Name: Enrolment No:	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, April/May 2018

Course: DIGITAL IMAGE PROCESSING **Semester: VIII**
Program: B.TECH. ICE- VIII
Time: 03 hrs. **Max. Marks: 100**

Instructions: ATTEMPT ALL QUESTIONS

SECTION A (20 Marks)

S. No.		Marks	CO
Q 1	For any system transformation as shown in Eq. 1 below, write the corresponding associativity, distributive and commutative properties assuming h(x) and f(x) as impulse response and input function respectively. $g(x) = L[f(x)] = f(x) * h(x)$…….(1)	5	CO1
Q 2	Prove that 2D-DFT has following expression for image analysis. $F = \frac{1}{MN} W_M f W_N$	5	CO2
Q 3	Explain Fast Fourier Transform (FFT) in detail for digital image processing applications.	5	CO3
Q 4	Discuss 2-component image model in detail.	5	CO2
	SECTION B (40 Marks)		
Q 5	Explain topological data structures with the help of RAG (region adjacency graph).	10	CO3
Q 6	Explain following relational structures: (i) Pyramids (ii) Quadtrees	10	CO4
Q 7	Explain different types of image pre-processing in detail.	10	CO5
Q 8	Name the following image operator application and discuss in detail. $\frac{1}{9}\begin{bmatrix}1&1&1\\1&1&1\\1&1&1\end{bmatrix}, \frac{1}{10}\begin{bmatrix}1&1&1\\1&2&1\\1&1&1\end{bmatrix}$	10	CO1
	SECTION-C (40 Marks)		
Q 9	(i) Discuss the significance of operator based on following components:	20	CO4

	$$\|\operatorname{grad} g(x,y)\| = \sqrt{\left(\frac{\partial g}{\partial x}\right)^2 + \left(\frac{\partial g}{\partial y}\right)^2}$$ $$\psi = \arg\left(\frac{\partial g}{\partial x}, \frac{\partial g}{\partial y}\right),$$ (i) For the given image, apply any 3 x 3 edge operator. $$\begin{matrix} 100 & 0 & 0 & 255 & 1 & 3 \\ 200 & 9 & 12 & 34 & 90 & 120 \\ 98 & 23 & 90 & 45 & 87 & 2 \\ 87 & 5 & 10 & 54 & 11 & 12 \\ 1 & 5 & 9 & 9 & 8 & 1 \\ 0 & 7 & 9 & 0 & 1 & 1 \end{matrix}$$ (ii)			
Q 10	(i) Derive expression for Canny edge detection algorithm.	**10**	**CO3**
	(ii) Explain frequency domain local pre-processing in detail, and derive appropriate image processing for following image transformation.  	**10**	**CO4**

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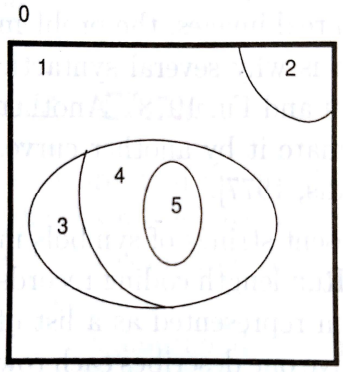
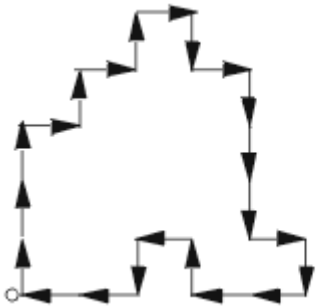
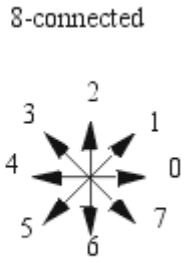
SECTION A (20 Marks)

S. No.		Marks	CO
Q 1	Explain Object-space scanning (rotating mirror) image scanning method in detail.	5	CO1
Q 2	Discuss 2-d filter design using frequency sampling technique for digital image processing applications.	5	CO2
Q 3	Explain DCT (Discrete Cosine transform) with the help of equations.	5	CO3
Q 4	Explain relational structures with the help of Quadtrees.	5	CO4
	SECTION B (40 Marks)		
Q 5	Explain different edge detector operators. (atleast 5 operators 3 x 3 size)	10	CO3
Q 6	Derive RAG (regions adjacency graph) for following: 	10	CO2
Q 7	Break the following 5 x 5 operator into two separate operators of 1 x 5 and 5 x 1 size. $\begin{bmatrix} 1 & 4 & 6 & 4 & 1 \\ 4 & 16 & 24 & 16 & 4 \\ 6 & 24 & 36 & 24 & 6 \\ 4 & 16 & 24 & 16 & 4 \\ 1 & 4 & 6 & 4 & 1 \end{bmatrix}$	10	CO3

Q 8	(i) (ii)	Enumerate major differences between CCD and CMOS sensor. Discuss linear integral transforms in detail.	**10**	**CO1**
		SECTION-C (40 Marks)		
Q 9	(ii) (iii)	Explain JPEG-2000 encoding in detail, with the help of necessary transformation block diagram. For the given image, apply any 3 x 3 edge operator. 100 0 0 255 1 3 200 9 12 34 90 120 98 23 90 45 87 2 87 5 10 54 11 12 1 5 9 9 8 1 0 7 9 0 1 1	**20**	**CO5**
Q 10	(i)	Discuss Chains in detail.	**10**	**CO4**
	(i)	Derive chain code for following:  	**10**	