

SEVENTH SEMESTER BTECH. (E & C) DEGREE END SEMESTER EXAMINATION MARCH 2021 SUBJECT: DIGITAL IMAGE PROCESSING (ECE - 4006)

TIME: 3 HOURS

MAX. MARKS: 50

Instructions to candidates

- Answer **ALL** questions.
- Missing data may be suitably assumed.

1A. Compute the 2D Fourier transform for the following 2D function

 $f(x, y) = \sin 4\pi x + \cos 6\pi y$

 $f(x, y) = \sin(2\pi x + 3\pi y)$

 $f(x, y) = \sin(3\pi x)\cos(5\pi y)$

1B. Use the Hit or Miss transform to identify the location of the following shape pixel configuration in the image below using the two structuring element B1 and B2.

S	Shape								
0	1	0							
1	1	1							
0	1	0							

				I	mag	e				
0	0	0	0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0	0	0
0	0	1	0	0	1	1	1	1	0	0
0	1	1	1	0	0	0	0	0	0	0
0	0	1	0	0	0	0	1	1	0	0
0	0	0	0	1	0	0	1	1	1	0
0	0	0	1	1	1	0	0	1	0	0
0	0	0	0	1	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0

B2								
1	0	1						
0	0	0						
1	0	1						
	B 1							
0	1	0						

 $\frac{1}{0}$

(5+5)

- 2A Explain first and second order derivative with a neat example and explain its significance in thick and thin edge detection
- 2B. A certain X- ray imaging geometry produces a blurring degradation that can be modelled as a convolution of the sensed image with the spatial, circularly symmetric function.

$$h(x, y) = \frac{x^2 + y^2 - 2\sigma^2}{\sigma^4} e^{-\frac{x^2 + y^2}{2\sigma^2}}$$

Assuming continuous variables, show that the degradation in the frequency domain is given by the following expression.

$$H(u,v) = -8\pi^2 \sigma^2 (u^2 + v^2) e^{-2\pi^2 \sigma^2 (u^2 + v^2)}$$

(5+5)

3A. Transmitter (T), transmits the Image 'A' to the receiver. During the transmission channel noise is added to the image 'A', results with image 'B'. Perform the suitable transformation on the noisy image 'B' to retrieve the original signal 'A'.

		В					А		
1	0	7	5	0	1	0	0	5	0
6	2	3	4	6	6	2	3	4	1
0	7	1	5	4	0	1	1	5	4
3	4	1	0	0	3	4	1	0	0
7	3	4	5	6	1	3	4	5	1

- 3B. Explain the following properties of 2D Fourier transform with the mathematical expression:
 i. Translation ii. Rotation iii. Distributivity and scaling (5+5)
- 4A. Perform the histogram specification for the given image and histogram desired as shown below



4B. Perform the transformation task on the given time domain coefficient as per the JPEG Image coding standards. (Coloured Pixels)

127	103	120	98
89	90	111	123
109	49	98	122
100	112	99	94

(5+5)

5A. Encode the message INDIA GOVT using Arithmetic coding for the given probability distribution.

Symbol	Ι	Ν	D	А	SP	G	0	V	Т
Probability	.2	.1	.1	.1	.1	.1	.1	.1	.1

5B. Explain global thresholding using Ostu's method.

(5+5)