

**COLLEGE OF ELECTRICAL AND MECHANICAL ENGINEERING  
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**Course title** : CSE-855, DIGITAL IMAGE PROCESSING  
**Credits** : 3  
**Instructor** : Dr Amir H. Dar  
**Office/ Consultation:** 9000-1200 Hours ( Mon. & Thur.)

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**Goals:** To develop thorough understanding of fundamentals of digital images, properties of discrete transforms and their importance role in digital image processing, study of various image enhancement techniques in spatial as well as frequency domains, fundamentals of image compression, Introduction to color image processing, wavelets and Morphological Image Processing.

**Text Books**

- Digital Image Processing by Rafael C. Gonzalez, Richard E. Woods, Addison Wesley, 2<sup>nd</sup> Edition 2002.

**Reference Books**

- Digital Image Processing by William K. Pratt, John Wiley & Sons inc. 3<sup>rd</sup> edition, 2001
- Digital Image Processing by Kenneth R. Castleman, Prentice hall International Edition, 1996
- Fundamentals of Digital Image Processing, Anil K. Jain, Prentice Hall, 1989

**Topics**

**Introduction to Digital Image Processing (5 hours)**

Applications Areas of DIP  
Modalities for image formation  
Digital Image Representation  
Acquisition  
Storage  
Processing  
Communication  
Display

**Human Visual system (6 hours)**

Structure of Human Eye  
Image formation in the Eye  
Visual Perception( adaptation, discrimination, resolution)  
Image Sensing and Acquisition  
Issues in Sampling and Quantization, Spatial and Gray level Resolution  
Zooming and shrinking of digital images  
Connectivity and relations between pixels

**Image Enhancement ( spatial and frequency domain) (8 hours)**

Enhancement by point processing  
Log, power-law, Piecewise-linear Transforms  
Histogram modifications (Equalization, specification, matching)  
Spatial and Frequency Filtering  
Two-Dimensional DFT and its Properties  
Highpass/Lowpass Filter(Butterworth, Gaussian, Ideal)

**Image Restoration (6 hours)**

Degradation models  
Statistical Noise Models  
Image restoration( Noise only spatial filtering, periodic noise)  
Degradation function Estimation(observation, experimentation, modeling)  
Pseudoinverse image restoration

Inverse filtering, Wiener filtering introduction.  
Blind Image restoration

**Image Compression (4 hours)**

Fundamentals  
Type of redundancy ( coding, inter-pixel and psycho-visual ),  
Fidelity criterion  
Measuring Information  
Study of error free compression and loss compression techniques

**Color Image Processing (4 hours)**

Fundamentals of color image processing  
Color models  
Pseudo-color Image Processing, Intensity Slicing  
Color transformations, Smoothing and sharpening of color images

**Image Segmentation (4 hours)**

Point, Line, Edge Detection  
First-order/second order derivative edge detection  
Edge linking and boundary detection  
Global and adaptive Thresholding

**Introduction to Wavelets (4 hours)**

Introduction & background  
Basis, Scaling, wavelet Functions  
Wavelet Series Expansion, 2D wavelet transforms  
Wavelets for image compression

**Morphological Image Processing (4 hours)**

Set Theory Basics  
Logic Operations for binary images, Dilation, Erosion  
Hit or Miss transformations  
Opening and closing

**Lab Works**

Extensive lab work is required, by the students in MATLAB, to carryout assignments and homework. However, a regular and supervised lab will not be conducted.

**Tests**

Sessional # 1	:	6 <sup>th</sup> week
Sessional # 2	:	12 <sup>th</sup> week
Final Exam	:	As per NUST Schedule

**Grading Criteria**

Sessional # 1	:	20 %
Sessional # 2	:	20 %
Final Exam	:	40 %
Quizzes / Class Assignments	:	10 %
Lab Assignments / Project	:	10 %