

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Sixth Semester B.Tech Degree (S, FE) Examination May 2024 (2015 Scheme)



Course Code: MR304

Course Name: DIGITAL IMAGE PROCESSING AND MACHINE VISION

Max. Marks: 100

Duration: 3 Hours

**PART A***Answer all questions, each carries 5 marks.***Marks**

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|---|--|---|
| 1 | Define the term reflectance.   | 5 |
| 2 | What is contrast stretching?   | 5 |
| 3 | Explain the affine transformation.   | 5 |
| 4 | Define the term histogram equalization with suitable example.  | 5 |
| 5 | If one looks across a large bay in the daytime, it is often hard to distinguish the mountains on the opposite side; near sunset, they are clearly visible. This phenomenon has to do with scattering of light by air—a large volume of air is a source. Explain what is happening. We have modelled air as a vacuum and asserted that no energy is lost along a straight line in a vacuum. Use your explanation to give an estimate of the kind of scales over which that model is acceptable. | 5 |
| 6 | Differentiate between opening and closing operation on gray scale image.   | 5 |
| 7 | A CCD camera chip of dimensions 7*7 mm, and having 1024*1024 elements, is focused on a square, flat area, located 0.5 m away. How many line pairs per mm will this camera be able to resolve? The camera is equipped with a 35-mm lens.  | 5 |
| 8 | Define wiener filter. List the applications, advantages and drawbacks of wiener filter.  | 5 |

**PART B***Answer any three questions, each carries 10 marks.*

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|----|--|---|
| 9  | We have a square area source and a square occluder, both parallel to a plane. The source is the same size as the occluder, and they are vertically above one another with their centers aligned. |   |
| a) | What is the shape of the umbra?  | 5 |
| b) | What is the shape of the outside boundary of the penumbra?   | 5 |

- 10 a) Define Hough transform. 5  
 b) Write a pseudocode for Hough transform. 5
- 11 Propose a set of gray-level-slicing transformations capable of producing all the individual bit planes of an 8-bit monochrome image. (For example, a transformation function with the property  $T(r)=0$  for  $r$  in the range  $[0, 127]$ , and  $T(r)=255$  for  $r$  in the range  $[128, 255]$  produces an image of the 7th bit plane in an 8-bit image.) 10
- 12 Explain various types of elements in visual perception with a clean drawing. 10
- 13 a) What effect would setting to zero the lower-order bit planes have on the histogram of an image in general? 5  
 b) What would be the effect on the histogram if we set to zero the higher order bit planes instead? 5

### PART C

*Answer any two questions, each carries 15 marks.*

- 14 Consider a file containing the following characters with the frequencies as  $\langle a, 10 \rangle$ ,  $\langle e, 15 \rangle$ ,  $\langle i, 12 \rangle$ ,  $\langle o, 3 \rangle$ ,  $\langle u, 4 \rangle$ ,  $\langle s, 13 \rangle$ , and  $\langle t, 1 \rangle$ . If Huffman Coding is used for data compression, determine- 15  
 a) Huffman Code for each character  
 b) Average code length  
 c) Length of Huffman encoded message (in bits)
- 15 Write a short description on sensing devices CCD, CED and CID. 15
- 16 Give the detailed description of 7  
 a) Global thresholding 8  
 b) Adaptive thresholding
- 17 Explain in detail about continuous wavelet transform and its application in image compression. 15

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