**IT6005-DIGITAL IMAGE PROCESSING**

**INTERNAL ASSESSMENT –II [KEY]**

**PART-A**

**1.Operations on error free compression:**

**i.**Reducing interpixel redundancy

ii. To remove coding redundancies.

**2.Need of image compression:**

**i.**Reduce the storage

i. The band width increased

**3.Function of sub band coding:**

i. Breaks a signal into a number of different frequency bands, typically by using a fast Fourier transform, and encodes each one independently.

i.It performs up sampling (decoder) & down sampling(encoder).

**4.Frequency domain method:**

**i.** Compute the Fourier transform

ii. multiply the result by a filter

iii.Take the inverse transform .

G (u, v) =H (u, v) F (u, v)

**5.Properties of fourier transform:**

i.Linearity ii.shifting iii.convolution iv.differentiation

v.scaling vi.parseval’s

**6.Region growth:**

i. is a simple region-based image segmentation method. It is also classified as a pixel-based image segmentation method since it involves the selection of initial seed points.

ii. Region-based segmentation is a technique for determining the region directly

**PART-B**

**6.A).SPATIAL DOMAIN ENHANCEMENT:**

The term spatial domain refers to the Image Plane itself which is DIRECT manipulation of pixels.

Denoted by: g(x,y)=T[f(x,y)]

F(x,y) : Input Image , T: Operator on Image , g(x,y): Processed Image.

**I.Gray level transformations**:

s=T(r), where s ,r : gray level of f(x,y) and g(x,y) respectively.

**types of transformations**

**(i)Image Negative**: s = L −1 –r

**(ii)Log Transformations:**

General form: s= c log(1 / r), c is a constant and r≥0 Maps a narrow range of low intensity values in input to a wider output range.

**(iii)Power-Law (Gamma) Transformations:**

Basic form S=cr γ

Where c and γ are positive constants. Power- law curves with fractional values of γ map a narrow range of dark input values to a wider range of output values.

**(iv)Piecewise-Linear Transformations:**

Piecewise functions can be arbitrarily complex. Example functions: Contrast stretching, Intensity-level slicing, Bit-plane slicing.

**II.Histogram Processing:**

The histogram of a digital image with gray levels in the range [0.L-1] is a discrete function **h(rk)= nk** ,where rk is the kth gray level and nk is the number of pixels in the image havinggray level rk.

**histogram equalization:(brief with equation)**

continuous intensity that lies within the interval [0, L-1], represent the new, grey levels (image intensity) in the image, where now 0 ≤ r ≤ 1, pr(r) denote the probability density function (pdf) of the variable r.

**Histogram specification or histogram matching:** The method used to generate a processed image that has a specified histogram is called histogram matching or histogram specification.

**III.Spatial Filtering:**

**1) Smoothing Spacial Filter:** Smoothing filter are used for blurring and for noise detection.

**a) Smoothing Linear Filter**

The output (response) of a smoothing, linear spatial filter is simply the average of the pixels contained in the neighborhood of the filter mask. These filters sometimes are called averaging filters. They also are referred to a lowpass filters.

**b) Order-Statistics ( non linear )Filters**

**2) Sharpening Spatial Filters**:

**Objective**: to highlight detail in an image or enhance detail that has been blurred, either in error or as a natural effect of a particular method of image acquisition.

First order derivative properties, Second derivative properties.

**B).FREQUENCY DOMAIN ENHANCEMENT:** frequency domain is G (u, v) =H (u, v) F (u, v)

**i.steps involved in frequency domain(with diagram)**

1.pre-processing 2.fourier transform 3.filter function 4.inverse FT 5.post –processing

**ii. smoothing (blurring):**achieved by low pass filters.

**1.Ideal Lowpass Filters**:2-D LPF passes all frequency within Do and cut off all frequency outside Do

H(u,v)= 0, if D(u.v)<=Do

1, if D(u.v)>Do

**2.Butterworth LPF:**order n ,cut off frequency at Do from origin.

H(u,v)=1/1+[D(u,v)/Do]^2n

**3.Guassian LPF**: one dimensional(**with equation**)

**iii.sharpening:** achieved by high pass filters.

H (u,v) of hpf =1-H(u,v) of lpf

**1.Ideal HPF**: H(u,v)=0, if D(u,v)<=0

1,if D(u,v)>0

2**.Butterworth HPF:** H(u,v)=1/1+[Do/D(u,v)]^2n

3.**Guassian HPF (with equation)**

**7.A).** **Variable-Length Coding**:

• Variable-Length coding assigns shortest possible code words to the most probable gray levels and vice versa.

• It is the simplest approach to reduce coding redundancy that is present in any natural binary coding of gray levels.

**Objective:**The objective is to code the gray levels of an image in such a way that the averagenumber of bits required to represent each pixel, Lavg should be reduced.

**Lavg equation**

**entropy equation(H)**

**i.Huffman Coding:(with table)**

Huffman coding provides the smallest number of code symbols per source

{a1, a2, a3, a4, a5, a6} = {0.1, 0.4, 0.06, 0.1, 0.04, 0.3}

1. Step 1: to order the probabilities of descending order.

{a2, a6, a1, a4, a3, a5} = {0.4, 0.3, 0.1, 0.1, 0.06, 0.04}

1. Step 2: Next, a source reduction is created by adding the lowest i.e. bottom twoprobabilities into a single symbol.
2. until a source with only two symbols is obtained

**B).Bit plane coding:** **Bit-Plane Coding**

Another effective technique for reducing an image's inter pixel redundancies is to process the image's bit planes individually.

**Bit-plane decomposition:**

**A=**am-1 \* 2^m-1 + am-2 \* 2^m-2 +………+ a1 \*2\*1 + a2 \* 2^2,

gm-1=am-1

The gray levels of an m-bit gray-scale image can be represented in the form of the base 2 polynomial

Based on this property, a simple method of decomposing the image into a collection of binary images is to separate the m coefficients of the polynomial into m 1-bit planes.