Course Specifications

General Information

Course name	Image Processing
Course number	ITCS4347
Faculty	
Department	
Course type	Major Needs
Course level	4
Credit hours (theoretical)	3
Credit hours (practical)	0
Course Prerequisites	

Course Objectives

1 - Develop a theoretical foundation of fundamental Digital Image Processing concepts

2 - Provide mathematical foundations for digital manipulation of images; image acquisition; preprocessing; segmentation; Fourier domain processing; and compression

3 - Gain experience and practical techniques to write programs using MATLAB language for digital manipulation of images; image acquisition; preprocessing; segmentation; Fourier domain processing; and compression

Intended Learning Outcomes

Knowledge and Understanding	* a1 Have a clear understanding of the principals the Digital Image Processing terminology used to describe features of images
	* a2 Have a good understanding of the mathematical foundations for digital manipulation of images; image acquisition; preprocessing; segmentation; Fourier domain processing, compression and analysis
	* a3 Be able to write programs in Matlab language for digital manipulation of images; image acquisition; preprocessing; segmentation; Fourier domain processing; and compression
	* a4 Have knowledge of the Digital Image Processing Systems
	* a5 Be able to understand the documentation for, and make use of, the MATLAB library and MATLAB Digital Image Processing Toolbox (IPT)
	* a6 Learn and understand the Image Enhancement in the Frequency Domain
	* a7 Learn and understand the Image Enhancement in the Spatial Domain
	* a8 Understand the Image Restoration, Compression, Segmentation, Recognition, Representation and Description
Intellectual Skills	* b1 Be able to use different digital image processing algorithms
	* b2 Be able to design, code and test digital image processing applications using MATLAB language
	* b3 Be able to understand the documentation for, and make use of, the MATLAB library and MATLAB Digital Image Processing Toolbox (IPT)
	* b4 Analyze a wide range of problems and provide solutions related to the design of image processing systems through suitable algorithms, structures, diagrams, and other appropriate methods
	* b5 Practice self-learning by using the e-courses and web materials
Professional Skills	* c1 Plan and undertake a major individual image processing project
	* c2 Be able to work effectively alone or as a member of a small group working on some programming tasks
	* c3 Prepare and deliver coherent and structured verbal and written technical reports
	* c4 Use laboratory equipment effectively
	* c5 Use the scientific literature effectively
General Skill	* d1 Display personal responsibility by working to multiple deadlines in complex activities
	* d2 Be able to work effectively alone or as a member of a small group working on some programming tasks

Course Contents

1 - Introduction And Digital Image Fundamentals
2 - Digital image Representation
3 - Image Enhancement in the Spatial Domain
4 - Image Enhancement in the Frequency Domain
5 - Image Restoration
6 - Image Compression
7 - Image Segmentation
8 - Object Recognition

Teaching and Learning Methods

1 - Lectures
2 - Tutorial
3 - Seminar
4 - Assignments
5 - Project

Students Assessment

Assessment Method	TIME	MARKS
Midterm Examination	Week 8	30
Reports, Quizzes, Home works, Projects	During Semester	20
Final Examination	Week 16	50

Books and References

Essential books	Title: “Digital Image Processing”. Author(s)/Editor(s): R. C. Gonzalez and R. E. Woods. Publisher: Pearson-Prentice-Hall, 2008 ISBN: 0-13-168728-x, 978-0-13-168728-8 Edition: third
Recommended books	Title: “Digital Image Processing using Matlab”. Author(s)/Editor(s): R. C. Gonzalez, R. E. Woods, S. L. Eddins. Publisher: Pearson-Prentice-Hall, 2004 ISBN: 0-13-008519-7 Edition: 2nd
Other References (Periodical, web sites, ... etc.)	www.imageprocessingplace.com; www.mathworks.com; en.wikipedia.org/wiki/Digital image processing; www.mathworks.com/access/helpdesk/help/pdf_doc/matlab/getstart.pdf

Knowledge and Skills Matrix

Main Course Contents	Study Week	Knowledge and Understanding	Intellectual Skills	Professional Skills	General Skill
Introduction And Digital Image Fundamentals (The origins of DIP, Examples of Fields that Use DIP, Fundamentals Steps in IP, Elements of DIP Systems)	Week 1	A1	x	x	x
Introduction And Digital Image Fundamentals (cont.) - (□Image Sampling and Quantization; Some basic relationships; Translation, Scaling, Rotation ... etc.)	Week 2	A1, A2	x	x	x
Introduction And Digital Image Fundamentals (cont.): □Linear and Non Linear Operations + Digital image Representation: Reading, Displaying, Writing Images etc.	Week 3	A2, A3	B1, B2	x	x
Digital image Representation (cont.): □ Converting Between data classes and Image Types + Image Enhancement in the Spatial Domain: Gray Level Transformations; Histogram Processing.	Week 4	A4, A5	B2, B3	C1	x
Image Enhancement in the Spatial Domain (cont.): Enhancement Using Arithmetic and Logic operations; Combining Spatial Enhancement Methods; Basics of Spatial Filters	Week 5	A5, A6	B3	C2, C3	x
Image Enhancement in the Spatial Domain (cont.): Smoothening and Sharpening Spatial Filters; Intensity Transformation Function (MATLAB)	Week 6	A6	B3	x	D2
Image Enhancement in the Spatial Domain (cont.): Histogram Processing and Function Plotting + Image Enhancement in the Frequency Domain: Fourier Transform and the frequency Domain etc.	Week 7	A7	B3	C3	D1, D2
Image Enhancement in the Frequency Domain (cont.) (Smoothing Frequency Domain Filters; Sharpening Frequency Domain Filters; Homomorphic Filtering)	Week 8	A7	x	x	x

Image Restoration (A model of The Image Degradation / Restoration Process; Noise Models; Restoration in the presence of Noise Only Spatial Filtering)	Week 9	A8	B4	C4, C5	D1, D2
Image Restoration (cont.) (Periodic Noise Reduction by Frequency Domain Filtering; Linear Position-Invariant Degradations; Estimation of Degradation Function)	Week 10	A8	B4	C4, C5	D1, D2
Image Restoration (cont.) (Inverse filtering; Wiener filtering)	Week 11	A8	B4, B5	C4, C5	D1, D2
Image Restoration (cont.) (Geometric Mean Filter; Geometric Transformations)	Week 12	A8	B4, B5	C4, C5	D1, D2
Image Compression (Coding; Interpixel and Psychovisual Redundancy; Image Compression models; Compression standards)	Week 13	A8	B4, B5	C4, C5	D1, D2
Image Segmentation (Detection of Discontinuities; Edge linking and boundary detection; Thresholding)	Week 14	A8	B4, B5	C4, C5	D1, D2
Object Recognition (Patterns and Pattern Classes; Decision-Theoretic Methods; Structural Methods)	Week 15	A8	B4, B5	C4, C5	D1, D2