COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute of Government of Maharashtra.)
SHIVAJI NAGAR, PUNE - 411 005

END Semester Examination

Digital Image Processing (IE-DE-14005)

Course: B.Tech

Branch: Instrumentation and Control Engineering

Semester: Sem VII

Year: 2014-2015

Max.Marks:60

Duration: 3 Hours Time:- 2 to 5 P.M.

Date: 30 NOV 2014

Instructions: MIS No. | | | | | | | | | |

1. Figure to right indicates full marks.
2. Mobile phone and programmable calculators are strictly prohibited.
3. Writing anything on question paper is not allowed.
4. Exchange or sharing of anything like stationary, calculator is not allowed.
5. Assume suitable data if necessary.
6. Write your MIS number on your question paper.
7. Solve any **five** questions

Q. 1 A A common measure of transmission for digital data is the *baud rate*, defined as the number of bits transmitted per second. Generally, transmission is accomplished in packets consisting of a start bit, a byte (8 bits) of information, and a stop bit. Using these facts, answer the following: 8
(a) How many minutes would it take to transmit a 1024*1024 image with 256 gray levels using a 56K baud modem?
(b) What would the time be at 750K baud, a representative speed of a phone DSL (digital subscriber line) connection?

B Develop an algorithm for converting a one-pixel-thick 8-path to a 4-path. 4

Q. 2 A Consider two 8-bit images whose gray levels span the full range from 0 to 255. 6
(a) Discuss the limiting effect of repeatedly subtracting image (b) from image (a).
(b) Would reversing the order of the images yield a different result?

B **(a)** What effect would setting to zero the lower-order bit planes have on the histogram of an image in general? 6
(b) What would be the effect on the histogram if we set to zero the higherorder bit planes instead?

Q. 3 A Suppose that you form a low pass spatial filter that average that four immediate neighbors of a point (x, y) but excludes the point itself 6
i. Find the equivalent filter H(u, v) in the frequency domain.
ii. Show that your result is low pass filter.

B Given an image of size M x N, you are asked to perform an experiment that consist of repeatedly low pass filtering the image using a Gaussian low pass filter with given cutoff D_0. You may ignore the computational round off errors. Let Kmin denote the smallest positive number representable in the machine in which the proposed experiment will be conducted. 6

i. Let K denote the number of applications of the filter. Can you predict, without doing the experiment what result (image) will be for a sufficient large value of K. If so, What is the result?

ii. Derive an expression for minimum value of K that will guarantee the result that you predicted.

Q. 4 A Obtain equation for the band pass filter corresponding to band reject filter 5

B Consider the problem of image blurring caused by uniform acceleration in the x direction. If the image is at rest at time t = 0 and accelerates with a uniform acceleration $x_0(t) = at^2/2$ for time T find the blurring function H(u, v). you may assume shutter opening and closing times are negligible 7

Q. 5 A Draw the general shape of the transformation functions used to correct excessive contrast in the RGB color space 4

B Assume that the monitor and printer of an imaging systems are imperfectly calibrated. An image that looks balanced on the monitor appears yellowish in print. Decibe general transformations that might correct the imbalance. 4

C Derive CMY transformations to generate the complement of color imege. 4

Q. 6 A Compute the quantization step size of the subbands for a JPEG 2000 encoded image in which implicit quantization is used and 8 bits are alloted to the mantissa and exponent of the 2LL subband. 6

B Derive the Lloyd-Max decision and reconstruct levels for L = 4 and uniform proability density function 6

$$p(s) = \begin{cases} \dfrac{1}{2A} & -A \le s \le A \\ 0 & otherwise \end{cases}$$