



# **DIGITAL IMAGE PROCESSING-1**

## **Lecture 1: Introduction**

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**Dr. Shikha Tripathi**

Department of Electronics &  
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# DIGITAL IMAGE PROCESSING - 1

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## Introduction & Course Overview

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*“Vision is the most advanced of our senses, so it is not surprising that images play most important role in human perception”*



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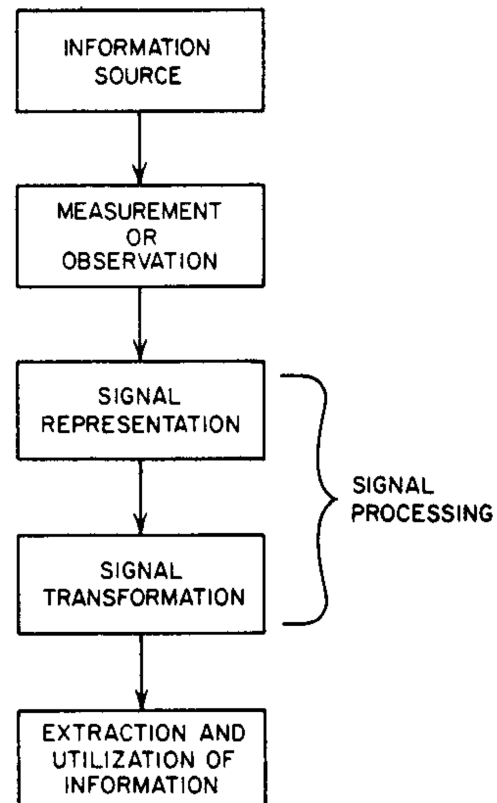
*“One picture is worth more than thousands of words”*

• Anonymous

# DIGITAL IMAGE PROCESSING-1

## Introduction

### Signal Processing:



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## Prerequisites for DIP

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- **Signal Processing**
  - Signals and Systems (S & S)
  - Digital Signal Processing (DSP)

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## Signal Processing Courses

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- **Digital Image Processing (DIP)**
- Speech Processing
- Biomedical Signal Processing
- Radar Signal Processing
- Estimation and detection
- Multirate signal processing
- Adaptive Signal Processing
- Pattern Recognition and classification
- .....

**DIP is a sub area of Signal processing**

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### Digital Image Processing

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- Digital image processing encompasses processes whose inputs and outputs are images and in addition encompasses processes that extract attributes from images, up to and including the recognition of individual objects





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## DIP / Computer Vision

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- Automated analysis of text:
  - **Acquiring an image** of the area containing text
  - **preprocessing** that image, extracting (segmenting) individual characters
  - **describing** the characters in a form suitable for computer processing and
  - **recognizing** those individual characters
- **Digital image processing**
- **Making sense** of the content of the page- **Image analysis and Computer Vision** depending on complexity

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## Techniques of DIP

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- Image Sharpening and restoration
- Image Segmentation
- Image Morphology
- Transmission and encoding
- Machine/Robot vision
- Color processing
- Pattern recognition
- Video Processing
- Image/Video Compression
- .....



# DIGITAL IMAGE PROCESSING-1

## Introduction

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### Course Objectives:

- To introduce basic concepts of digital image processing
- To understand important image transforms
- To learn image enhancement methods
- To familiarize with image restoration
- To learn color image processing concepts and color transforms



## DIGITAL IMAGE PROCESSING-1

### Course Outcomes

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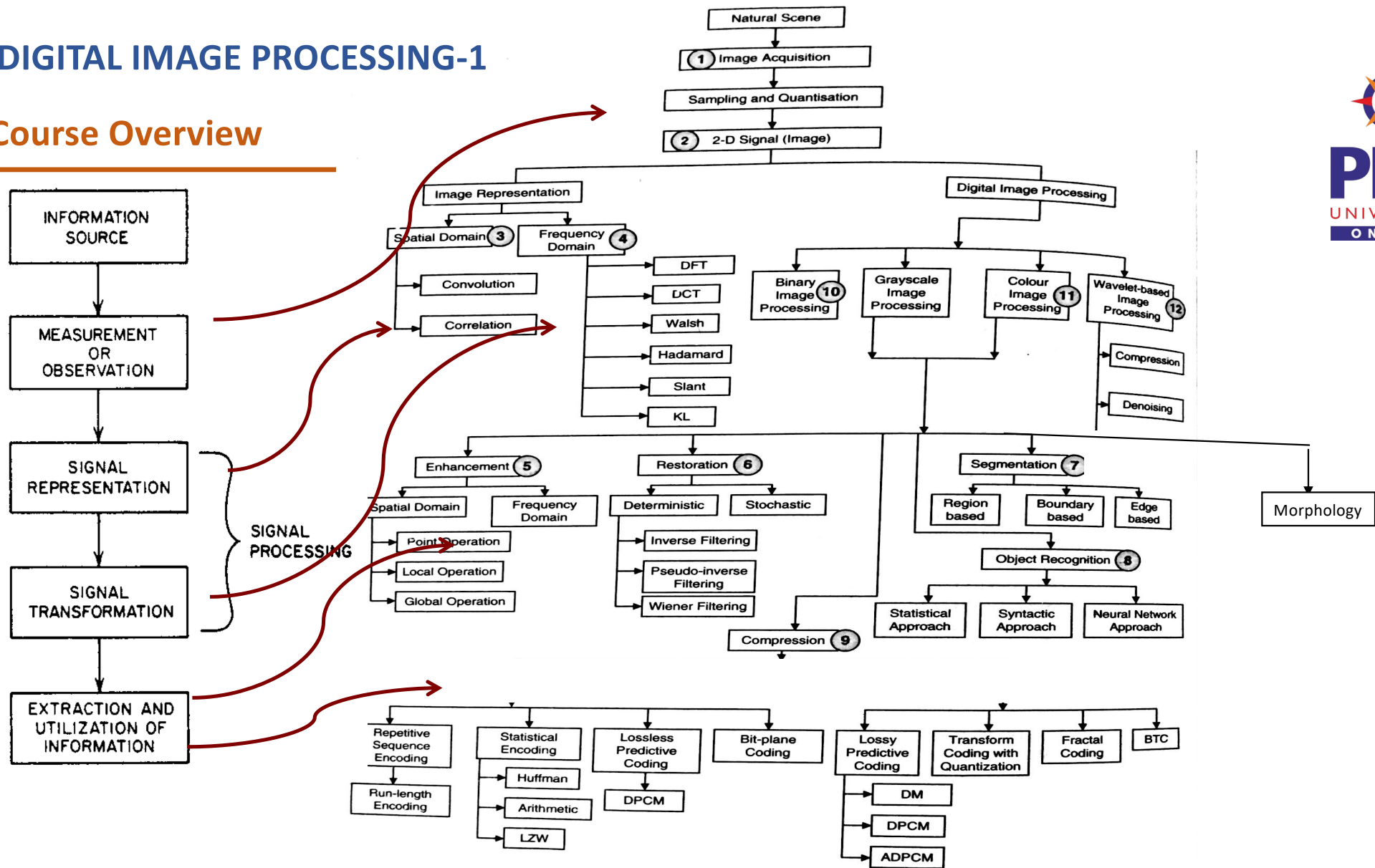


Students completing the course should be able to

- Describe the required fundamental transforms
- Explain the different image processing algorithms
- Use different techniques in image enhancement and image restoration for improving image quality
- Investigate the best algorithm for enhancing an image
- Design image processing algorithms for different applications

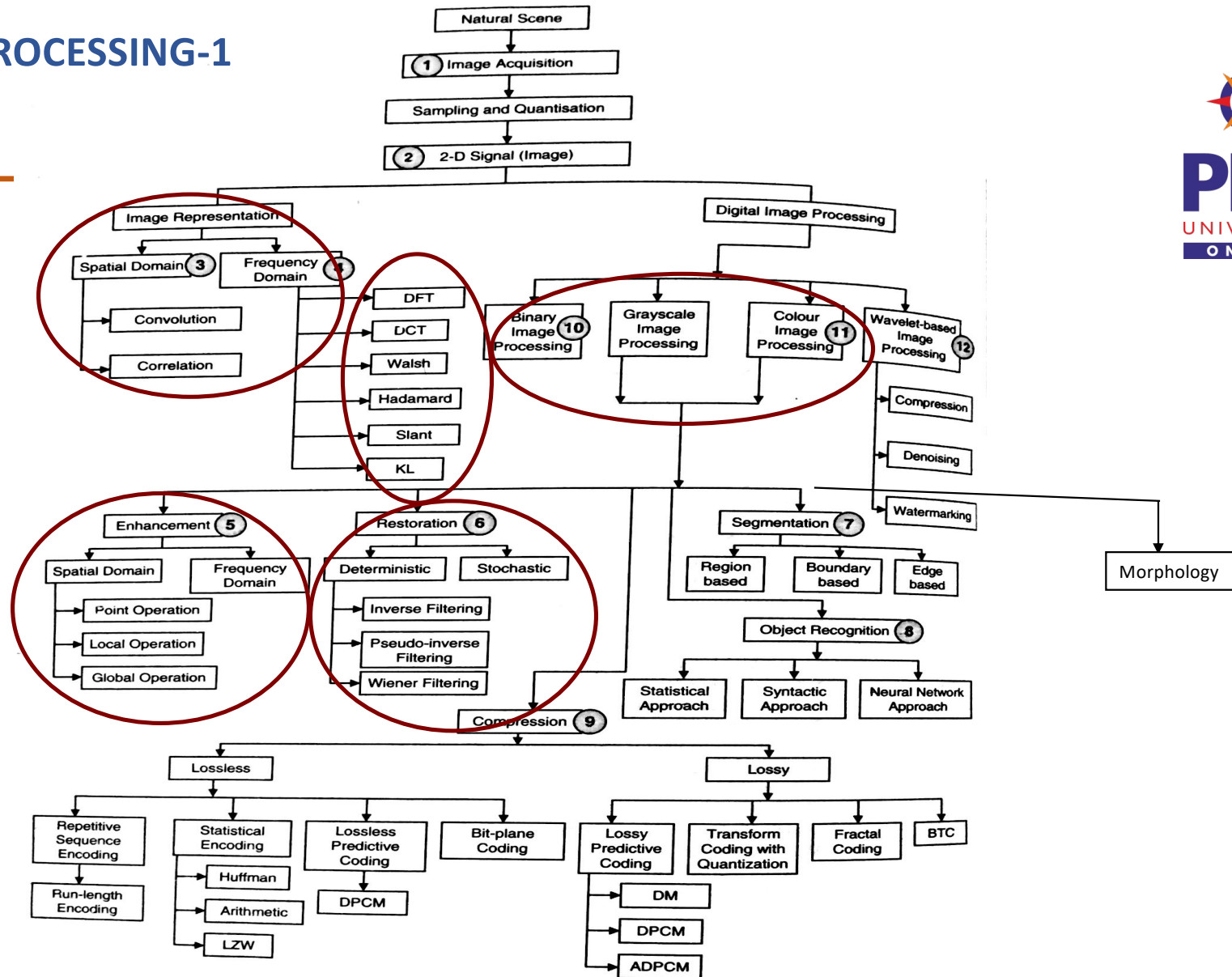
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## Course Overview



# DIGITAL IMAGE PROCESSING-1

## DIP Overview



# DIGITAL IMAGE PROCESSING-1

## Course Overview

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### Modules (55 Hrs):

- **Unit 1: Digital Image Fundamentals**
- **Unit 2: Image Transforms**
- **Unit 3: Image Enhancement in spatial and frequency domains**
- **Unit 4: Image filtering and restoration**
- **Unit 5: Color Image processing**

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## Course Plan

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### Unit 1: 11 Hrs

#### Digital Image Fundamentals :

- What is digital image processing
- Fundamental steps in digital Image processing
- Components of image processing
- Elements of visual perception
- Image sensing and acquisition
- Image sampling and quantization
- Some basic relationships between pixels
- Linear and non linear operations



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## Course Plan

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### Unit 2: 12 Hrs

#### Image Transforms :

- 2-D orthogonal and Unitary transforms
- 1-D and 2-D DFT
- Cosine, Sine, Hadamard, Haar, Slant, Karhunen-loeve transforms
- Singular Value Decomposition (SVD)

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### Unit 3: 12 Hrs

#### **Image Enhancement in spatial and frequency domains:**

- Basic Gray Level transformations
- Histogram processing
- Enhancement using ALU operations
- Basics of spatial filtering, smoothing spatial filters, sharpening spatial filters
- Image Enhancement in Frequency domain:
  - Ideal low pass filters, Butterworth low pass filters, Gaussian low pass filters, Sharpening filters, Unsharp masking, High boost filtering, Notch filters, Homomorphic filtering

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### Unit 4: 10 Hrs

#### **Image filtering and restoration :**

- Image observation models, Noise Models
- Restoration in the presence of noise only-Spatial Filtering
- Periodic noise reduction by frequency domain filtering
- Inverse and Wiener filtering, least square filters

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### Unit 5: 10 Hrs

#### **Color Image Processing :**

- Color Fundamentals, Color Models
- Pseudocolor Image Processing
- Basics of Full-Color Image Processing
- Color Transformations
- Smoothing and Sharpening
- Noise in Color Images

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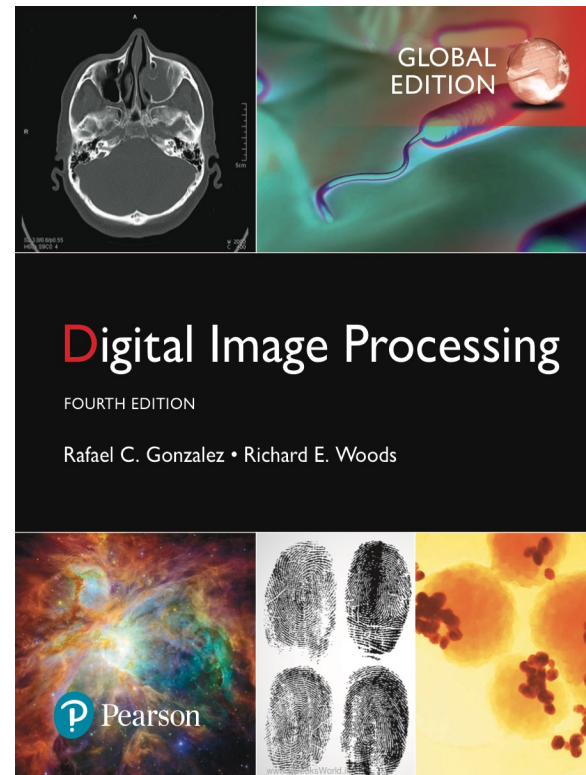
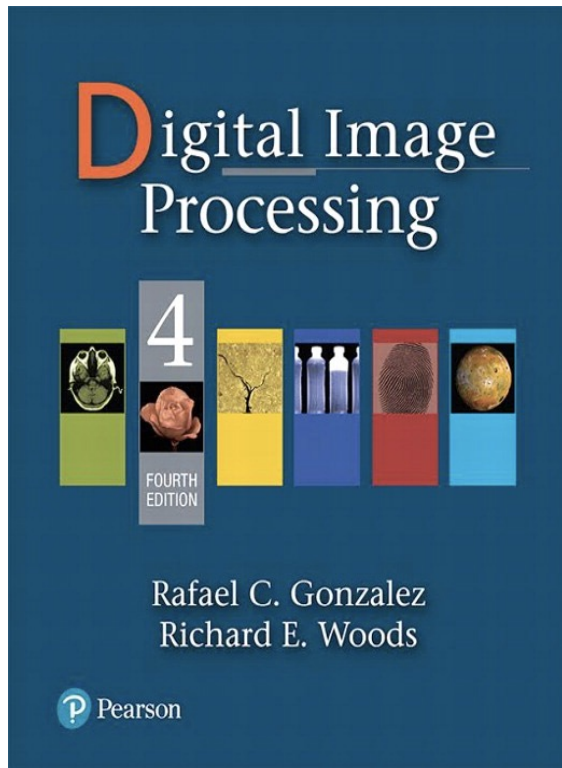
## Reference Books



Book Type	Title & Author	Publication info	
		Publisher	Edition
<b>Text Book (T1)</b>	Digital Image Processing, R.Gonzalez and woods	Prentice Hall	4 <sup>th</sup> edition, 2008
<b>Reference 1 (R1)</b>	Fundamentals of Digital Image Processing, Anil K Jain	Pearson Education Pvt. Ltd	2 <sup>nd</sup> edition, 2004
<b>Reference 2 (R2)</b>	Digital Image Processing, S Jayaraman, S Esakkirajan and T Veerakumar	Mc Graw Hill	2009

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## The Text Book

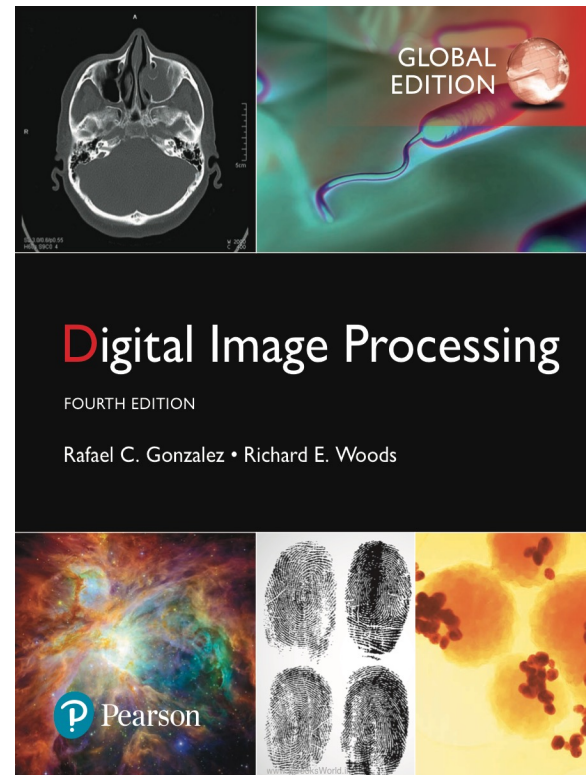
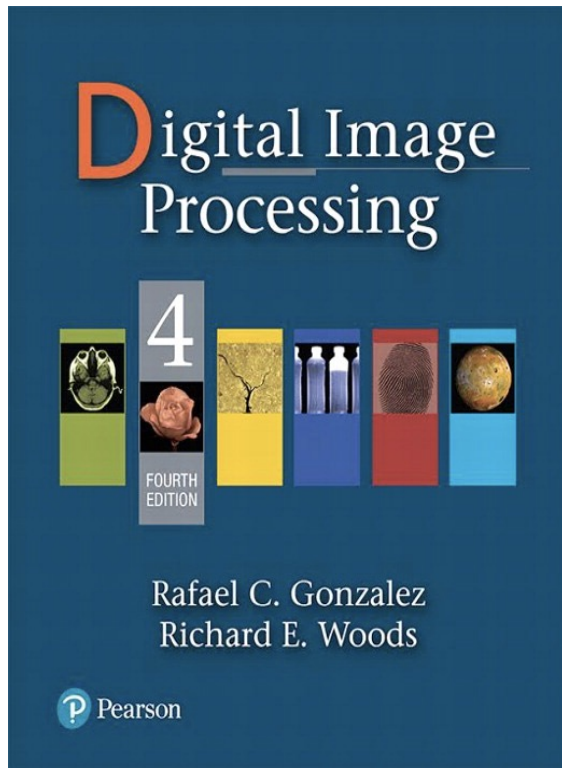


***“When Something can be read without effort, great effort has gone into its writing”***

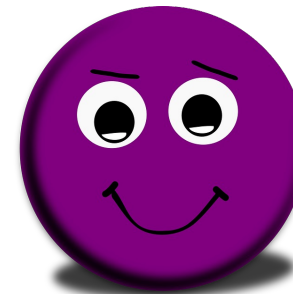
□ **Enrique Jardiel Poncela**

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## The Course Delivery



***“When Something can be understood without effort, great effort has gone into its teaching”***



# DIGITAL IMAGE PROCESSING-1

## Course Instructor

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- Dr. Shikha Tripathi
  - 28 years of teaching and research experience
  - Research Interests:
    - Image /video processing
    - Speech Processing
    - Signal processing and control for robotics
  - Contact:
    - Email: [shikha@pes.edu](mailto:shikha@pes.edu)
    - Chamber: B-Block, 5 S04
  - Teaching Assistants: TBA



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## Course Evaluation Components

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Event	Portion/number	Marks
4/5 ISAs	Units 1-5	30%
Numerical quiz	Unit 3,4	2%
Simulation Assignments	Units 1-5	8 %
Simulation Assignments	Mini Project : Units 1-5	10 %
Total ISA		50
ESA	Unit-1 to Unit 5	50
Total	ISA+ESA	100

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## Next Session

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- Digital image fundamentals
- Types of images
- Fundamental Steps in Image Processing





## THANK YOU

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