**Study guide for Test #1 Digital Image Processing**

You will have 75 minutes for the test. You may use: 1) calculator (your own, you cannot share during the test),

2) One sheet, one-side of hand-written notes – in your own hand writing

The test will cover, in general: 1) Lectures, 2) Homework, 3) Textbook (see syllabus), 4) Lab

*Notes:* Most of the test material will be from lecture and homework. When you take the test, work smart – be sure to work the problems you know first.

**TOPICS:**

Digital Image Processing and Analysis

* definitions, applications
* CVIP fundamentals, pixels, mathematical models
* I(r,c) depends on lighting and object properties
* general IP systems, image display basics
* analysis, enhancement, restoration, compression: definitions, applications

Image Formation and Sensing

* general imaging system hardware
* video signal: frame, field, interlaced, synch pulse
* cameras, sensors, frame grabbers
* electromagnetic spectrum, visible, IR, UV, acoustic, laser, electron imaging

Image Representation

* optical image, vector, matrix, binary, gray-scale, color, multi-spectral, range images
* Color images: color pixel vector, HSL, chromaticity coordinates
* File formats: bitmap vs. Vector images (key points/rendering),LUT
* remapping for display

Image Processing Development Tools

* CVIPtools GUI,Viewer, Analysis->Transforms, Enhancement->Histogram/Contrast->Linear mod, Utilities
* CVIPlab

Digital Image Processing and Visual Perception

* Image analysis is largely a data reduction process
* Image analysis can be done in both spatial or transform domain, feedback lo0p is key
* The eye/brain model, sensors/rods/cones, blind spot, scotopic/photopic vision, bandwidth, metamer, neural model, visible spectrum, tristimulus curves, lateral inhibition
* Properties: resolution (spatial frequency), brightness discrimination/adaptation, false contours/bits per pixel, IGS quant, dither/halftone, temporal response flicker sensitivity, Mach‑band effect, simultaneous contrast, brightness constancy, optical illusion, Image fidelity: objective vs. subjective, error metrics, quality, impairment, comparison

Transforms and Filtering

* Basis functions, basis vectors, basis images, spatial frequency, orthonormal/orthogonal vectors, inner product (projection), outer product
* Fourier, 2‑D DFT, implementing 2‑D with 2, 1‑D;magnitude and phase, properties, display
* Walsh/Hadamard, DCT, Haar, PCT
* Filtering: cutoff, passband, stopband, spectral symmetry, LP,HP,BP,BR, high freq. Emphasis notch, ideal vs. Butterworth (order)
* Spatial filters via convolution: lowpass, highpass, bandpass, band reject; mask coefficients
* Discrete wavelet transform, circular convolution, spatial domain implementation with LP, HP 1-D filters

Image Enhancement

* Point, mask and global operations
* Gray scale modification: mapping equations, compression/stretch negative, power-law, gamma correction

CVIPtools: See homework