Republic of Yemen

Ministry of Higher Education & Scientific Research

Council of Academic Accreditation & Quality

Assurance of Higher Education (CAQA)

21 September University for medical and Applied Science

Faculty of Engineering and Computer

Department of Information Technology

Program of Information Technology

Course Specification of

Elective 2 (Image and Video Processing)

Course Code. (07.01. 731)

2024

T4: This Template is Developed and Approved by CAQA-Yemen, 2023

Prepared by:	Reviewed by:	Head of the Department:	Quality Unit:	Dean
Assoc. Prof. Farouk Al-Fahaidy	Dr. -----			

إرشادات: تحذف جداول الإرشادات من قوالب التوصيف بعد الانتهاء من التوصيف

1- يكتب اسم المقرر وكود المقرر وعدد الساعات والفصل والسنة الدراسية للمقرر كما هو في الخطة الدراسية.
2- تكتب المقررات القبلية والمقررات المصاحبة بحسب توصيف البرنامج.

I. General Information:

1.	Course Title:	Elective 2 (Image and Video Processing)				
2.	Course Code:	07.01. 731				
3.	Credit Hours:	Credit Hours	Theory Contact Hours		Practical Contact Hours	
			Lecture	Tutorial/ Seminar	Lab	Clinical
		3	2	--	2	--
4.	Level/ Semester at which this Course is offered:	4th Level / 2nd Semester				
5.	Pre –Requisite (if any):	Object-Oriented Programming (07.01. 706)				
6.	Co –Requisite (if any):	------				
7.	Program (s) in which the Course is Offered:	Bachelor of Medical Information Technology				
8.	Language of Teaching the Course:	Mixed (English + Arabic)				
9.	Location of Teaching the Course:	Faculty of Medical Technology				
10.	Prepared by:	Assoc. Prof. Farouk Al-Fahaidy				
11	Date and Number of Approval by Council:					

II. Course Description:

This introductory course provides students with concepts, fundamentals, theories, algorithms and technical tools useful for digital image & video processing. Image processing (IP) has wide range applications in the context of medical such as, diseases diagnosis & categorization. Course topics cover, basic concepts and fundamentals of imaging systems & biomedical image processing, image representation & basic operations, image enhancement in spatial & frequency domains, images restoration & segmentation, image compression and fundamentals of video processing. Upon successful completion of the course and during computer-based lab sessions & term-project work, students will develop their problem-solving skills related to IP to meet medical imaging context issues.

III. Course Intended Learning Outcomes (CILOs): Upon successful completion of the course, students will be able to:		Referenced PILOs		
	A. Knowledge and Understanding:	**I, P or M/A**		
a1	Know concepts, fundamentals, theories and techniques connected to digital image processing in the field of medical information system.	I	A1	Demonstrate an understanding of appropriate models, theories, mathematical foundations, and techniques related to Health Information Technology discipline.
a2	Recognize numerous IP algorithms & techniques including, trivial images processing, image filtering, image restoration & segmentation and modern s/w working environments.	M	A4	Demonstrate a sound understanding the computing concept related to analysis, design, implementation, and evaluation of Health information system.
	B. Intellectual Skills:			
b1	Employ procedural IP's steps for analyzing & solving of problems and issues related to the medical information discipline.	M	B1 & B2	Critically analyse complex computing problems and propose appropriate information technology based solutions and integrate them

				effectively into the uses and organization Health. **B2.** Analyze the impacts of computing on Health objectives and customer needs, and consider them during the analytical processing, selection, integration, configuration and administration of information systems.
b2	Choose the appropriate algorithm and/or IT-based solution that meets a given set of Health requirements in the context of Health Information Technology.	**M**	**B3 & B4**	**B3.** Explore variety of challenges and problems related to Health Information Technology to select the optimal solution. **B4.** Evaluate IT based solution to meet a given set of Health requirements in the context of Health Information Technology discipline.
	C. Professional and Practical Skills:			
c1	Write a creative Python and/or MATLAB program for solving medical information problems related to image & video processing.	**P**	**C1**	Employ effectively the concepts, principles of computational tools, techniques used for the construction and documentation of Health Information of varying complexity.
c2	Use fitting MATLAB's and/or Python's libraries & components for modeling & analyzing of image's enhancement, restoration, and segmentation algorithms.	**M**	**C4**	Use current techniques, skills, and tools necessary for computing practices.
	D. Transferable Skills:			
d1	Function effectively either in performing of individual duties or in	**M**	**D1**	Function effectively as an individual, as a member, or

	accomplishment of team responsibilities.			leader of a team engaged in activities appropriate to the Health Information Technology discipline to accomplish a common goal.
d2	Engage in continuing professional development and lifelong learning as a medical IT professional, through recognizing the inspiration of digital IP science to the medical imaging systems when compared to conventional methods.	**A**	**D4**	Engage in continuing professional development and lifelong learning as an IT professional
I= Introduced, P=Practiced or M/A= Mastered/Advanced				

	(A) Alignment of Course Intended Learning Outcomes (Knowledge and Understanding) to Teaching Strategies and Assessment Methods:		
	Course Intended Learning Outcomes	**Teaching Strategies**	**Assessment Strategies**
a1	Know concepts, fundamentals, theories and techniques connected to digital image processing in the field of medical information system.	▪ Interactive lectures, ▪ Interactive Class Discussions, ▪ Exercises and Home Works,	▪ Written tests ▪ Written assessments such as multiple -choice questions and Quizzes ▪ Coursework Activities, ▪ Home works and assignments.
a2	Recognize numerous IP algorithms & techniques including, trivial images processing, image filtering, image restoration & segmentation and modern s/w working environments.	▪ Interactive lectures, ▪ Interactive Class Discussions, ▪ Exercises and Home Works, ▪ Directed Self- Study,	▪ Written tests ▪ Written assessments such as multiple -choice questions and Quizzes ▪ Coursework

			Activities, ▪ Home works and assignments, ▪ Report/Project/ Practical Lab Sessions.
	(B) Alignment of Course Intended Learning Outcomes (Intellectual Skills) to Teaching Strategies and Assessment Methods:		
	Course Intended Learning Outcomes	**Teaching Strategies**	**Assessment Strategies**
b1	Employ procedural IP's steps for analyzing & solving of problems and issues related to the medical information discipline.	▪ Interactive lectures, ▪ Interactive Class Discussions, ▪ Exercises and Home Works, ▪ Directed Self- Study, ▪ Seminar/ Project/Presentation, ▪ Teamwork, ▪ Laboratory based session,	▪ Written tests ▪ Written assessments such as multiple -choice questions and Quizzes ▪ Coursework Activities, ▪ Home works and assignments, ▪ Report/Project/ Practical Lab Sessions, ▪ Presentations.
b2	Choose the appropriate algorithm and/or IT-based solution that meets a given set of Health requirements in the context of Health Information Technology.	▪ Interactive Class Discussions, ▪ Exercises and Home Works, ▪ Directed Self- Study, ▪ Seminar/ Project/Presentation, ▪ Teamwork, ▪ Laboratory based session,	▪ Written tests ▪ Written assessments such as multiple -choice questions and Quizzes ▪ Coursework Activities, ▪ Home works and assignments, ▪ Report/Project/

			Practical Lab Sessions, ▪ Presentations.
	(C) Alignment of Course Intended Learning Outcomes (Professional and Practical Skills) to Teaching Strategies and Assessment Methods:		
	Course Intended Learning Outcomes	**Teaching Strategies**	**Assessment Strategies**
c1	Write a creative Python and/or MATLAB program for solving medical information problems related to image & video processing.	▪ Interactive lectures, ▪ Exercises and Home Works, ▪ Directed Self- Study, ▪ Seminar/ Project/Presentation, ▪ Teamwork, ▪ Laboratory based session,	▪ Written assessments such as multiple-choice questions and Quizzes ▪ Coursework Activities, ▪ Home works and assignments, ▪ Report/Project/ Practical Lab Sessions, ▪ Presentations.
c2	Use fitting MATLAB's and/or Python's libraries & components for modeling & analyzing of image's enhancement, restoration, and segmentation algorithms.	▪ Exercises and Home Works, ▪ Directed Self- Study, ▪ Seminar/ Project/Presentation, ▪ Teamwork, ▪ Laboratory based session,	▪ Written assessments such as multiple-choice questions and Quizzes ▪ Coursework Activities, ▪ Home works and assignments, ▪ Report/Project/ Practical Lab Sessions, ▪ Presentations.
	(D) Alignment of Course Intended Learning Outcomes (Transferable Skills) to Teaching Strategies and Assessment Methods:		
	Course Intended Learning Outcomes	**Teaching Strategies**	**Assessment Strategies**

d1	Function effectively either in performing of individual duties or in accomplishment of team responsibilities.	▪ Exercises and Home Works, ▪ Directed Self- Study, ▪ Seminar/ Project/Presentation, ▪ Teamwork, ▪ Laboratory based session,	▪ Coursework Activities, ▪ Home works and assignments, ▪ Report/Project/ Practical Lab Sessions, ▪ Presentations.
d2	Engage in continuing professional development and lifelong learning as a medical IT professional, through recognizing the inspiration of digital IP science to the medical imaging systems when compared to conventional methods.	▪ Directed Self- Study, ▪ Seminar/ Project/Presentation, ▪ Teamwork, ▪ Laboratory based session,	▪ Coursework Activities, ▪ Report/Project/ Practical Lab Sessions, ▪ Presentations.

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
1	**Introduction**	– Course Orientations: Course Topics, Aims & Objectives, Tools and Applications, – Human Vision vs. Computer Vision, Fields of Computer Vision.	1	2	**a1**
2	**Image Processing & Medical Images**	– Image Processing: Steps, Fundamentals, Image Sampling & Quantization, – Digital Image: Types, Representations and DIP System Elements, – Medical Image: Fundamentals, Types & Applications.	1	2	**a1, a2, b1**

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
3	**Digital Image Acquisition & Basic Operations**	– Digital Image Acquisition System, – Basic Image Operations: Image Elements & Basic Operations, Image Pixels, Relationships between Image's Pixels, – Image Pixels & Regions Adjacency, Distances and Paths.	1	2	**a1, a2, b1**
4	**Image Filtering & Enhancement**	– Spatial Domain Enhancement Methods: Histogram-based Image Processing, Fundamentals of Spatial Filtering, Smoothing Filters, Sharpening Filters, – Frequency Domain Enhancement Methods: Fundamentals of Frequency Domain Filtering, Image Smoothing (Low-Pass Filter), Image Sharpening (High-Pass Filter), Selective Filters (Band-Pass/Block Filters).	3	6	**a2, b1, b2**
5	**Digital Image Programming**	– Digital Image Programming: Use of MATLAB and/or Python for Image Programming, Basic Digital Image Manipulation Function, – Trivial IP's Functions in Python/MATLAB – Image Representation, Transformation, and Plotting.	1	2	**a2, b2, c2**
6	**Mid-Term Theoretical Exam**	All Previous Topics	1	2	**a1, a2, b1, b2, c2**
7	**Digital Image Segmentation**	– Introduction to image segmentation, Point, Line and Edge Detection, Region based segmentation., – Classification of segmentation techniques, Region approach to image segmentation, clustering	2	4	**a1, a2, b1, b2**

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
		techniques, Image segmentation based on thresholding, Edge based segmentation, Edge detection and linking, Hough transform and Active contour.			
8	**Digital Image Restoration**	– Introduction to Image restoration, Image degradation, Types of image blur, – Classification of image restoration techniques, Image restoration model, Linear and Nonlinear image restoration techniques, and Blind deconvolution.	2	2	**a1, a2, b1, b2**
9	**Digital Image Registration & Shape Analysis**	– Image Registration: Definition, Purpose, bases, Similarity Measures, Optimization & Example, – Shape Analysis: Area, Perimeter, Axes, Aspect Ratio, Compactness, Convexity, Solidity and Fiber Length.	1	2	**b1, b2**
10	**Digital Image Compression & Video Processing Concepts**	– Image Compression: Introduction, Need for image compression, Redundancy in images, Classification of redundancy in images, image compression scheme, Classification of image compression schemes, – Fundamentals of information theory, Run-length coding, Huffman coding, Transformation-based compression like DCT-compression, – Video Processing: basic concepts of video processing, – Video Constitutes: Define Frames of a Video, Methods & techniques of Video processing.	2	4	**a1, b1, b2**

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
11	Final Theoretical Exam	– ALL Topics	1	2	a1, a2, b1, b2, c2
Number of Weeks /and Units Per Semester			16	32	

B. Practical Aspect (Lab/Clinical):

No.	Tasks/ Experiments	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
1	**Preparing Software Working Environment:** – Install either MATLAB of Python – Arithmetic and logic Operations: Averaging, Subtraction, Multiplication, Set Operation.	2	4	a2, b1, b2, c2, d2
2	**Intensity Transformation functions:** – Image Negatives, Log, Power-Law, Contrast stretching, Intensity-Level Slicing, Bit-Plane Slicing.	2	4	b1, b2, c1, c2, d1
3	**Histogram Processing:** - Plotting Image Histogram, Histogram Equalization, Histogram Specification, Local Histogram Processing using statistics.	1	2	b1, b2, c1, c2, d1
4	**Spatial Filtering:** – Smoothing Linear Filters, – Order-Static (Nonlinear) Filters, – Sharpening Filters. **Frequency Domain Filtering:** – Low-Pass & High-Pass, – Band-Pass & Band-Stop Filters.	3	6	b1, b2, c1, c2, d1

No.	Tasks/ Experiments	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
5	**Image Segmentation, Demonstration of the Following:** – Detection of Isolated Points, Line Detection, Edges detection, – Global Thresholding using Iterative Algorithm, – Global Thresholding using Iterative Algorithm using Otsu's method, – Optimum Global Thresholding Using Otsu's Method, Using Edge to Improve Global Thresholding, – Multiple Thresholding, Region Growing, Region Splitting and Merging.	2	4	b1, b2, c1, c2, d1
6	**Image Restoration:** - Image restoration model, Linear and Nonlinear image restoration techniques, and Blind deconvolution	1	2	b1, b2, c1, c2, d1
7	– **Apply & Verify Image Registration & Shape Analysis methods,** – **Evaluate some different Image Compressions techniques** – **Perform some Video Processing methods.**	2	4	b1, b2, c1, c2, d1
8	**Project Presentations** **(Students work in teams of 2 or 3 members since the 4th week)**	1	2	a2, b1, b2, c1, c2, d1, d2
9	- **Final Practical Exam**	1	2	b1, b2, c1, c2
Number of Weeks /and Units Per Semester		**15**	**30**	

C. Tutorial Aspect (if any):

No.	Tutorial	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
1	NONE			
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
Number of Weeks /and Units Per Semester				

VII. Assignments & Reports:

No.	Assignments	Week Due	Mark	Aligned CILOs (symbols)

No.	Assignments	Week Due	Mark	Aligned CILOs (symbols)
1	**Assignment 1:** Image Processing & Transformations and Basic Image Operations	4th	2	a1, a2, d1
2	**Assignment 2:** Image Enhancement	6th & 7th	2	a1, a2, b2, c2, d1
3	**Assignment 3:** Image Segmentation & Restoration **Short Report:** The Impact of Digital IP in Biomedical Disease' Diagnostic Devices and New Technologies in the Field.	9th to 12th	4	b1, b2, c1, d1, d2
4	**Assignment 4:** Image Compression & Video Processing.	14th	2	b1, b2, c2, d1
5	**Lab Reports**	4th to 12th	5	b1, b2, c1, c2, d1
Total			**15**	

VIII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1	Assignments & Reports	4th – 14th	15	10%	a1, a2, b1, b2, c1, c2, d1, d2
2	Quizzes 1 & 2	6th & 11th	10	6.67%	a1, a2, b1, b2, c1, c2
3	Mid-Term Theoretical Exam	8th	20	13.33%	a1, a2, b1, b2, c2
4	Final Practical Exam including Project Presentation & Evaluation	14th & 15th	30	20%	a1, a2, b1, b2, c1, c2, d1, d2
5	Final Theoretical Exam	16th	75	50%	a1, a2, b1, b2, c2
Total					

IX. Learning Resources:

- *Written in the following order:* Author, Year of publication, Title, Edition, Place of publication, Publisher.

1- Required Textbook(s) (maximum two):

1- Rafael C. Gonzalez, Richard E. Woods 2017, **Digital Image Processing**, 4th edition, Pearson.

2- Stan Birchfield, 2017, **Image Processing and Analysis**, 1st edition,

2- Essential References:

1- J. Prince and J. Links, **Medical Imaging, Signals and Systems**, ISBN: 0-13-065353-5.

1- S.Jayaraman, S.Esakkirajan and T.VeeraKumar, 2009, **Digital Image processing**, TataMcGraw Hill publisher.

2- Atam Dhawan, **Medical Image Analysis**, second edition, WILEYISBN: 978-0-470-62205-6.

3- Vipula Singh, **Digital Image Processing with MATLAB and Labview**, Elsevier.

3- Electronic Materials and Web Sites etc.:

Websites:

1- Some Images & Data are taken from:
http://www.mips.stanford.edu/public/video_lectures/index.adp
http://www.math.ucla.edu/~gilboa/PDE-based_image_filtering.html

2- **Some Materials and Data:**
http://www.cs.sunysb.edu/~mueller/

3- Other Web Sources:

Documentation on Matlab and the Image Processing Toolbox can be found on the Mathworks' Web site at https://www.mathworks.com/help/

X. Course Policies: (Based on the Uniform Students' By law (2007)

1	**Class Attendance:** Class Attendance is mandatory. A student is considered absent and shall be banned from taking the final exam if his/her absence exceeds 25% of total classes.
2	**Tardiness:** A student will be considered late if he/she is not in class after 10 minutes of the start

	time of class.
3	**Exam Attendance/Punctuality:** No student shall be allowed to the exam hall after 30 minutes of the start time, and shall not leave the hall before half of the exam time has passed.
4	**Assignments & Projects:** Assignments and projects must be submitted on time. Students who delay their assignments or projects shall lose the mark allocated for the same.
5	**Cheating:** Cheating is an act of fraud that results in the cancelation of the student's exam or assignment. If it takes place in a final exam, the penalties stipulated for in the Uniform Students' Bylaw (2007) shall apply.
6	**Forgery and Impersonation:** Forgery/Impersonation is an act of fraud that results in the cancelation of the student's exam, assignment or project. If it takes place in a final exam, the penalties stipulated for in the Uniform Students' Bylaw (2007) shall apply.
7	**Other policies:** The University official regulations in force will be strictly observed and students shall comply with all rules and regulations of the examination set by the Department, Faculty and University Administration.

Republic of Yemen
Ministry of Higher Education & Scientific Research
University: 21 September University for Medical & Applied Sciences

الجمهورية اليمنية
وزارة التعليم العالي والبحث العلمي
جامعة: جامعة 21سبتمبر للعلوم الطبية والتطبيقية

Faculty of Medical Technology

Department of Medical Information Technology

Program of Medical Information Technology

Course Plan (Syllabus) of Elective 2 (Image and Video Processing)

Course Code. 07.01.731

I. Information about Faculty Member Responsible for the Course:								
Name of Faculty Member:		Office Hours						
Location& Telephone No.:	777909815							
E-mail:	farouqakh@gmail.com	SAT	SUN	MON	TUE	WED	THU	

2025/2024

II. Course Identification and General Information:

1	Course Title:	Elective 2 (Image and Video Processing)			
2	Course Code & Number:	07.01.731			
3	Credit Hours:	Credit Hours	Theory Hours		Lab. Hours
			Lecture	Exercise	
		3	--	2	--
4	Study Level/ Semester at which this Course is offered:	4th Level / 2nd Semester			
5	Pre –Requisite (if any):	Object-Oriented Programming (07.01. 706)			
6	Co –Requisite (if any):	------			
7	Program (s) in which the Course is Offered:	Bachelor of Medical Information Technology			
8	Language of Teaching the Course:	Mixed (English + Arabic)			
9	Study System:				
10	Mode of Delivery:	Full Time			
11	Location of Teaching the Course:	Faculty of Medical Technology			
12	Prepared by:	Assoc. Prof. Farouk Al-Fahaidy			
13	Date of Approval:				

III. Course Description:

This introductory course provides students with concepts, fundamentals, theories, algorithms and technical tools useful for digital image & video processing. Image processing (IP) has wide range applications in the context of medical such as, diseases diagnosis & categorization. Course topics cover, basic concepts and fundamentals of imaging systems & biomedical image processing, image representation & basic

operations, image enhancement in spatial & frequency domains, images restoration & segmentation, image compression and fundamentals of video processing. Upon successful completion of the course and during computer-based lab sessions & term-project work, students will develop their problem-solving skills related to IP to meet medical imaging context issues.

IV. Course Intended Learning Outcomes (CILOs) :

Upon successful completion of the Course, student will be able to:

	A. **Knowledge and Understanding:**
a1	Know concepts, fundamentals, theories and techniques connected to digital image processing in the field of medical information system.
a2	Recognize numerous IP algorithms & techniques including, trivial images processing, image filtering, image restoration & segmentation and modern s/w working environments.
	B. **Intellectual Skills:**
b1	Employ procedural IP's steps for analyzing & solving of problems and issues related to the medical information discipline.
b2	Choose the appropriate algorithm and/or IT-based solution that meets a given set of Health requirements in the context of Health Information Technology.
	C. Professional and Practical Skills:
c1	Write a creative Python and/or MATLAB program for solving medical information problems related to image & video processing.
c2	Use fitting MATLAB's and/or Python's libraries & components for modeling & analyzing of image's enhancement, restoration, and segmentation algorithms.
	D. Transferable Skills:
d1	Function effectively either in performing of individual duties or in accomplishment of team responsibilities.

d2	Engage in continuing professional development and lifelong learning as a medical IT professional, through recognizing the inspiration of digital IP science to the medical imaging systems when compared to conventional methods.

V. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
1	**Introduction**	– Course Orientations: Course Topics, Aims & Objectives, Tools and Applications, – Human Vision vs. Computer Vision, Fields of Computer Vision.	1	2
2	**Image Processing & Medical Images**	– Image Processing: Steps, Fundamentals, Image Sampling & Quantization, – Digital Image: Types, Representations and DIP System Elements, – Medical Image: Fundamentals, Types & Applications.	1	2
3	**Digital Image Acquisition & Basic Operations**	– Digital Image Acquisition System, – Basic Image Operations: Image Elements & Basic Operations, Image Pixels, Relationships between Image's Pixels, – Image Pixels & Regions Adjacency, Distances and Paths.	1	2
4	**Image Filtering & Enhancement**	– Spatial Domain Enhancement Methods: Histogram-based Image Processing, Fundamentals of Spatial Filtering, Smoothing Filters, Sharpening Filters, – Frequency Domain Enhancement Methods: Fundamentals of Frequency	3	6

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
		Domain Filtering, Image Smoothing (Low-Pass Filter), Image Sharpening (High-Pass Filter), Selective Filters (Band-Pass/Block Filters).		
5	**Digital Image Programming**	– Digital Image Programming: Use of MATLAB and/or Python for Image Programming, Basic Digital Image Manipulation Function, – Trivial IP's Functions in Python/MATLAB – Image Representation, Transformation, and Plotting.	1	2
6	**Mid-Term Theoretical Exam**	All Previous Topics	1	2
7	**Digital Image Segmentation**	– Introduction to image segmentation, Point, Line and Edge Detection, Region based segmentation., – Classification of segmentation techniques, Region approach to image segmentation, clustering techniques, Image segmentation based on thresholding, Edge based segmentation, Edge detection and linking, Hough transform and Active contour.	2	4
8	**Digital Image Restoration**	– Introduction to Image restoration, Image degradation, Types of image blur, – Classification of image restoration techniques, Image restoration model, Linear and Nonlinear image restoration techniques, and Blind deconvolution.	2	2
9	**Digital Image Registration & Shape Analysis**	– Image Registration: Definition, Purpose, bases, Similarity Measures, Optimization & Example, – Shape Analysis: Area, Perimeter, Axes, Aspect Ratio, Compactness, Convexity, Solidity and Fiber Length.	1	2
10	**Digital Image Compression &**	– Image Compression: Introduction, Need for image compression, Redundancy in	2	4

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
	Video Processing Concepts	images, Classification of redundancy in images, image compression scheme, Classification of image compression schemes, – Fundamentals of information theory, Run-length coding, Huffman coding, Transformation-based compression like DCT-compression, – Video Processing: basic concepts of video processing, – Video Constitutes: Define Frames of a Video, Methods & techniques of Video processing.		
11	Final Theoretical Exam	– ALL Topics	1	2
Number of Weeks /and Units Per Semester			16	32

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
1	Introduction	– … – … – … – …		
2	…	– …		
3	…	– …		
4	…	– …		
5	…	– …		
6	Mid-Term Exam			
7	…	– …		
8	…	– …		
9	…	– …		

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
10	…	– …		
11	…	– …		
12	Final Theoretical Exam			
Number of Weeks /and Units Per Semester			16	32

B. Case Studies and Practical Aspect:

No.	Tasks/ Experiments	Week Due	Contact Hours
1	**Preparing Software Working Environment:** – Install either MATLAB of Python – Arithmetic and logic Operations: Averaging, Subtraction, Multiplication, Set Operation.	2	4
2	**Intensity Transformation functions:** – Image Negatives, Log, Power-Law, Contrast stretching, Intensity-Level Slicing, Bit-Plane Slicing.	2	4
3	**Histogram Processing:** – Plotting Image Histogram, Histogram Equalization, Histogram Specification, Local Histogram Processing using statistics.	1	2
4	**Spatial Filtering:** – Smoothing Linear Filters, – Order-Static (Nonlinear) Filters, – Sharpening Filters. **Frequency Domain Filtering:** – Low-Pass & High-Pass, – Band-Pass & Band-Stop Filters.	3	6
5	**Image Segmentation, Demonstration of the Following:**	2	4

No.	Tasks/ Experiments	Week Due	Contact Hours
	– Detection of Isolated Points, Line Detection, Edges detection, – Global Thresholding using Iterative Algorithm, – Global Thresholding using Iterative Algorithm using Otsu's method, – Optimum Global Thresholding Using Otsu's Method, Using Edge to Improve Global Thresholding, – Multiple Thresholding, Region Growing, Region Splitting and Merging.		
6	**Image Restoration:** – Image restoration model, Linear and Nonlinear image restoration techniques, and Blind deconvolution	1	2
7	– **Apply & Verify Image Registration & Shape Analysis methods,** – **Evaluate some different Image Compressions techniques** – **Perform some Video Processing methods.**	2	4
8	**Project Presentations** **(Students work in teams of 2 or 3 members since the 4th week)**	1	2
9	**Final Practical Exam**	1	2
Number of Weeks /and Units Per Semester		**15**	**30**

No.	Tasks/ Experiments	Week Due	Contact Hours
1			
2			
3	-		
4	-		
5	-		

No.	Tasks/ Experiments	Week Due	Contact Hours
6	-		
7	-		
8	-		
9			
10	-		
11	-		
12	-		
13	-		
14	-		
15			
16			
Number of Weeks /and Units Per Semester			

C. Tutorial Aspect:

No.	Tutorial	Number of Weeks	Contact Hours
1	NONE		
2			
3			
4			
5			
6			
7			
8			

No.	Tutorial	Number of Weeks	Contact Hours
9			
10			
Number of Weeks /and Units Per Semester			

VI. Teaching Strategies of the Course:

- Active Lectures,
- Interactive class discussions,
- Exercises and Home Works.
- Laboratory based session,
- Problem-solving,
- Group work,
- Presentation
- Directed Self-study,
- Seminar/ project/presentation,
- Project

VII. Assessment Methods of the Course:

- Project presentation,
- Laboratory exam,
- Assignment work,
- Report/Project
- Written exams,
- Quizzes,
- Practical exam,
- Report Submission.

VIII. Assignments & Reports:

No.	Assignments	Week Due	Mark

No.	Assignments	Week Due	Mark
1	**Assignment 1:** Image Processing & Transformations and Basic Image Operations	4th	2
2	**Assignment 2:** Image Enhancement	6th & 7th	2
3	**Assignment 3:** Image Segmentation & Restoration **Short Report:** The Impact of Digital IP in Biomedical Disease' Diagnostic Devices and New Technologies in the Field.	9th to 12th	4
4	**Assignment 4:** Image Compression & Video Processing.	14th	2
5	**Lab Reports**	4th to 12th	5
Total			**15**

IX. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment
1	Assignments & Reports	4th – 14th	15	10%
2	Quizzes 1 & 2	6th & 11th	10	6.67%
3	Mid-Term Theoretical Exam	8th	20	13.33%
4	Final Practical Exam including Project Presentation & Evaluation	14th & 15th	30	20%
5	Final Theoretical Exam	16th	75	50%
Total			**150**	**100%**

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment
1	Assignments			
2	Quizzes 1 & 2			
3	Mid-Term Theoretical Exam			
4	Mid-Term Practical Exam			

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment
5	Final Practical Exam including Project Presentation & Evaluation			
6	Final Theoretical Exam			
Total				

X. Learning Resources:

- *Written in the following order: Author, Year of publication, Title, Edition, Place of publication, Publisher.*

1- Required Textbook(s) (maximum two):

Rafael C. Gonzalez, Richard E. Woods 2017, **Digital Image Processing**, 4th edition, Pearson.

Stan Birchfield, 2017, **Image Processing and Analysis**, 1st edition,

2- Essential References:

1- J. Prince and J. Links, **Medical Imaging, Signals and Systems**, ISBN: 0-13-065353-5.

2- S.Jayaraman, S.Esakkirajan and T.VeeraKumar, 2009, **Digital Image processing**, TataMcGraw Hill publisher.

3- Atam Dhawan, **Medical Image Analysis**, second edition, WILEYISBN: 978-0-470-62205-6.

4- Vipula Singh, **Digital Image Processing with MATLAB and Labview**, Elsevier.

3- Electronic Materials and Web Sites etc.:

Websites:

5- Some Images & Data are taken from:
http://www.mips.stanford.edu/public/video_lectures/index.adp

http://www.math.ucla.edu/~gilboa/PDE-based_image_filtering.html

6- **Some Materials and Data:**

http://www.cs.sunysb.edu/~mueller/

7- Other Web Sources:

Documentation on Matlab and the Image Processing Toolbox can be found on the Mathworks' Web site at https://www.mathworks.com/help/

XI. Course Policies: (Based on the Uniform Students' Bylaw (2007)

1	**Class Attendance:** Class Attendance is mandatory. A student is considered absent and shall be banned from taking the final exam if his/her absence exceeds 25% of total classes.
2	**Tardiness:** A student will be considered late if he/she is not in class after 10 minutes of the start time of class.
3	**Exam Attendance/Punctuality:** No student shall be allowed to the exam hall after 30 minutes of the start time, and shall not leave the hall before half of the exam time has passed.
4	**Assignments & Projects:** Assignments and projects must be submitted on time. Students who delay their assignments or projects shall lose the mark allocated for the same.
5	**Cheating:** Cheating is an act of fraud that results in the cancelation of the student's exam or assignment. If it takes place in a final exam, the penalties stipulated for in the Uniform Students' Bylaw (2007) shall apply.
6	**Forgery and Impersonation:** Forgery/Impersonation is an act of fraud that results in the cancelation of the student's exam, assignment or project. If it takes place in a final exam, the penalties stipulated for in the Uniform Students' Bylaw (2007) shall apply.
7	**Other policies:** The University official regulations in force will be strictly observed and students shall comply with all rules and regulations of the examination set by the Department, Faculty and University Administration.