Continuous Assessment Test (CAT) – II - MARCH 2025

Programme	:	B.Tech[CSE]	Semester	:	Winter 24-25
Course Code & Course Title	:	BCSE403L- Digital Image Processing	Class Number	:	CH2024250502017
Faculty	:	Dr.Sridhar Ranganathan	Slot	:	A1+TA1
Duration	:	1½ Hours	Max. Mark		50

General Instructions:
Write only your registration number on the question paper in the box provided and do not write other information.
Only non-programmable calculator without storage is permitted

Answer all questions

Q. No	Sub Sec.	Description	Marks
1	[a]	Given the parameters K=1 and $\sigma = 3$, construct a Gaussian filter of size 5*5 with these parameters. Filter coefficients for each cell should be specified accurately upto two decimal places.[5 marks].	10
	[b]	You need to smoothen a 111*111 pixel image with the above filter. Your professor Gurunath asks you to recommend best filter size that would give maximum smoothing theoretically for the given image size and effort. [3 marks]	
	[c]	Compare Box and Gaussian filters and recommend for which applications one needs to choose Gaussian filters. [2 marks]	
2		A 4*4 image is given here	15

1	4	14	11
2	22	27	22
3	33	3	33
5	55	15	5

	[a]	Calculate the 2-D DFT of the image using kernel matrix method [5 marks]	
	[b]	If 2-D DFT of $f(x,y)$ is $F(u,v)$, calculate the 2-D DFT of $f(ax,by)$ [both a and b are positive] [3 marks]	
	[c]	You are accompanying your friend TinTin, Prof.Calculus and Captain Haddock on a trip to Afghanistan to visit a cave in which an ancient Vimana has been uncovered by US troops in 2012. Unfortunately that area is in control of Taliban now. A secret photograph of a 'Sceptre' has to be shown to the Taliban commander guarding the cave so as to let your team and examine the rare Vimana. At that time, this photograph should not be shown to other tribes on the way who might eexecute your team on seeing that. Hence Prof. Calculus calculated the 2-D DFT of the picture and given it to Haddock and asked him to store that and the 2-D IDFT calculation routine in the same pendrive such that it can be converted to image form when required. Captain Haddock, stored the 2-D DFT routine instead of 2-D IDFT routine. On discovering this at the entry point to cave, your team gets shocked. Tintin knows that you have studied Digital Image processing in VIT and he requests you to solve this problem. You do not have internet access to get IDFT routines. Can you advice how DFT routine itself could be used to get IDFT of a given transformed image. Prove how it is possible to calculate IDFT from DFT formula itself.[5 marks]	
	[d]	Calculate the dc-value of the above image [2 marks]	
3	[a]	An object is printed using CMYK values [85, 59, 0, 23].You want to show it in a digital terminal Determine the equivalent RGB values. [5 marks]	10
	[b]	Your friend Tintin sends a picture of a flower from Afghanistan with the following HSI values [H=255 degrees; S =0.5; I = 128]. He wants you to convert to CMY and send it to him. Calculate the equivalent CMY value. [5 marks]	

Illustrate the step-by-step procedure of region split & merge segmentation algorithm for the 8×8 grayscale image as shown in Figure below.

0	0	2	2	4	4	16	16
0	0	2	2	4	4	18	18
1	1	6	6	4	4	20	20
1	1	6	6	4	4	20	20
7	7	12	12	28	28	28	28
7	7	12	12	28	28	28	28
15	15	15	15	28	28	28	28
15	15	15	15	28	28	28	28

Splitting criteria : QUADTREE splitting
Merging criteria: A cell can be mergede with adjoining region if abs value (max of all cells within region - intensity of new joining cell) < 3 OR abs value(min of all cells within region - intensity of new joining cell) < 3.
[SPLIT – 5 marks ; MERGE- 5 marks]

A 'dancing girl' artifact which belongs to 'Kanishka era' is stolen from India and is displayed in the 'World Heritage museum' of USA. One photo [hardcopy] of the artifact is kept in a temple in Lucknow. The CBI official who is deputed from India gets a 4096* 4096 pixel digital image from the Curator of the Heritage museum of USA. The police official handling the case in Lucknow takes the digital image of the artifact from the temple photo but that image is 1024*1024 pixel image. UP police seeks the help of VIT Infosystems to compare the details and to verify whether both the images are of the same artifact. Which technique would you use to compare these two photographs and explain the same. [5 marks]