Roll No.													

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST 1

Sem: Odd Sem 2019-20
Course Code: CSE 401
Course Name: IMAGE PROCESSING
Program & Sem: B.Tech (CSE) & VII (OE)

Date: 12.10.2019
Time: 1.30 PM to 2.30 PM
Max Marks: 40
Weightage: 20%

Instructions:

i) Answer all the Questions.

Part A [Memory Recall Questions]

Answer all the Questions. Each Question carries two marks. (5Qx2M=10M)

1. Define Image sampling. (C.O.NO.1) [Knowledge]
2. What are the common Image format by samples for presentation of pixels? (C.O.NO.1) [knowledge]
3. Identify three level of process in Image Processing. (C.O.NO.1) [Knowledge]
4. Frame the mathematical model for the given Image. (C.O.NO.1) [Comprehension]
5. Differentiate Image Enhancement and Image Restoration. (C.O.NO.1) [Comprehension]

Part B [Thought Provoking Questions]

Answer both the Questions. Each Question carries five marks. (2Qx5M=10M)

6. How the Images are used in real time based on energy spectrum? Explain the main applications area of Image processing where it support in different fields (C.O.NO.1) [Comprehension]

7. For Image formation, we need two main components. One component is Reflectance Model. Illustrate the main three categories with neat diagram.

(C.O.NO.1) [Comprehension]

Part C [Problem Solving Questions]

Answer both the Questions. Each Question carries ten marks. (2Qx10M=20M)

8. Image processing which follows various stages for getting good quality Images. This images are processed by using different techniques. Consider the image f(x), for this image apply the nine stages of Image processing techniques and give clear description for each stages.

(C.O.NO.1) [Application]

9. Consider the image f(x,y) which has two values(0,1),background represent 0 and foreground represent 1 that finally gives binary image. If suppose the given image is grey, how to convert them into binary image and Illustrate its geometric properties.

(C.O.NO.1) [Comprehension]

SCHOOL OF ENGINEERING

Semester: VII
Course Code: CSE401

Date: 27/09/2019
Time: 1:00 to 2:00 PM
Max Marks: 40
Weightage: 20%

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels	Thought provoking type [Marks allotted] Bloom's Levels	Problem Solving type [Marks allotted]	Total Marks
			K	C	A	
1	1	Unit-1	2			2
2	1	Unit-1	2			2
3	1	Unit-1	2			2
4	1	Unit-1		2		2
5	1	Unit-1		2		2
6	1	Unit-1		5		5
7	1	Unit-1		5		5
8	1	Unit-1			10	10
9	1	Unit-1		10		10
	Total Marks		6	24	10	40

K =Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

[I hereby certify that All the questions are set as per the above guide lines.Mr. R Arul Murugan]

Reviewers' Comments

Annexure- II: Format of Answer Scheme

SCHOOL OF ENGINEERING

SOLUTION

Semester: VII

Course Code: CSE401

Course Name: Image processing

Date: 27/09/2019

Time: 1:00 to 2:00 PM

Max Marks: 40

Weightage: 20%

Part A (5 x 2 =10 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	• A static image is a two dimensional spatially varying signal. • A sampling period should be smaller than or at the most equal to half of the period of the finest detail in the image according to Nyquist rate. • This implies that sampling frequency along x axis $\omega_x \geq 2\omega_x^L$ and along y axis $\omega_y \geq 2\omega_y^L$ where ω_x^L and ω_y^L are the limiting factors along x and y axis	2 MARKS	3 MINUTES
2	1 samples 2 samples 3 samples	2 MARKS	1 MINUTE

	4 samples		
3	**Digital Image Processing** **— process digital images by means of computer, it covers low-, mid-, and high-level processes** **low-level: inputs and outputs are images** **mid-level: outputs are attributes extracted from input images** **high-level: an ensemble of recognition of individual objects**	**2 MARKS**	**2 MINUTES**
4	f(x,y)=i(x,y).r(x,y)	**2 MARKS**	**2 MINUTES**
5	**S.no** **Image Enhancement** **Image Restoration** **1** **Image Enhancement is subjective** **Image restoration is objective process.** **2** **Better visual representation** **Its removes effects of sensing environment** **3** **No Quantitative measure is required** **Mathematical model is required** **4** **It concerns about the extraction of features** **It concerns about the restoration of degradation**		**2 MINUTES**

Part B (2 x 5 = 10 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
6	• GAMMA-RAY IMAGING • X-RAY IMAGING • IMAGING IN THE ULTRAVIOLET BAND • IMAGING IN THE VISIBLE AND INFRARED BANDS • IMAGING IN THE MICROWAVE BAND • IMAGING IN THE RADIO BAND	1 MARK 1 MARK 1 MARK 1 MARK 1 MARK	10 MINUTES
7	Reflectance Model • Depending on the nature reflection • Three categories :	2 MARKS 3 MARKS	10 MINUTES

	1. Lambertian 2. Specular 3. Hybrid		

Part C (2x10 = 20 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
8	1) Image Acquisition 2) Image Enhancement 3) Image Restoration 4) Morphological Processing 5) Segmentation 6) Representation & Description 7) Object Recognition	2 MARKS 2 MARKS 2 MARKS 2 MARKS 2 MARKS	15 MINUTES
9	Binary Image Processing Obtained from gray-level (or color) image g(x, y) by Thresholding Characteristic Function b(x, y) = 1 if g(x, y) < T 0 if g(x, y) >= T Geometric properties of the Images: • Connectivity • Projection • Area • Perimeter	2 MARKS 4+4 MARKS	15 MINUTES

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BENGALURU

SCHOOL OF ENGINEERING

TEST –2

Sem & AY: Odd Sem 2019-20
Course Code: CSE 401
Course Name: IMAGE PROCESSING
Program & Sem: B.Tech (CSE) & VII DE

Date: 16.11.2019
Time: 1:00 to 2:00 PM
Max Marks: 40
Weightage: 20%

Instructions:
(i) *Answer all the Questions.*

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries two marks. (5Qx2M=10)

1. What is Image arithmetic? Write needed function. (C.O.NO.2)[Knowledge]
2. List two main Image Enhancement Methods and define them.(C.O.NO.2)[Knowledge]
3. How Thresholding is done gray level imaging? Justify with graph representation. (C.O.NO.2)[Knowledge]
4. Outline the model of the Image Degradation / Restoration Process. (C.O.NO.3)[Comprehension]
5. Define the Fourier Properties of Noise. (C.O.NO.3)[Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each question carries five marks. (2Qx5M=10)

6. A geometric transformation is usually required to align the images. Identify the various Arithmetic Operations that used for transforming the image. And explain with different equations for each operations. (C.O.NO.2)[Comprehension]
7. Noise in digital image arises during Image Acquisition and Transmission. Some Noise Probability Density Functions (PDFs) are used for Image processing. Major noise models are Gaussian Noise and Rayleigh Noise. Identify the mathematical representation above noise model and plot function graph for Gaussian and Rayleigh. (C.O.NO.3)[Comprehension]

Part C [Problem Solving Questions]

Answer both the Questions. Each question carries ten marks. (2Qx10M=20)

8. Consider the Image matrix of 8×8 which have 10 and 50 pixels value. This matrix have to be smoothen by average mask filter of 3×3 matrix. Apply the averaging masking technique and generate the blurred matrix for given below matrix.

(C.O.NO.2)[Application]

10	10	10	10	10	10	`10	10
10	10	10	10	10	10	10	10
10	10	10	10	10	10	10	10
10	10	10	10	10	10	10	10
50	50	50	50	50	50	50	50
50	50	50	50	50	50	50	50
50	50	50	50	50	50	50	50
50	50	50	50	50	50	50	50

9. Consider an 8-level 64 x 64 image with gray values (0, 1, ...,7). The normalized gray values are (0, 1/7, 2/7, ..., 1). The normalized histogram is given below:

k	r_k	n_k	$p(r_k) = n_k/n$
0	0	790	0.19
1	1/7	1023	0.25
2	2/7	850	0.21
3	3/7	656	0.16
4	4/7	329	0.08
5	5/7	245	0.06
6	6/7	122	0.03
7	1	81	0.02

How to implement histogram equalization? Generate equalized Histogram for given Image pixels. [10] (C.O.NO.2)[Comprehension]

SCHOOL OF ENGINEERING

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

Semester: VII
Course Code: CSE401
Course Name: Image Processing

Date: 16/11/2019
Time: 1:00 to 2:00 PM
Max Marks: 40
Weightage: 20%

Extract of question distribution [outcome wise & level wise]

Q.NO	C.O.NO	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels			Thought provoking type [Marks allotted] Bloom's Levels			Problem Solving type [Marks allotted]			Total Marks
			K			C			A			
1	2	Unit-2		2								2
2	2	Unit-2		2								2
3	2	Unit-2		2								2
4	3	Unit-3					2					2
5	3	Unit-3		2								2
6	2	Unit-2					5					5
7	3	Unit-3					5					5
8	2	Unit-2								10		10
9	2	Unit-2					10					10
	Total Marks			8			22			10		40

K =Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

Annexure- II: Format of Answer Scheme

GAIN MORE KNOWLEDGE REACH GREATER HEIGHTS

SCHOOL OF ENGINEERING

SOLUTION

Semester: VII

Course Code: CSE401

Course Name: Image processing

Date: 27/09/2019

Time: 1:00 to 2:00 PM

Max Marks: 40

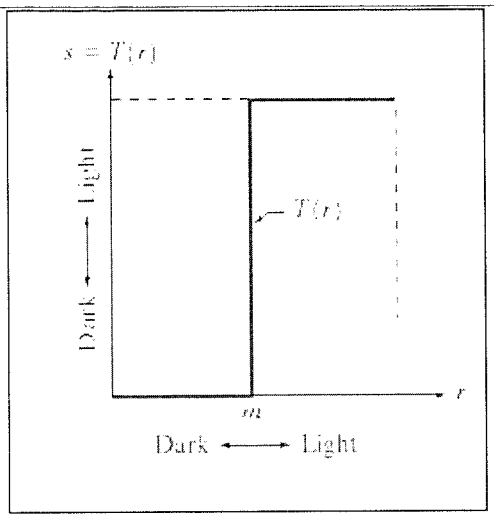
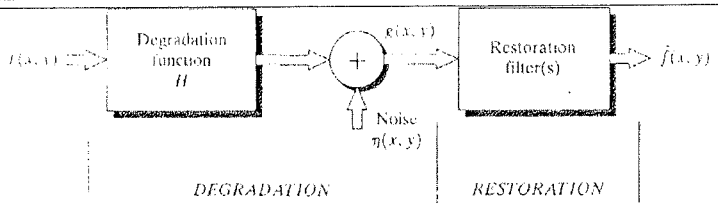
Weightage: 20%

Part A (5 x 2 =10 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question

1	Image Arithmetic
	► For input images f_1 and f_2 and some function Op:
	$g(x.y) = \mathrm{Op}(f_1(x.y).f_2(x.y))$
	The operator is applied pairwise to each pixel in the images.
	► Pseudocode:
	`for all pixel positions x, y:`
	`  out[x,y] = func( image1[x,y] , image2[x,y] )`
	► Possibilities: addition, subtraction, and, or, ...
		2 MARKS	2 MINUTES

2	**Spatial Domain Methods (Image Plane)** • Techniques are based on direct manipulation of pixels in an image **Frequency Domain Methods** • Techniques are based on modifying the Fourier transform of the image	2 MARKS	2MINUTE

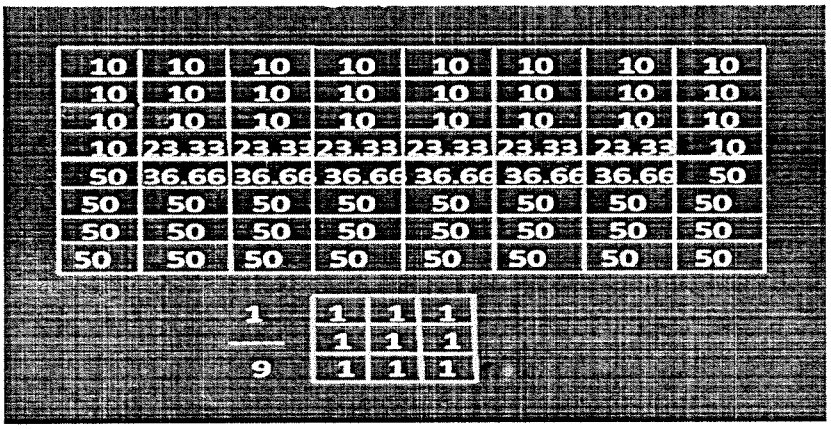
3		2 MARKS	2 MINUTES
4		2 MARKS	2 MINUTES
5	❑ **Refers to the frequency contents of noise in the Fourier sense.** ❑ **If Fourier spectrum of noise is Constant, the noise is usually called *WHITE NOISE***		2 MINUTES

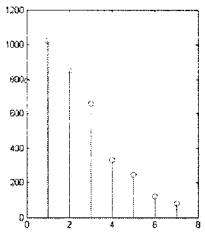
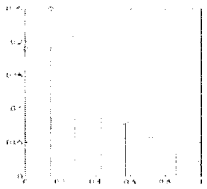
Part B (2 x 5 = 10 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
6	Explanation **Arithmetic operations** ● Addition: $g(x,y) = f_1(x,y) + f_2(x,y)$ ● Subtraction: $g(x,y) = f_1(x,y) - f_2(x,y)$ ● Multiplication: $g(x,y) = f_1(x,y) \cdot f_2(x,y)$ ● Division: $g(x,y) = f_1(x,y) / f_2(x,y)$	1MARK Each operator 1*4=4MARK	10 MINUTES

7	Gaussian Model: 1. Most frequently used. 2. PDF of Gaussian random variable z is given by: ▪ z à Gray level ▪ μ à Mean of average value of z ▪ σ à Standard Deviation of z ▪ σ^2 à Variance of z Rayleigh Noise PDF of Rayleigh Noise is given by: ▪ z à Gray level ▪ μ à Mean of average value of z ▪ σ^2 à Variance of z	2.5 MARKS 2.5 MARKS	10 MINUTES

Part C (2x10 = 20 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
8		Iteration 1-5 each 2 marks	15 MINUTES

9	Normalized Histogram:  	2 marks	15 MINUTES
	$$s_k = T(r_k) = (L-1)\sum_{j=0}^{k} p_{in}(r_j)$$	2 marks	
	Equalization • Applying the transformation, $s_k = T(r_k) = (L-1)\sum_{j=0}^{k} p_{in}(r_j)$ we have	4 marks	
	$s_0 = T(r_0) = 7\sum_{j=0}^{0} p_r(r_j) = 7 \times 0.19 = 1.33 \rightarrow 1$ $s_1 = T(r_1) = 7\sum_{j=0}^{1} p_r(r_j) = 7 \times (0.19 + 0.25) = 3.08 \rightarrow 3$ $s_2 = 4.55 \rightarrow 5$ $s_3 = 5.67 \rightarrow 6$ $s_4 = 6.23 \rightarrow 6$ $s_5 = 6.65 \rightarrow 7$ $s_6 = 6.86 \rightarrow 7$ $s_7 = 7.00 \rightarrow 7$		
	• With this transformation, the output image will have histogram	2 marks	

k	s_k	n_k	$p(s_k) = n_k/n$
0	1/7	790	0.19
1	3/7	1023	0.25
2	5/7	850	0.21
3	6/7	985	0.24
4	1	448	0.11

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SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Semester: Odd Sem. 2019 - 20 | **Date**: 23 December 2019

Course Code: CSE 401 | **Time**: 9:30 AM to 12:30 PM

Course Name: IMAGE PROCEESSING | **Max Marks**: 80

Program & Sem: B.Tech (CSE) & VII (OE-II) | **Weightage**: 40%

Instructions:

i. Read the all questions carefully and answer accordingly.

Part A [Memory Recall Questions]

Answer all the Questions. Each Question carries 1 marks. (10Qx1M=10M)

1. Median filter belongs to _____ of filters? (C.O.No.1) [Knowledge]

2. A continuous image is digitised at _____ points. (C.O.No.1) [Knowledge]

3. The property indicating that the output of a linear operation due to the sum of two inputs is same as performing the operation on the inputs individually and then summing the results is called _____ (C.O.No.2) [Knowledge]

4. An image is considered to be a function of a(x,y), where a represents:_____ (C.O.No.2) [Knowledge]

5. Black and white images have only_____ levels (C.O.No.2) [Knowledge]

6. The method that is used to generate a processed image that have a specified histogramis called _____ (C.O.No.3) [Knowledge]

7. Shrinking of image is viewed as _____sampling (C.O.No.3) Knowledge]

8. Images are represented in dpi, dpi stands for_____ (C.O.No.4) [Knowledge]

9. PDF in histogram equalization stands for _____ (C.O.No.4) [Knowledge]

10. While implementing logic operation on gray-scale images, the processing of pixel values is done as _____ (C.O.No.4) [Knowledge]

Part B [Thought Provoking Questions]

Answer all the Questions. Each Question carries 8 marks. (5Qx8M=40M)

11. Describe the arithmetic operation in image with mathematical expression and its use of each operation (C.O.No.1) [Comprehension]

12. Explain a Simple Image Formation Model. Describe .Key Stages in Digital Image Processing (C.O.No.1) [Application]

13. Write in detail about Image Sampling and Quantization Identify the different types of Quantization in Images. (C.O.No.2) [Comprehension]

14. Consider the following equations: (C.O.No.3) [Comprehension]

i) $p(z) = \begin{cases} \frac{1}{b-a} & for\ a \le z \le b \\ 0 \end{cases}$

ii) $p(z) = \begin{cases} ae^{-az} & for\ z \ge 0 \\ 0 & for\ z < 0 \end{cases}$

Above mathematical formulas are used for Image Degradation purpose. Identify the appropriate noise models for given equations. Illustrate them with graph.

15. Why are there so many different graphic file formats discuss with example? Discuss Color Depth with example. (C.O.No.4) [Comprehension]

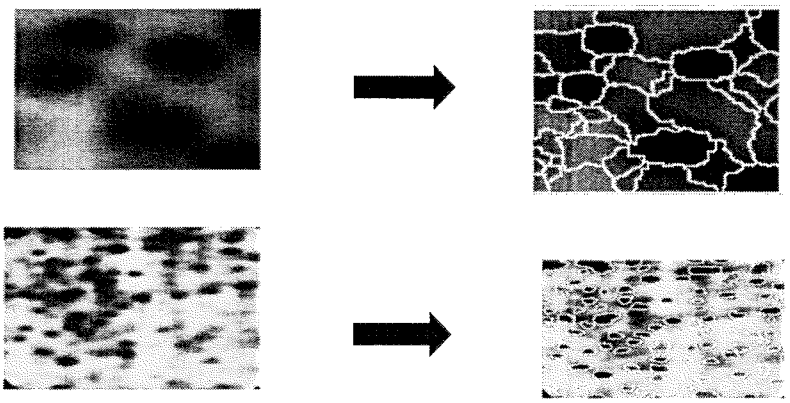
Part C [Problem Solving Questions]

Answer both the Questions. Each Question carries 15 marks. (2Qx15M=30M)

16 Consider an 8-level 64 x 64 image with gray values (0, 1, ...,7). The normalized gray values are (0, 1/7, 2/7, ..., 1). The normalized histogram is given below

k	r_k	n_k	$p(r_k) = n_k/n$
0	0	790	0.19
1	1/7	1023	0.25
2	2/7	850	0.21
3	3/7	656	0.16
4	4/7	329	0.08
5	5/7	245	0.06
6	6/7	122	0.03
7	1	81	0.02

17. Draw the Histogram of output image with all calculations and write pseudocode of it (C.O.No.2) [Application]



The images that given above are segmented into different parts. Segmentation can be done in various ways by using many algorithms. Identify the suitable algorithms that used for Image Segmentation. Describe the steps involved in Image Segmentation algorithms.

(C.O.No.4) [Application]

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO (% age of CO)	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels	Thought provoking type [Marks allotted] Bloom's Levels	Problem Solving type [Marks allotted]	Total Marks
			K	C	A	
PART A Q. NO1-10	CO 01 CO 02 CO 03 CO 04	All the 4 modules	10 [3+2+3+2]			10
PART B Q.NO.11	CO 01	MODULE 01 Fundamentals, Applications, Image Formation	-	08	-	08
PART B Q.NO.12	CO 01	MODULE 01 Fundamentals, Applications, Image Formation	-	08	-	08
PART B Q.NO.13	CO 02	MODULE 02 Image Transformation	-	08	-	08
PART B Q.NO.14	CO 03	MODULE 03 Image Restoration	-	08	-	08
PART B Q.NO.15	CO 04	MODULE 04 Image Segmentation	-	08	-	08
PARTC	CO 02	MODULE 02	-	-	15	15

Q.NO.16		Image Transformation				
PARTC Q.NO.17	CO 01	MODULE 01 Image Fundamentals	-	-	15	15
	Total Marks		10	40	30	80

K =Knowledge Level C = Comprehension Level, A = Application Level

C.O WISE MARKS DISTRIBUTION:

CO 01: 19 MARKS, CO 02: 25 MARKS, CO 03: 11 MARKS, CO 04:25 MARKS

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

I hereby certify that all the questions are set as per the above guidelines.

Faculty Signature:

Reviewer Commend:

Format of Answer Scheme

SCHOOL OF ENGINEERING

SOLUTION

Semester: Odd Sem. 2019-20
Course Code: CSE401
Course Name: IMAGE PROCESSING
Program & Sem: B.Tech(CSE)

Date: 23.12.2019
Time: 3 HRS
Max Marks: 80
Weightage: 40%

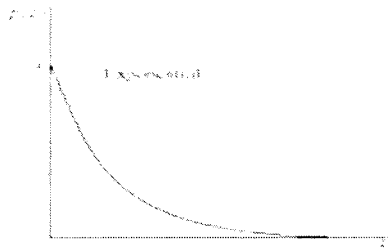
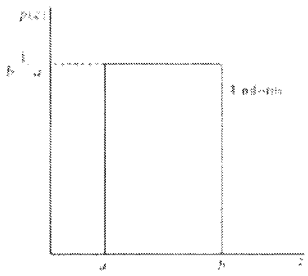
Part A (10Q x 1M = 10Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	Band Pass	1	1
2	Sampling	1	1
3	Additive	1	1
4	Amplitude	1	1
5	2	1	1
6	Histogram matching	1	1
7	High frequency components	1	1
8	Dots per inches	1	1
9	Probability density function	1	1
10	String of binary numbers	1	1

Part B (5Q x 8M = 40 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
11	Explain of each components		22

	Arithmetic operations ● Addition: $g(x,y) = f_1(x,y) + f_2(x,y)$ ● Subtraction: $g(x,y) = f_1(x,y) - f_2(x,y)$ ● Multiplication: $g(x,y) = f_1(x,y) \cdot f_2(x,y)$ ● Division: $g(x,y) = f_1(x,y)/f_2(x,y)$	4*2=8 marks	
12	**1. Spatial Domain Methods (Image Plane) Techniques are based on direct manipulation of pixels in an image** **2. Frequency Domain Methods Techniques are based on modifying the Fourier transform of the image.** **3. Combination Methods There are some enhancement techniques based on various combinations of methods from the first two categories**This implies that sampling **Details**	6 marks 2 Marks	22
13	Image sampling • A static image is a two dimensional spatially varying signal. • A sampling period should be smaller than or at the most equal to half of the period of the finest detail in the image according to Nyquist rate. • This implies that sampling frequency along x axis $\omega_x \geq 2\omega_x^L$ and along y axis $\omega_y \geq 2\omega_y^L$ where ω_x^L and ω_y^L are the limiting factors along x and y axis Image Quantization • It is opposite side of Sampling • As sampling is done in x-axis whereas Quantization is done on the y-axis • Digitizing the amplitudes is called Quantization • Quantization involves in assigning a single value to each samples • We divide signal amplitudes into quanta(partitions) Type of Quantization Uniform Quantization Random Quantization	2 MARKS 2 MARKS 2 MARKS 2 MARKS	22

14	PDF of Exponential Noise is given by: ▪ z → Gray level ▪ μ → Mean of average value of z ▪ σ^2 → Variance of z ▪ a > 0  PDF of Uniform Noise is given by: ▪ z → Gray level ▪ μ → Mean of average value of z ▪ σ^2 → Variance of z 	2 MARKS 2 MARKS 2 MARKS 2 MARKS	22
15	There are a number of fundamental different types of graphical data raster data (sampled values) geometry data (mathematical description of space) latent image data (data transformed into useful images by some algorithmic process4	4 MARKS 2 MARKS	22

	Colour Depth/Bit Depth ▪ 2 Colour: This is mostly a black and white image. It may however be any other two colour image also. It requires just 1 bit for colour information. ▪ 16 Colour: These are very basic image types used on old machines. The colour information here is encoded in 4 bits only. ▪ 256 Color: These are 8 Bit images often used in BMP and GIF formats. ▪ 16 Bit: This is also known as HI-COLOR setting. These have more than 64 Thousand colours and are suitable for most picture related work on computers. ▪ 24 Bit: This is known as TRUE COLOR Setting. These have a better colour depth of more than 16.7 Million Colours and are visually excellent. ▪ 32 Bit: These have even better picture quality to show excellent picture shading effects and shades of special colours like silver, gold, colours across a glass etc. This quality is also available on modern computers.			

Part C (2Q x 15M = 30Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
16	**Arithmetic operations** ▪ Addition: $g(x,y) = f_1(x,y) + f_2(x,y)$ ▪ Subtraction: $g(x,y) = f_1(x,y) - f_2(x,y)$ ▪ Multiplication: $g(x,y) = f_1(x,y) \cdot f_2(x,y)$ ▪ Division: $g(x,y) = f_1(x,y)/f_2(x,y)$ Each arithmetic function with explanation Image averaging logic operations AND, 0R and NOT operators Each arithmetic function with explanation	4 MARKS 2 marks 2 marks 3 marks 4 marks	30 minutes

17	Image Segmentation • Discontinuity: to partition an image based on abrupt changes in intensity (such as edges) • Similarity: to partition an image into regions that are similar according to a set of predefined criteria. • Detection of discontinuities: • There are three basic types of gray-level discontinuities: • points , lines , edges • the common way is to run a mask through the image Point Detection: • The only differences that are considered of interest are those large enough (as determined by T) to be considered isolated points. $\|R\| > T$ Line Detection • Horizontal mask will result with max response when a line passed through the middle row of the mask with a constant background. • the similar idea is used with other masks. • note: the preferred direction of each mask is weighted with a larger coefficient (i.e.,2) than other possible directions. • Apply every masks on the image • let R_1, R_2, R_3, R_4 denotes the response of the horizontal, +45 degree, vertical and -45 degree masks, respectively. • if, at a certain point in the image $\|R_i\| > \|R_j\|$, for all $j \neq i$, • that point is said to be more likely associated with a line in the direction of mask i. Edge Detection Approach ■ Segmentation by finding pixels on a region boundary. ■ Edges found by looking at neighboring pixels. ■ Region boundary formed by measuring gray value differences between neighboring pixels Region-Based Segmentation ■ Important in interpreting an image because they may correspond to objects in a scene. ■ For that an image must be partitioned into regions that correspond to objects or parts of an object.	2 marks 2 marks 3 marks 4 marks 2 MARKS 2 MARKS	30 minutes