Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
(Constituent Institute of Manipal University)
MANIPAL-576104

VI SEMESTER B.E. (COMPUTER SCIENCE AND ENGINEERING) DEGREE
END SEMESTER EXAMINATION - MAY 2013
SUBJECT: ELECTIVE I – DIGITAL IMAGE PROCESSING (CSE 320)
DATE: 13-05-2013

TIME: 3 HOURS MAX. MARKS: 50

INSTRUCTIONS TO CANDIDATES
- ANSWER ANY **FIVE** FULL QUESTIONS.

1A. Consider an image segment shown.

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

(a) Let $V = \{0, 1\}$, compute the lengths of shortest 4-path, 8-path and m-path between p and q. If a particular path does not exist between these two points, explain why.

(b) Repeat for $V = \{1, 2\}$. [04]

1B. Describe the process of acquiring images using X-rays. Also discuss its application in contrast enhanced radiography. [03]

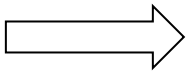
1C. How do you define spatial and intensity resolution of an image? What happens if these resolutions are varied? Suggest minimum possible spatial and intensity resolution for proper visualization by humans. [03]

2A. What effect would setting to zero the lower order bit planes have on the histogram of an image in general? What would be the effect on the histogram if we set to zero the higher order bit planes instead? [02]

2B. Describe how power law transformations are used in CRT monitors. [02]

2C. Consider the following image segment with gray levels in the range [0, 9]. Perform the histogram equalization on this and fill in the equalized gray levels in the space provided.

2	3	3	2
4	2	4	3
3	2	3	5
2	4	2	4



[04]

2D. Consider the following that shows intensity values for a single scan line. Calculate the responses of one dimensional first order and second order derivatives.

6 6 6 6 5 4 3 2 1 1 1 1 1 1 6 6 6 6 6 [02]

3A. With proper mathematical expressions explain, Butterworth and Gaussian, lowpass and highpass filters. [04]

3B. Describe probability density functions for the following types of noise. Also plot the PDF for each. (i) Gaussian noise (ii) Rayleigh noise (iii) Gamma noise (iv) Exponential noise (v) Uniform noise (vi) Salt and pepper noise. [06]

4A. Consider the simple 4×8, 8-bit image:

21	21	21	95	169	243	243	243
21	21	21	95	169	243	243	243
21	21	21	95	169	243	243	243
21	21	21	95	169	243	243	243

(i) Compute the entropy of the image.

(ii) Compress the image using Huffman coding.

(iii) Compute the compression achieved and effectiveness of Huffman coding. [05]

4B. Given a four symbol source {a, b, c, d} with source probabilities {0.1, 0.4, 0.3, 0.2}, arithmetically encode the sequence bbadc.

The arithmetic decoding process is the reverse of the encoding procedure. Decode the message 0.23355 given the coding model. [05]

Symbol	Probability
A	0.2
E	0.3
I	0.1
O	0.2
U	0.1
!	0.1

5A. Explain the following morphological operations: Hole filling, Thinning, Skeletons, Pruning. [06]

5B. What are the steps involved in binary morphological reconstruction. [02]

5C. Provide the steps to automatically compute global threshold. [02]

6A. Find the edge corresponding to the minimum cost path in the subimage shown. The numbers in the brackets are gray levels and the outer numbers are the spatial co-ordinates. Assume that edge starts in the first column and ends in the last column. Also provide the graph representation. [05]

	1	2	3
1	• [2]	• [1]	• [0]
2	• [1]	• [1]	• [7]
3	• [6]	• [8]	• [2]

6B. Provide a 3×3 filter to detect isolated point, 45 degree line, horizontal edge and vertical edge in an image. [02]

6C. Explain Marr-Hildreth edge detector. [03]

****