

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/Backlog), November-December 2017

B. Tech in Electronics & Communication Engineering, Semester VII

Roll No.....

CSE 728: Digital Image Processing

Time: 3 hours

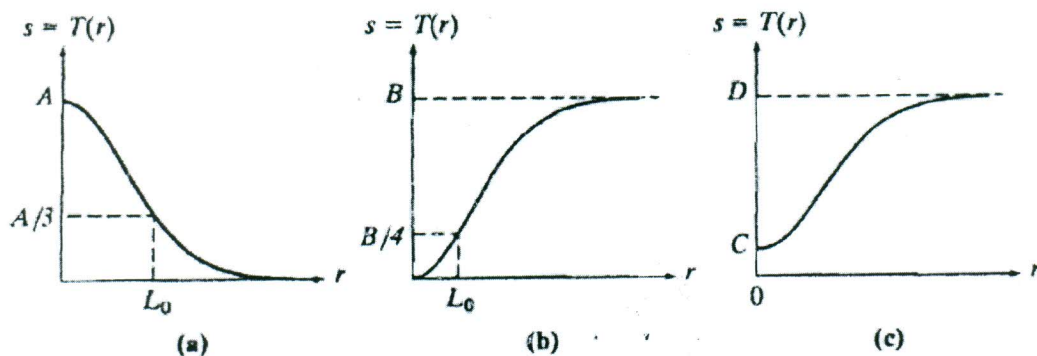
Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A	Objective type multiple choice questions (10 questions @ 1 mark)	10
i.	Which of the following is correct for the distance measures? (a) $D_8 > D_4$ (b) $D_8 < D_4$ (c) $D_8 \leq D_4$ (d) $D_4 \leq D_8$	
ii.	What is gamma correction?	
iii.	What does critical sampling mean?	
iv.	What does hue represents in HIS colour model?	
v.	Which of the following is highly sensitive to colours? (a) Choroid (b) Fovea (c) Ciliary fibres (d) Iris	
vi.	What will be the expression for image negative?	
vii.	The pixels having a D_4 distance from (x, y) less than or equal to some value r form a centered at (x, y) . (a) circle (b) diamond (c) square (d) None of these	
viii.	Light that is void of color is called _____ light.	
ix.	Write down the conversion formulae from RGB to CMY.	
x.	Which are the two components of chromaticity?	
Q.2	Short answer type questions (4 questions @ 2.5 marks)	10
i.	Explain the difference between full-colour and pseudocolour processing with proper examples.	
ii.	What effect would setting to zero the lower-order bit plane have on the histogram of an image in general?	
iii.	Explain the image quantization with the help of an example.	
iv.	Explain aliasing and anti-aliasing.	
Q.3A	Assuming continuous intensity values, suppose that an image has the intensity PDF $p_r(r) = 2r/(L-1)^2$ for $0 \leq r \leq (L-1)$ and $p_r(r) = 0$ for other values of r . Find the transformation function that will produce an image whose intensity PDF is $p_z(z) = 3z^2 / (L-1)^3$ for $0 \leq z \leq (L-1)$ and $p_z(z) = 0$ for other values of z .	05

Q.3B	The median, ζ , of a set of numbers is such that half the values in the set are below ζ and the other half are above it. For example, the median of the set of values {2, 3, 8, 20, 21, 25, 31} is 20. Show that an operator that computes the median of a subimage area, S , is nonlinear.	05
Q.4A	Write down the 2-D impulse function and explain its shifting property.	05
Q.4B	Consider any two valid colours c_1 and c_2 with coordinates (x_1, y_1) and (x_2, y_2) in the chromaticity diagram. Derive the necessary general expressions for computing the relative percentage of colours c_1 and c_2 composing a given colour that is known to lie on the straight line joining these two colours.	05
Q.5A	High-definition television (HDTV) generates images with 1125 horizontal TV lines interlaced (where every other line is painted on the tube face in each of two fields, each field being $1/60^{\text{th}}$ of a second in duration). The width to height aspect ratio of the image is 16:9. The fact that the number of horizontal lines is fixed determines the vertical resolution of the images. A company has designed an image capture system that generates digital images from HDTV images. The resolution of each TV (horizontal) line in their system is in proportion to vertical resolution, with the proportion being the width-to-height ratio of the images. Each pixel in colour image has 24 bits of intensity resolution, 8 bits each for a red, a green, and a blue image. These three "primary" images from a colour image. How many bits would it take to store a 2-hour HDTV movie?	05
Q.5B	Consider the two image subsets, S_1 and S_2 , shown in the following figure. For $V = \{1\}$, determine whether these two subsets are (a) 4-adjacent (b) 8-adjacent or (c) m-adjacent.	05
	$\begin{array}{cccccccccc} & & & S_1 & & & S_2 & & & \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \end{array}$	
Q.6A	Exponentials of the form $e^{-\alpha r^2}$, with α a positive constant, are useful for constructing smooth intensity transformation functions. Start with this basic function and construct transformation function having the general shapes shown in the following figures. The constants shown are input parameters, and your proposed transformations must include them in their specification. (For simplicity in your answer, L_0 is not a required parameter in the third curve.)	05



Q.6B Explain the followings: 05
 (a) Compression (b) Morphological Processing (c) Image restoration
 OR

Q.6B In the given arrangement of pixels, if $V = \{1\}$, find out the pixel which are: 05
 (a) 4-adjacent (b) 8-adjacent (c) m-adjacent

0	1	1
0	1	0
0	0	1

Q.7A What is HSI colour model? Explain the conceptual relationship between RGB and HIS color models. 05

Q.7B What is pseudocolor image processing? Explain the Intensity to colour transformation using functional block diagrams. 05
 OR

Q.7B Explain the followings with proper examples: 05
 (a) Intensity level slicing (b) Bit plane slicing

Q.8A What is image smoothing? Explain the image smoothing using different frequency domain filters. 10

Q.9A Explain the following properties of Discrete Fourier transform with proper examples: 10
 (a) Periodicity (b) Symmetricity

Q.9B Suppose that a flat area with center at (x_0, y_0) is illuminated by a light source with intensity distribution 10

$$i(x, y) = e^{-[(x-x_0)^2 + (y-y_0)^2]}$$

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, and the eye can detect an abrupt change of eight shades of intensity between adjacent pixels, what value of k will cause false visible contouring?

Also sketch the image for the case $k=2$.

OR

Q.9B Explain histogram processing. Also explain the histogram equalization in detail with one example. 10