

Name :

Roll No. :

Invigilator's Signature :

CS / M.TECH (CSE) / ME (SE) / SEM-3 / PGCSE-301A/PGSE-301A / 2010-11

2010-11

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.*

GROUP – A

Answer Question 1 and any four from the rest

(Short Answer Type Questions)

1. Answer any *three* questions : $3 \times 5 = 15$

i) Perform a histogram equalization of the 4×4 image
given below :

$$\begin{pmatrix} 1 & 2 & 3 & 4 \\ 6 & 5 & 5 & 6 \\ 7 & 7 & 3 & 2 \\ 0 & 1 & 4 & 4 \end{pmatrix}$$

Draw the normalized histogram.

ii) Find the DFT of the 2×2 image given below :

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



- iii) How long will it take to transmit a 512×512 image (256 grey levels) using a 112 k modem ?
- iv) For the image given below, what is the result of applying

the filter $\begin{pmatrix} 0 & 1 & 0 \\ 1 & -4 & 1 \\ 0 & 1 & 0 \end{pmatrix}$ to the central pixel (encircled).

Can you recognize the filter ?

Image (3×3)

$$\begin{pmatrix} 2 & 3 & 2 \\ 0 & 1 & 1 \\ 1 & 0 & 3 \end{pmatrix}$$

How many bits/pixel (minimum) are required to represent the image ? Justify your answer.

- v) What is the chain code and shape number of the shape given below ? What is the order number ?

What is the Euler number of the figure below ?



(Long Answer Type Questions)

Answer any *four* of the following. $4 \times 5 = 20$

2. Name three point processing transformations to perform spatial enhancement of an image. Describe any one method.



3. Mention three different colour models and describe any one.
4. Write down the expression for a 2D discrete Fourier transform (DFT) explaining the terms involved. What do you understand by magnitude spectrum, spectral density and phase spectrum ?

$$\begin{pmatrix} 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

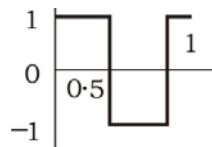
Image

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

Mask

For the image given above, perform a convolution on the pixel encircled, using the mask given on the right.

5. a) With the help of a diagram state how an image is restored.
b) What is an image pyramid ? 2 + 3
6. What is a wavelet ? What are the advantages of the wavelet transform over the Fourier transform ? Write down the expression for the ID wavelet transform. For the wavelet given below, what is the effect of scaling by a factor of 2 ? What type of wavelet is this ?



7. Explain what you understand by dilation and erosion.



GROUP – B

(Answer any three questions from Q.8 and any two questions from Q.9)

8. a) Give the masks used for detecting horizontal, vertical and $\pm 45^\circ$ slanting lines. 5
- b) Describe the algorithm for the seeded region growing algorithm. 5
- c) Write a brief note on JPEG image compression. 5
- d) With a neat block diagram, explain lossless predictive coding approach for image compression. 5
- e) Briefly explain the arithmetic coding technique for image compression. 5
9. a) Discuss briefly the two main approaches to image segmentation. Write down the Ostu's method for threshold selection. 2 + 8
- b) What are the different types of redundancies normally available in an image ? Give the major building blocks of an image compression model and explain their functions. 5 + 5
- c) Explain the salient features of Huffman coding approach. Find set of code words and the average word length using Huffman coding scheme for a set of input grey level symbols with probabilities as given below :

Symbol	S ₁	S ₂	S ₃	S ₄	S ₅	S ₆	S ₇	S ₈
Probability	0.19	0.21	0.25	0.08	0.16	0.06	0.02	0.03

2 + 8

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