B.E. COMPUTER SCIENCE AND ENGINEERING
FOURTH YEAR
SECOND SEMESTER EXAM 2019

Image Processing

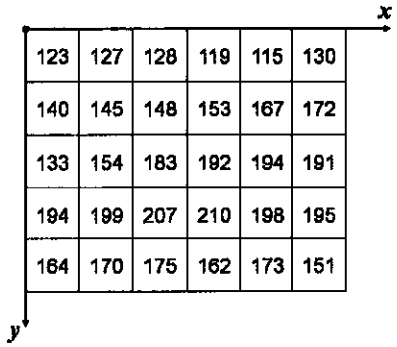
Time: Three Hours **Full Marks: 100**

Answer question number ONE and any FOUR from the rest

1. Answer the following short questions in brief.
   a) What is *Chess-Board Distance*?
   b) Define *Power Law Transformation.*
   c) What is *Bit-plane slicing*?
   d) Define *Euler number* (as a topological descriptor).
   e) What is the range (in nanometers) of visible spectrum?
   f) What is convex deficiency?
   g) Write the formulations for *Butterworth high-pass* and *low-pass* filters.
   h) What is *unsharp masking*?
   i) What is *Sobel's edge detection* operator?
   j) What is *Alpha-trimmed mean filter*?

(10 x 2)

2. **a)** What is Chain Code representation of a digital image? Discuss with an example.
   b) What is intensity slicing in pseudo-colour image processing?
   c) Consider the following image segment. Compare between 3x3 *Median filter* and 3x3 *Average filter* and generate the resultant images. Ignore computation of pixels at the boundaries.



(4+6+10)

3. **a)** Discuss the conversion formulation from RGB to HIS model and vice-versa.
   b) What is zigzag encoding? Why is it used?
   c) Consider the image segment shown below. Let **V={0,1}** and compute the lengths of the shortest 4-, 8-, and *m*-paths between *p* and *q* . Repeat for **V={1,2}**. If a path does not exist between these two points explain why.

	3	**1**	**2**	**1** ***(q)***
	2	**2**	**0**	**2**
	1	**2**	**1**	**1**
(p)	**1**	**0**	**1**	**2**

(5+5+10)

4. **a)** Write the algorithm for construction of a Huffman Tree. Use Huffman Coding to encode/decode the following text "this is an example of a huffman tree". Create the frequency table, Huffman tree and show the encoding and decoding steps with examples.

(20)

5. **a)** Briefly discuss *Gaussian*, *Rayleigh* and *Gamma* noise models.
   b) Discuss the effects of Harmonic and contra harmonic mean filters for the removal of salt and pepper noise.
   c) Write the basic formulation for DFT and Inverse DFT. What are the basic steps for image filtering in Frequency domain?

(6+4+10)

6. **a)** What are morphological Open & Close operations? Design simple morphological operations for boundary extraction of an object.
   b) What is Adaptive Median Filtering?
   c) Discuss the Minimum-Perimeter Polygons algorithm for polygonal approximation with an example.

(6+4+10)

7. Write short notes on the following.
   a) *Laplacian* filtering
   b) *Histogram-equalization* algorithm
   c) *Wiener* filtering
   d) *CIE Chromaticity Diagram*

(5+5+5+5)