2023
TP-153

Course Specification
(Bachelor)

Course Title:	Digital Image Processing and Analysis
Course Code:	CS1765
Program:	Computer Science
Department:	Computer Science and Engineering
College:	Computer Science and information technology
Institution:	Al-Baha University
Version:	TP-153
Last Revision Date:	8/10/2023

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3 H)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☐Required		☒ Elective		
3. Level/year at which this course is offered: (11 / 4th)					
4. Course general Description:					

Lecture:

This course introduces basic mathematical concepts, algorithms, and other building elements in digital image processing and analysis. The course covers image acquisition and sensing, restoration and enhancement in the spatial and frequency domains, such as noise reduction and DE-blurring, color image processing, various image compression techniques, morphological image processing, image edge detection, region segmentation, object recognition and watersheds, as well as image representation and description.

Lab:

The lab experiments have been developed using the Matlab image processing toolbox environment for digital image processing and analysis. The lab starts off with an overview of the basics of MATLAB functions and programming prior to addressing the most popular aspects of image processing. The major areas covered on the lab include intensity transformations, fuzzy image processing, linear and nonlinear spatial filtering, frequency domain filtering, image restoration and reconstruction, geometric transformations and image registration, color image processing, wavelets and other transforms, image data compression, morphological image processing, image segmentation using traditional methods and active contours, feature extraction, and image pattern classification.

5. Pre-requirements for this course (if any)**:**

Computer graphics (CS1751)

6. Pre-requirements for this course (if any)**:**

None

7. Course Main Objective(s):

The main purpose for this course is to teach students how to:

- Understand the definition and the concept of digital image processing.
- Recognize the Digital Image Fundamentals.
- Apply the various techniques for intensity transformations, spatial filtering, function reconstruction, image restoration, reconstruction, and aliasing
- Implement spatial filtering on color images, wavelet packet representations, image compression and watermarking.
- Perform tasks such as morphological smoothing, edge detection, and extracting connected components.
- Work both independently and collaboratively.
- Communicate concepts and techniques in oral presentations.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	44	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	22
2.	**Laboratory/Studio**	22
3.	**Field**	--
4.	**Tutorial**	--
5.	**Others (specify)**	--
Total		44

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Understand the definition and the concept of digital image processing	K1	- Lectures - Discussions	- Homework (rubric) - Midterm - Final exam
1.2	Recognize the Digital Image Fundamentals	K2	- Lectures - Discussions	- Homework (rubric) - Midterm - Final exam
2.0	**Skills**			
2.1	Apply the various techniques for intensity transformations, spatial filtering, function reconstruction, image restoration, reconstruction, and aliasing	S1	- Lectures - Problem-based learning - Assignments - Demonstration - Projects	- Homework (rubric) - midterm - Final exam - Lab reports (rubric) - Lab exam evaluation form (rubric)
2.2	Implement spatial filtering on color images, wavelet packet representations, image compression and watermarking	S2	- Lectures - Problem-based learning - Assignments - Demonstration - Projects	- Homework (rubric) - midterm - Final exam - Lab reports (rubric) - Lab exam evaluation form (rubric)
2.3	Perform tasks such as morphological smoothing, edge detection, and extracting connected components	S3	- Lectures - Problem-based learning - Assignments - Demonstration - Projects	- Homework (rubric) - Final exam - Lab reports (rubric) - Lab exam evaluation form (rubric) - Project Evaluation form (rubric)
2.4	Communicate concepts and techniques in oral presentations	S5	- Oral presentation	- Project evaluation form (rubric)
3.0	**Values, autonomy, and responsibility**			
3.1	Work both independently and collaboratively	V1	- Projects	- Project evaluation form (rubric)

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction and Digital Image Fundamentals	2
2.	Intensity Transformations and Spatial Filtering	3
3.	Filtering in the Frequency Domain	3
4.	Image Restoration and Reconstruction	2
5.	Wavelet and Other Image Transforms	3
6.	Color Image Processing	2
7.	Image Compression and Watermarking	3
8.	Morphological Image Processing	2
9.	Image Segmentation	2
Total		**22**

No	List of Topics	Contact Hours
1.	Introduction to MATLAB, Image Processing Toolbox, and Other Related Toolboxes	1
2.	Digital Image Fundamentals	1
3.	Intensity Transformations and Spatial Filtering Functions	3
4.	Filtering in the Frequency Domain	2
5.	Image Restoration and Reconstruction	2
6.	Geometric Transformations and Image Registration	2
7.	Color Image Processing	2
8.	Wavelet and Other Image Transforms	2
9.	Image Compression	2
10.	Morphological Image Processing	2
11.	Image Segmentation and Feature Extraction	3
Total		**22**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework	Every two Weeks	10%
2.	Midterm	6	20%
3.	Quiz	10	10%

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
4.	Lab reports and discussions (rubric)	Every two Weeks	10%
5.	Lab exam evaluation form (rubric)	12	10%
6.	Final Exam	13	40%
	Total		**100%**

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	- Rafael Gonzalez and Richard E. Woods, “Digital Image Processing”, Pearson Education, fourth edition, 2018. - Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins, "Digital Image Processing USING MATLAB", Gatesmark Publishing, 2020.
Supportive References	- Bhabatosh Chanda and Dwejesh Dutta Majumder, “Digital Image Processing and analysis”, Second Edition, PHI Learning Pvt. Ltd., 2011 - Computer Science Curriculum 2013 – http://cs2013.org - ACM (Association for Computer Machinery) Curricula Recommendations - http://www.acm.org/education/curricula-recommendations
Electronic Materials	• ACM (Association for Computer Machinery) web site - http://www.acm.org/ • IEEE Computer Society web site - http://www.computer.org/portal/web/guest/home • Access to the Saudi Digital Library (SDL). Using the learning management system of the university – Rafid System (https://lms.bu.edu.sa/).
Other Learning Materials	None

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• A classroom or lecture hall with whiteboard for 25 students. • A digital circuit’s laboratory.
Technology equipment (projector, smart board, software)	• A digital image projection system with connection to desktop computer and laptop computer. • High speed Internet connection. • An instructor computer station. • MATLAB with digital image processing toolbox

Items	Resources
Other equipment (depending on the nature of the specialty)	None

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	• Students • Faculty • Peer Reviewers • Program Leader • Course Coordinator	• Surveys (indirect). • Direct feedback from students (interview between Program leader and students). • Course evaluation by Peer Reviewers (indirect). • Class visit by Program Leader • Comprehensive Course report (where we can find information about teaching difficulties and action plan, …)
Effectiveness of Students assessment	• Students • Faculty • Peer Reviewers • Course Coordinator • Exam Evaluation Committee • Course Coordinator	• Surveys (indirect). • Direct feedback from students (interview between Program leader and students). • Assessment results (direct) • Course evaluation by Peer Reviewers (indirect). • Comprehensive Course report (where we can find information about assessment difficulties and action plan, …) • Exam evaluation by the Exam Evaluation Committee (indirect)
Quality of learning resources	• Students • Faculty • Peer Reviewers • Course Coordinator	• Surveys (indirect) • Course evaluation by Peer Reviewers (indirect). • Comprehensive Course report (where we can find information about difficulties and challenges about learning resources as well as consequences and action plan, …)
The extent to which CLOs have been achieved	• Faculty • Program Leader • Course Coordinator	• Student Results (direct) • Comprehensive Course report (where we can find the CLO assessment results)
Other	None	None

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	CURRICULUM COMMITTEE MEETING
REFERENCE NO.	
DATE	8/10/2023