



**COMSATS University Islamabad,
Abbottabad Campus
Department of Computer Science
Syllabus Spring 2023**

I. Course code and Title

CSC331	DIGITAL IMAGE PROCESSING
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II. Course Prerequisites

Course Code	Title
MTH231	Linear Algebra
MTH262	Statistics and Probability Theory

III. Instructor's Information

Full Name:	Dr. Mubashir Ahmad
Email:	mubashirahmad@cuiatd.edu.pk
Contact Number	03179617929
Office Hours & Location	09 AM to 05 PM
Teaching Assistant (if any)	N/A

IV. Course Composition

	Credit Hours	Weekly	Duration (hrs)	Contact Hours
Lectures	3	2	1.5	3.0
Laboratories	0	0	0.0	0.0

V. Course Description

This course gives an overview of the fundamental theories and techniques of Digital Image Processing. Major topics covered in the lectures include: Introduction: Elements of Digital Image Processing, Image Model, Sampling and Quantization, Relationships between Pixels; Image Enhancement: Enhancement by Point Processing, Spatial Filtering, Enhancement in the Frequency Domain, Color Image Processing, Image Segmentation: Discontinuity Detection, Edge Linking and Boundary Detection, Thresh Holding, Region Oriented Segmentation, Use of Motion for Segmentation; Image Registration: Introduction to Image Registration, Techniques of Image Registration; Representation and Description: Boundary Description, Regional Description; Morphological Image Processing: Dilation and Erosion, Opening and Closing, Some basic Morphological Algorithms, Extensions to Gray Level Images; Image Transforms: Discrete Fourier Transform, Discrete Cosine Transform, Haar Transform, Hadamard Transform.

VI. Text book

1. Digital Image Processing, Gonzalez, R.C. & Woods, R.E., Pearson, 2018.

VII. Reference books & Material

1. Digital Image Processing A Complete Guide, Gerardus Blokdyk, 5STARCooks, 2020.

VIII. Course Assessment

Evaluation methods	Theory Weight (%) [T]	Lab Weight (%) [L]
Quizzes	15	0
Assignments	10	0
Mid Term	25	0
Terminal Exam	50	0
Total	100	0
Total =T+L	T=(T/100)	NA

The course teacher may select any one of the above weightages as per the course credit hours.

IX. Course Outline and Contents

Lecture	CDF Unit #	Topics Covered	Textbook Section
1.	1	Introduction: Elements of digital image processing course, image acquisition,	Woods:Ch1
2.	1	Image Model, Sampling and Quantization, Relationships between Pixels, Basic image processing operation in Matlab	Woods:Ch2
3.	2	Image Enhancement in spatial domain: Relationship between pixels, pixel operations, Enhancement by Point Processing, Histogram processing	Woods:Ch2
4.	2	Histogram equalization, Spatial Filtering (Local enhancement techniques using spatial filtering/ convolution): Image Smoothing	Woods:Ch3
5.	2	Spatial Filtering: Image 1 st and 2 nd order Derivatives, Gradient Operator, Laplacian Operator, Matlab implementation of convolution for image enhancement	Woods:Ch3
6.	2	Enhancement in the Frequency Domain: Introduction to Fourier transforms, Basic properties of Fourier transforms, Image smoothing (low pass filtering) in frequency domain, Implementation of FFT in Matlab	Woods:Ch4
7.	2	High Pass filtering in frequency domain, Laplacian in frequency domain, High frequency emphasis filtering, Homomorphic filtering, Matlab implementation for filtering in frequency domain	Woods:Ch4
8.	2	Image restoration using Band pass and Notch pass filtering filtering in frequency domain, Matlab implementation for image restoration in frequency domain	Woods:Ch5

9.	2	Color image processing: basics of color imaging, color models, color transformations, RGB to CMYK, HSI color model, color model transformations: RGB to HSI, RGB to YUV	Woods:Ch6
10.	2	Basics of Full-Color image processing, Color image processing in Matlab, Color image smoothing, Laplacian, Color image histogram equalization and segmentation, Matlab implementation of Color image smoothing, Laplacian, histogram equalization and segmentation	Woods:Ch6
11.		MID Term Exam	
12.	3	Image Segmentation , Thresh Holding, Discontinuity detection	Woods:Ch4
13.	3	Edge Linking and Boundary Detection, canny edge Detection	Woods:Ch5
14.	3	Hough Transform (HT) for line detection	
15.	3	Use of motion for segmentation: Background subtraction, shot boundary detection	Woods:Ch10
16.	3	Region Oriented Segmentation, segmentation by clustering, Dendrograms	
17.	5	Image Registration: Introduction to Image Registration, Techniques of Image Registration	Woods:Ch5
18.	5	Geometric transformations: spatial transformation (translation, scaling, rotation) using affine transformation	Woods:Ch5
19.	5	Representation and Description for Image Registration: Boundary Description, Regional Description.	Woods:Ch5
20.	5	Grey-level interpolation techniques, Bilinear interpolation, bi-cubic interpolation, Matlab implementation of Geometric transformation and interpolation	Woods:Ch5
21.	5	Scale Invariant Feature Transform (SIFT)	
22.	4	Morphological Image Processing: Dilation and Erosion	Woods:Ch9
23.	4	Opening and closing, binary image thinning (skeleton),	Woods:Ch9
24.	4	Some basic Connected components extraction using Morphological processing, connected components analysis	Woods:Ch9
25.	4	Morphological Algorithms, Extensions to Gray Level Images	Woods:Ch9
26.	4	Image Transforms: Discrete Cosine Transform	Woods:Ch7
27.	4	Image Transforms: Discrete Cosine Transform (DCT), Image compression using (DCT)	Woods:Ch7
28.	4	Image Transforms: Haar Transform	Woods:Ch7
29.	4	Wavelet transform and wavelet functions and their applications	Woods:Ch8
30.	4	Image Data Compression and Properties of Image Data	Woods:Ch9
31	4	JPEG and MPEG Compression methods	Woods:Ch9
		Terminal Examination	

X. Course Learning Outcomes (CLO) and Program Learning Outcomes

Upon completion of the course, students will be able to:

CLO	Description	PLO
C1	Describe the image acquisition process and its representation.	a-1
C2	Explain the image enhancement techniques in both spatial and frequency domains.	i-1
C3	Differentiate between various segmentation techniques.	a-2,c-3
C4	Analyze different image morphological algorithms and transformations.	a-2,c-3
C5	Discuss various image registration techniques.	a-2

Program Learning Outcomes (PLOs)

PLO	Description
a-1	Use knowledge of computing to solve problems
a-2	Use mathematics to solve problems
i-1	Ability to use current techniques or skills necessary for computing practice
c-3	Evaluate a computer-based system, process, component, or program

XI. Assessment Schedule - Tentative

Give your tentative assessment plan with submission due date.

S. No.	Artifact	Due Date	Remarks
1	Assessment 1		
2	Assessment 2		
3	Assessment 3		
4	Mid Term		
5	Assessment 4		
6	Assessment 5		
7	Terminal Examination		

The course teacher may add quizzes, project or more assignment as he/she may deemed fit

XII. Policy & Procedures

- **Attendance Policy:** Every student must attend 80% of the lectures delivered in this course and 80% of the practical/laboratory work prescribed for the respective courses. The students falling short of required percentage of attendance of lectures/seminars/practical/laboratory work, etc., shall not be allowed to appear in the terminal examination of this course and shall be treated as having failed this course.
- **Grading Policy:** The minimum pass marks for each course shall be 50%. Students obtaining less than 50% marks in any course shall be deemed to have failed in that course. The correspondence between letter grades, credit points, and percentage marks at CIIT shall be as follows:

Grade	A	A-	B+	B	B-	C+	C	C-	D	F
Marks	90 - 100	85 - 89	80 - 84	75 - 79	70 - 74	65 - 69	60 - 64	55 - 59	50 - 54	<50
Cr. Point	4.0	3.7	3.3	3.0	2.7	2.3	2.0	1.7	1.3	0.0

- **Missing Exam:** No makeup exam will be given for final exam under any circumstance. When a student misses Sessional 1 or Sessional 2 for a legitimate reason (such as medical emergencies), his grade for this exam will be determined based on the Department policy. Further, the student must provide an official excuse within one week of the missed exam.
- **Academic Integrity:** All CUI policies regarding ethics apply to this course. The students are advised to discuss their grievances/problems with their counsellors or course instructor in a respectful manner.
- **Plagiarism Policy:** Plagiarism, copying and other anti-intellectual behavior are prohibited by the university regulations. Violators may have to face serious consequences.