)</td><td>Compute:
A Dilated by B ($A \oplus B$)
A Erosion by B ($A \ominus B$)
A^c Erosion by B ($A^c \ominus B$)
A^c Dilated by B ($A^c \oplus B$)
A
<table><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr></table>B
<table><tr><td>1</td></tr><tr><td>1 .</td></tr><tr><td>1</td></tr></table></td><td>16 Marks</td><td>L2</td><td>CO5</td></tr>
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******* BEST WISHES *******