

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION

WINTER SEMESTER, 2021-2022

DURATION: 1 HOUR 30 MINUTES

FULL MARKS: 75

CSE 4733: Digital Image Processing**Programmable calculators are not allowed. Do not write anything on the question paper.**Answer **all 3 (three)** questions. Marks of each question and corresponding CO and PO are written in the right margin with brackets.

1. a) Suppose you have a gray-scale image of size 50×50 pixels. Your job is now to shrink this image to a size of 32×32 pixels. Apply a resizing operation with less amount of blocking effects? 8
(CO1)
(PO1)
- b) Suppose that a flat area with center at (x_0, y_0) is illuminated by a light source with intensity distribution $i(x, y) = Ke^{-[(x-x_0)^2 + (y-y_0)^2]}$. Assume for simplicity that the reflectance of the area is constant and equal to 1.0, and let $K=255$. If the resulting image is digitized with k bits of intensity resolution (in 256 levels; $k=8$), and the eye can detect an abrupt change of eight shades of intensity between adjacent pixels, what value of k will cause visible false contouring? 7
(CO2)
(PO2)
- c) Interpret the statement – “Discrete histogram equalization technique does not, in general, yield a flat histogram”. 10
(CO1)
(PO1)
2. a) In a given application an averaging mask is applied to input images to reduce noise, and then a Laplacian mask is applied to enhance small details. Would the result be the same if the order of these operations were reversed? Compare and explain your answer. 7
(CO2)
(PO2)
- b) Show that applying a $n \times n$ Box filter repeatedly on an image is equivalent to applying a Weighted Average filter of size $m \times m$, where $m > n$. Demonstrate with an example from 1-D image values. 10
(CO1)
(PO1)
- c) Design a single mask with which if you perform spatial convolution once, the output will be equal to sharpening with High-Boost Filter (parameter $k > 1$). 8
(CO3)
(PO3)
3. a) How can you employ the Histogram Specification technique for color images? 7
(CO1)
(PO1)
- b) Suppose the color values of your image are corrupted by separately adding Gaussian noise of zero mean and σ variance in each RGB color channels. Now if the same image is analyzed using Hue-Saturation Intensity (HSI) components, which channels will show more or less color degradation levels? Compare and explain the cause. 10
(CO2)
(PO2)
- c) Consider the following 500×500 image in Figure 1, in which the squares are fully saturated red, green, and blue, and each of the colors is at maximum intensity [e.g., (1, 0, 0) for the red square]. An HSI image is generated from this image.

Green	Red
Blue	Green

Figure 1: Input for Question 3.(a)

- i. The *saturation* channel of the HSI image is smoothed using an averaging mask of size 125×125 . Determine the appearance of the result (you may ignore image border effects in the filtering operation).
- ii. Repeat the same process for the *hue* channel.

4+4
(CO2)
(PO2)