1.	Course title	**Digital Image Processing**
2.	Course number	1901757
3.	Credit hours (theory, practical)	3
	Contact hours (theory, practical)	3
4.	Prerequisites/corequisites	-
5.	Program title	Computer Science
6.	Year of study and semester (s)	2022/2023 - Spring
7.	Final Qualification	-
8.	Other department (s) involved in teaching the course	-
9.	Language of Instruction	English
10.	Date of production/revision	1/2/2023
11.	Required/ Elective	Elective

12. Course Coordinator:

Computer Science Department, Office no. 113, 1st floor
Phone: +9625355000. Extension: 22578
Email: hazemh@ju.edu.jo
Office hours: 10:30-11:30 (Sun, Tue), 3-4 (Sun)

13. Other instructors:

None

14. Course Description:

This course presents the techniques of Digital Image Processing. Pre-Processing the image in spatial and frequency domains: Fourier and other transforms. Geometric transformations and Brightness interpolation. Continuous and discrete convolution and filtering. Gray level transforms. Color Image Processing. Edge Detection and Feature identification. Image Compression. Morphological Image Processing. Image Segmentation. Application to models of human and machine vision. Survey and Presentation about different topics and trends in Image Processing.

15. Course aims and outcomes:

A- Aims: The main goal of this course is to teach students the following:

1. Understand the basic concepts of digital image processing.
2. Understand spatial and frequency domains.
3. Understand image enhancement in spatial and frequency domains.
4. Understand brightness interpolation
5. Understand processing of color images.
6. Understand image compression algorithms.
7. Understand image edge detection and segmentation techniques.
8. Understand morphological image processing.
9. Understand object recognition in images (presentation).
10. Understand how to presents a selected topic in image processing and computer vision.

B- Intended Learning Outcomes (ILOs): Upon successful completion of this course students will be able to

A- Knowledge and Understanding: Students should …

A1) Have an idea on the importance and applications of digital image processing.
A2) Learn basics, concepts and methodologies of digital image processing.
A3) Understand how image enhancement, morphology, compression, edge detection, image segmentation, and object recognition.

B- Intellectual skills: with the ability to …

B1) Compare and analyze algorithms used to solve a problem.
B2) Apply mathematical tools to algorithm verification and analysis.
B3) Analytically recognize research methodologies in topics of image processing.

C- Subject specific skills – with ability to …

C1)Work on a specific research topic and present their work.
C2)Analyze different methods and algorithms of digital image processing.

D- Transferable skills – with ability to

D1) Possess good image analysis concept.
D2) Work in groups to share ideas and transfer them into a presentation work.

16. Topic Outline and Schedule:

Topic	Week	ILOs	Program SOs[1]	TLA (Teaching, Learning and Assessment)
Digital Image Fundamentals: Image Sampling and Quantization. Basic Relationships between Pixels. Visual perception of the image	1-2	A1	1	T: Lecture and examples L: Reading lecture notes A: in Class questions.
Intensity Transformations: Basic Intensity Transformation Function. Histogram Processing. Geometric Transformations. Brightness Interpolation. **Suggestion of topics for research presentation**	3-4	A2, A3, B3, C1, D1	1, 2, 6	T: Lecture and examples L: Reading lecture notes A: in Class questions. Presentation of research topic: Problem statement
Spatial Filtering: Fundamentals of Spatial Filtering. Smoothing Spatial Filters. Sharpening Spatial Filters. Combining Spatial Enhancement Methods. Edge Detection. Basic Segmentation	5-6	A2, A3, B1, B2, B3, D2	1, 2, 6	T: Lecture and examples L: Reading lecture notes A: in Class questions. Presentation of research topic: Motivation. Paper selection. Datasets
Midterm Exam	7			
Filtering in the frequency Domain: The Discrete Fourier Transform (DFT) one variable. Extension to functions of two variables. Image Smoothing using Frequency domain filters. Image Sharpening Using Frequency Domain Filters.	8-9	A3, B1, B2, C2	1, 2, 6	T: Lecture and examples. MATLAB for demo L: Reading lecture notes A: in Class questions.
Color Image Processing: Color Image Fundamentals. Color Models and Conversion. Pseudo-color Image Processing.	10	A3, B2, C2, D1	1, 2, 6	T: Lecture and examples. MATLAB for demo L: Reading lecture notes A: in Class questions.
Image Compression: Fundamentals. Image Properties. Compression Methods: Huffman Coding. LZW Coding. Run- Length Coding. Bit-Plane Coding. Lossy Image Compression (DCT/DCT II).	11-12	A3, B1, C2	1, 2, 6	T: Lecture and examples. L: Reading lecture notes A: in Class questions.
Morphological Image Processing: Preliminaries. Erosion and Dilation. Opening and Closing. Hit-or-Miss Transformation. Thinning. Thickening. Basic Morphological Algorithms. Grayscale Morphology.	12-13	A3, B1, B2, C2, D1	1, 2, 6	T: Lecture and examples. MATLAB for demo L: Reading lecture notes A: in Class questions.
Image Analysis and Understanding: Texture analysis. Co-occurrence matrix.	14	B2, C2, D1	1, 2, 6	T: Lecture and examples. L: Reading lecture notes A: in Class questions.
Presentation of research topic	15-16	B3, C1, D2	1, 2, 6	A: Evaluation of Presentations
Final Exam				

[1] The ABET outcomes

17. Evaluation Methods and Course Requirements (Optional):

Opportunities to demonstrate achievement of the ILOs are provided through the following assessment methods and requirements:

Midterm Exam: 30%
Presentation: 30%
Final Exam: 40%

18. Course Policies:

Please follow The University of Jordan regulations regarding the following policies, more information is at www.ju.edu.jo

A- Attendance policies:

B- Absences from exams and handing in assignments on time:

C- Health and safety procedures:

D- Honesty policy regarding cheating, plagiarism, misbehavior:

E- Grading policy + Weighting (i.e., weight assigned to exams as well as other student work)

F- Available university services that support achievement in the course:

G- Statement on Students with disabilities

Students with Disabilities: Students with disabilities who need special accommodations for this class are encouraged to meet with the instructor and/or their academic advisor as soon as possible. In order to receive accommodations for academic work in this course, students must inform the course instructor and/or their academic advisor, preferably in a written format, about their needs no later than the 4th week of classes.

19. Required equipment:

None

20. References:

A- Required book (s), assigned reading and audio-visuals:

- Digital Image Processing 4th edn., Gonzalez R. and Woods R., Pearson, 2018.
- Image Processing, Analysis, and Machine Vision 4th edn., Sonka M., Hlavac V., and Boyle R., Cengage Learning, 2014.

B- Recommended books, materials, and media:

- Digital Image Processing Using MATLAB 3rd edn, Gonzalez R. and Woods R., Eddins S., Gatesmark Publishing, 2020.

- Image Processing, Analysis & and Machine Vision - A MATLAB Companion, Svoboda, Kybic, and Hlavac, Cengage Learning, 2008.

Journal:

- IEEE Transactions on Image Processing.
- IEEE Transactions on Pattern Analysis and Machine Intelligence.
- Signal, Image and Video Processing.
- Multimedia Tools and Applications.
- International Journal of Computer Vision.

21. Additional information:

None

Date: 1/2/2023

Name of Course Coordinator: Prof. Hazem Hiary Signature: ----------

Head of curriculum committee/Department: ---------- Signature: ----------

Head of Department: ---------- Signature: ----------

Head of curriculum committee/Faculty: ---------- Signature: ----------

Dean: ---------- -Signature: ----------

Copy to:
Head of Department
Assistant Dean for Quality Assurance
Course File