

Name :

Roll No. :

Invigilator's Signature :

CS/ME (CSE)/M.Tech (SE)/SEM-3/PGCSE-302A/PGSE-302A/2009-10

2010

IMAGE PROCESSING

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

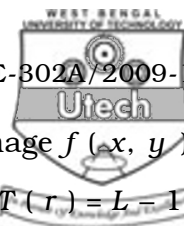
Answer Question No. 1 and any *five* from the rest.

1. a) A 512×512 CT image has 512 grey levels. How many minutes would it take to transmit this image using a 56 K modem ? 3

- b) Find the 2D DFT of the image given below :

$$\begin{pmatrix} 4 & 4 \\ 4 & 4 \end{pmatrix} \quad 3$$

- c) In an image compression system 65536 bits are used to represent a 256×256 image with 256 grey levels. Find the compression ratio. 3



- d) Given that the grey level value of an image $f(x, y)$ at point (x, y) is 65 and a transformation $T(r) = L - 1 - r$ is applied to this point, where $L - 1$ is the highest value of the grey level and r is the existing grey level value. What will be the result of this transformation at (x, y) if $L = 256$? 3

- e) For the given 3×3 image, what would be the result of applying the filter to the central pixel marked in bold ? Can you recognize the filter ? 5

Image	Filter
$\begin{pmatrix} 1 & 1 & 1 \\ 0 & 3 & 0 \\ 1 & 1 & 1 \end{pmatrix}$	$\begin{pmatrix} 0 & -1 & 0 \\ -1 & 4 & -1 \\ 0 & -1 & 0 \end{pmatrix}$

- f) Given below is a 3×3 image having 3 bits per pixel. Sketch the histogram. What would be the normalized histogram look like ? 3

$$\begin{pmatrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 1 \end{pmatrix}$$

2. a) Give a brief description of the power law transformation process for image enhancement.
- b) With the help of a diagram, explain the essential steps of frequency domain enhancement. 5 + 5



3. Describe briefly the 3 colour models RGB, CMY and HSI. What is pseudo-colour processing ? $(3 \times 3) + 1$
4. a) Write down expressions for the 2D DFT and its inverse. Also write down expressions for the magnitude, phase spectrum and power spectral density, explaining the terms involved. Briefly explain convolution with a simple example.
- b) What is STFT ? What is the wavelet transform and what are the advantages over the Fourier transform ? Write down an expression for the mother wavelet, explaining the terms involved. What is a Haar wavelet ? Draw the diagram and explain scaling. $5 + 5$
5. a) Discuss briefly the different types of redundancies that are removed in image compression.
- b) What is lossy compression ? Give the diagram of this type of compression model, explaining the different components.
- c) What is LZW coding ? $6 + 3 + 1$
6. a) Perform the histogram equalization for the image given below and draw the histograms before and after equalization.
- $$\begin{pmatrix} 1 & 2 & 3 & 2 \\ 4 & 2 & 5 & 1 \\ 1 & 2 & 6 & 3 \\ 2 & 4 & 6 & 7 \end{pmatrix}$$
- b) Obtain the Huffman code for the word 'INDIA'. $5 + 5$



7. a) Discuss briefly the two main approaches to image segmentation.
- b) For the binary image shown below, calculate the number of white pixels left if it is eroded by the structuring element
8. a) What is image restoration ?
- b) Answer any *three* :
- i) What is an image pyramid ?
 - ii) If the chain code is (030033212211), what is the corresponding shape and shape number ?
 - iii) What are Fourier descriptors ?
 - iv) What is the Euler number of the figure given below ?
