Course Specification of Image Processing and Computer Vision

Course No (.....)

2020/2021

Head of Department	Vise Dean for Quality Assurance	Dean of the Faculty	Dean of Academic Development center and Quality
Dr. Ahmed Al-shalabi	Dr. Anwar Al-Shamiri	Dr. Nagi Al-Shibani	Assoc. Prof. Dr.Huda Al.Emad

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Prof. Dr. Qassim Mohammed Abbas

I. Course Identification and General Information:

1	**Course Title:**	Image Processing and Computer Vision				
2	**Course Code & Number:**	.....				
3	**Credit hours:**	C.H				TOTAL
		Th.	Seminar	Pr.	Tr.	
		3	-	-	-	3
4	**Study level/ semester at which this course is offered:**	3rd year / 2nd semester				
5	**Pre–requisite (if any):**	None				
6	**Co–requisite (if any):**	None				
7	**Program (s) in which the course is offered:**	Computer Science				
8	**Language of teaching the course:**	English				
9	**Study System**	Credit Hours System				
10	**Mode of delivery:**	Full Time				
11	**Location of teaching the course:**	Faculty Campus				
12	**Prepared By:**					
13	**Date of Approval**					

II. Course Description:

Head of Department	Vise Dean for Quality Assurance	Dean of the Faculty	Dean of Academic Development center and Quality
Dr. Ahmed Al-shalabi	Dr. Anwar Al-Shamiri	Dr. Nagi Al-Shibani	Assoc. Prof. Dr.Huda Al.Emad

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Image Processing and Computer Vision are important and fast evolving areas of computer system, and have been applied in many disciplines. This course will cover methods in image processing and computer vision, with an emphasis on the state-of-the-art techniques currently used in academia and industry. Topics will include image filtering, edge detection, corner detection, segmentation, object/image/face classification, object detection, morphological operators, object tracking, camera calibration, image registration, and activity classification. Students are expected to have some familiarity with calculus, linear algebra, and basic probability and statistics. Basic skills in computer programming are expected. After you have successfully followed the course on image processing and computer vision you will be able to use techniques to process and analyze images.

III. Course Intended learning outcomes (CILOs) of the course (maximum 8CILOs)		Referenced PILOs (Only write code number of referenced Program Intended learning outcomes)
a.1	Understand the major concepts and techniques in image processing and computer vision.	A1, A4, D1
a.2	Demonstrate image processing and computer vision knowledge by designing and implementing algorithms to solve practical problems.	A1
b.1	Identify image processing problems and employ or propose effective solutions.	B2
b.2	Analyze images in practical settings using simple methods.	B4
c.1	Apply methods for processing of image data related to image filtering, image enhancement, segmentation, classification and representation.	C2
c.2	Develop solutions for solving computer vision issues that related to current academic and industrial problems.	C3, C5
d.1	Present research in image processing and computer vision.	D1

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d.2	Work effectively as individual and with a team.	D3

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	**Teaching strategies**	**Assessment Strategies**
a1.Understand the major concepts and techniques in image processing and computer vision.	Lecture, Discussion	Written exams, oral exams, reports, quizzes.
a2.Demonstrate image processing and computer vision knowledge by designing and implementing algorithms to solve practical problems.	Lecture, Discussion	Written exams, oral exams, reports, quizzes.

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	**Teaching strategies**	**Assessment Strategies**
b1.Identify image processing problems and employ or propose effective solutions.	Interactive Lecture Presentation Group discussion	Written exams, oral exams, reports, quizzes
b2.Analyze images in practical settings using simple methods.	Interactive Lecture Presentation	Written exams, oral exams, reports, quizzes

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	Group discussion	

(C) Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	**Teaching strategies**	**Assessment Strategies**
c1.Apply methods for processing of image data related to image filtering, image enhancement, segmentation, classification and representation.	Interactive Lecture, Presentation Group discussion	Reports and projects
c2.Develop solutions for solving computer vision issues that related to current academic and industrial problems.	Interactive Lecture Presentation Group discussion	Reports and projects

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	**Teaching strategies**	**Assessment Strategies**
d1.Present research in image processing and computer vision.	Presentation Group discussion	Discussion and oral exam
d2.Work effectively as individual and with a team.	Presentation Group discussion	Discussion and oral exam

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IV. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	contact hours
1	Introduction	a1,b1	- Image, Graphics, Vision and Computer - Image processing basics, Digital image formats - Image processing and Vision system/applications	1	2
2	Data Structures for Image Processing	a1,b1,c1	- Matrices, chains, Topological data structures - Relational structures, Hierarchical data structures	2	4
3	Preprocessing and Image Enhancement	a2,b2,c1	- Histogram, histogram transformations - Modification of the histogram pattern - Filtering	2	4
4	Introduction to Mathematical Morphology	a1,a2,b1,c1	- Elements of Set Theory and Logic - Thinning, erosion, dilation, opening, closing	1	2
5	Segmentation	b1,c1,d1,d2	- Detection of connected components - Thresholding , Edge detection - Region detection	1	2
6	Features Extraction and Representation	a2,b2,c1,d1	- Region Identification, Description and Representation of Contours - Description and Representation of Regions	1	2
7	Linear Image Transformations	a1,a2,b1,c2	- Basic Theory, Hadammard Transform, Haar Transform	1	2

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			- Fourier Transform, Discrete Cosine Transform, Wavelets		
8	Image Data Compression	a2,b2,c 1,d2	- Presentation of different techniques and different norms of compression, Coding - Fractal Image Compression	1	2
9	Elements of Pattern Recognition	b1,b2,c 1,d2	- Different methods of pattern recognition, Classification - Machine Learning Techniques, Structural pattern recognition	1	2
10	Texture Analysis	b1,b2,c 1,d2	- Statistical texture description - Syntactic texture description methods, applications	1	2
11	Motion Analysis	a2,b1,c 1,d2	- Optical flow, Moving Object Detection and Tracking, Behavior Detection and Modeling	1	2
12	Student Presentation	a1,b2,c 1,c2,d2		1	2
Number of Weeks /and Units Per Semester				**14**	**28**

B - Practical Aspect: (if any)

Order	Tasks/ Experiments	Number of Weeks	contact hours	Learning Outcomes
1	Understanding the tools	**1week**	**2**	**A2,c1,c2,d1**
2	Segmentation	**1 week**	**2**	

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3	Features Extraction and Representation	**2 weeks**	**4**	**c1,c2,b1**
4	Linear Image Transformations	**1 week**	**2**	**c1,c2,b1**
5	Image Data Compression	**2 weeks**	**4**	**c1,c2,b1**
6	Elements of Pattern Recognition	**2 weeks**	**4**	**c1,c2,b1**
7	Texture Analysis	**2 weeks**	**4**	**c1,c2,b1,b1**
8	Motion Analysis	**2 weeks**	**4**	**c1,c2,b1**
Number of Weeks /and Units Per Semester			**26**	

V. Teaching strategies of the course:

Interactive Lecture

Tutorials

Discussion

Assignments

Presentation

Project

Exams

VI. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1	- Image Processing	a1,a2,b1	2nd	5

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2	- Image Enhancement	b1,c1,c2,d1	4th	5
3	- Feature Extraction	a2,b2,c2,d1,d2	6th	5
4	- Image Transformations	a2,b1,c1,d2	9th	5
5	- Final team project	b2,c1,c2,d1,d2	15th	20
Total				40

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

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1	Homework and Programming Assignments	2nd ,4th, 6th, 9th	20	20%	a1,b1,b2,c1,c2,d1,d2
2	Mid-Exam	8h	20	20%	a1,b1,b2,c1,c2,d1
3	Final Project	15th	20	20%	a1,a2,b1,b2,c1,c2,d1,d2
4	Final-Exam	16th	40	40%	a1,a2,b1,b2,c1

VIII. Learning Resources:

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

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

1. Computer Vision: Algorithms and Applications" (2011) by Richard Szeliski

2- Essential References.

1. Gonzales R.C. & Woods R.E., "Digital Image Processing", 3rd edition, Prentice Hall, ISBN 0-201-18075-8

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	2. Serra J., Image Analysis and mathematical Morphology, Academic Press, 1982. 3. "Computer Vision – A Modern Approach" , David A. Forsyth, Jean Ponce, Prentice Hall, 2003. 4. "Three Dimensional Computer Vision: A Geometric Viewpoint" , Olivier Faugeras, The MIT Press, November 19, 1993 (ISBN: 0262061589 , 695 pages
3- Electronic Materials and Web Sites *etc*.	

IX. Course Policies:

Unless otherwise stated, the normal course administration policies and rules of the Faculty of Computer and Information Technology apply. For the policy, see: ----------

The University Regulations on academic misconduct will be strictly enforced. Please refer to ----------

1	**Class Attendance:** A student should attend not less than 75 % of total hours of the subject; otherwise he will not be able to take the exam and will be considered as exam failure. If the student is absent due to illness, he/she should bring a proof statement from university Clinic
2	**Tardy:** For late in attending the class, the student will be initially notified. If he repeated lateness in attending class, he will be considered as absent.
3	**Exam Attendance/Punctuality:** A student should attend the exam on time. He is Permitted to attend an exam half one hour from exam beginning, after that he/she will not be permitted to take the exam and he/she will be considered as absent in exam.
4	**Assignments & Project** The assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time.
5	**Cheating:** For cheating in exam, a student will be considered as fail. In case the cheating is repeated three times during his/her study the student will be disengaged from the Faculty.

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6	**Plagiarism:** Plagiarism is the attending of a student the exam of a course instead of another student. If the examination committee proofed a plagiarism of a student, he will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Council Affair of the university.
7	**Other policies:** - Mobile phones are not allowed to use during a class lecture. It must be closed, otherwise the student will be asked to leave the lecture room - Mobile phones are not allowed in class during the examination. - Lecture notes and assignments my given directly to students using soft or hard copy

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Faculty of Computer & Information Technology

Department of Computer Science

Program of Computer Science

Course Syllabus of Image Processing and Computer Vision

Course No (.....)

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

II. Course Identification and General Information:						
1-	Course Title:	Image Processing and Computer Vision				
2-	Course Number & Code:	.....				
3-	Credit hours:	C.H				Total
		Th.	Seminar	Pr.	F. Tr.	
		2	-	2	-	3
4-	Study level/year at which this course is offered:	3rd year - 2nd semester				
5-	Pre –requisite (if any):	None				
6-	Co –requisite (if any):	None				
7-	Program (s) in which the course is offered	Computer Science				
8-	Language of teaching the course:	Arabic/English				
9-	System of Study:	Term based system				
10-	Mode of delivery:	Full Time				

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11-	**Location of teaching the course:**	Faculty of Computer and Information Technology

III. Course Description:

Image Processing and Computer Vision are important and fast evolving areas of computer system, and have been applied in many disciplines. This course will cover methods in image processing and computer vision, with an emphasis on the state-of-the-art techniques currently used in academia and industry. Topics will include image filtering, edge detection, corner detection, segmentation, object/image/face classification, object detection, morphological operators, object tracking, camera calibration, image registration, and activity classification.

Students are expected to have some familiarity with calculus, linear algebra, and basic probability and statistics. Basic skills in computer programming are expected. After you hav successfully followed the course on image processing and computer vision you will be able techniques to process and analyze images.

IV. Intended learning outcomes (ILOs) of the course:

- Brief summary of the knowledge or skill the course is intended to:

a1.	Understand the major concepts and techniques in image processing and computer vision.
a2.	Demonstrate image processing and computer vision knowledge by designing and implementing algorithms to solve practical problems.
b1.	Identify image processing problems and employ or propose effective solutions.
b2.	Analyze images in practical settings using simple methods.
c1.	Apply methods for processing of image data related to image filtering, image enhancement, segmentation, classification and representation.

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c2.	Develop solutions for solving computer vision issues that related to current academic and industrial problems.
d1.	Present research in image processing and computer vision.
d2.	Work effectively as individual and with a team.

V. Course Content:

- Distribution of Semester Weekly Plan of Course Topics/Items and Activities.

A – Theoretical Aspect:

Order	Topics List	Week Due	Contact Hours
1	**- Introduction** • Image, Graphics, Vision and Computer • Image processing basics, Digital image formats • Image processing and Vision system/applications	1st	2
2	**- Data Structures for Image Processing** • Matrices, chains, Topological data structures • Relational structures, Hierarchical data structures	2nd, 3rd	4
3	**- Preprocessing and Image Enhancement** • Histogram, histogram transformations • Modification of the histogram pattern • Filtering	4th,5th	4

4	**- Introduction to Mathematical Morphology** • Elements of Set Theory and Logic • Thinning, erosion, dilation, opening, closing	6th	2
5	**- Segmentation** • Detection of connected components • Thresholding , Edge detection • Region detection	7th	2
6	**- Mid Exam**	8th	2
7	**- Features Extraction and Representation** • Region Identification, Description and Representation of Contours • Description and Representation of Regions	9th	2
8	**- Linear Image Transformations** • Basic Theory, Hadammard Transform, Haar Transform • Fourier Transform, Discrete Cosine Transform, Wavelets	10th	2
9	**- Image Data Compression** • Presentation of different techniques and different norms of compression, Coding • Fractal Image Compression	11th	2
10	**- Elements of Pattern Recognition** • Different methods of pattern recognition, Classification • Machine Learning Techniques, Structural pattern recognition	12th	2
11	**- Texture Analysis** • Statistical texture description • Syntactic texture description methods, applications	13th	2
12	**- Motion Analysis** • Optical flow, Moving Object Detection and Tracking, Behavior Detection and Modeling	14th	2
13	**- Student Presentation**	15th	2
14	**- Final Exam**	16th	2

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Number of Weeks /and Units Per Semester		**32**

B – Practical Aspect: *(if any)*

Order	Topics List	Week Due	Contact Hours
1	**Understanding the tools**	1st	2
2	Segmentation	2nd	2
3	Features Extraction and Representation	4th	4
4	Linear Image Transformations	5th	2
5	Image Data Compression	7th	4
6	Mid-Term	8th	2
7	Elements of Pattern Recognition	10th	4
8	Texture Analysis	12th	4
9	Motion Analysis	14th	4
10	Final Exam	15th	2
Number of Weeks /and Units Per Semester			**30**

VI. Teaching strategies of the course:

Interactive Lecture

Tutorials

Discussion

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Assignments
Presentation
Project
Exams

VII. Assignments:

No	Assignments	Week Due	Mark
1	-Image Processing	2nd	5%
2	-Image Enhancement	4th	5%
3	-Feature Extraction	6th	5%
4	-Image Transformations	9th	5%
5	-Final team project	15th	20%

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

Assessment	Type of Assessment Tasks	Week Due	Mark	Proportion of Final Assessment
1	Homework and Programming Assignments	2nd ,4th, 6th, 9th	20	20%
2	Mid-Exam	8th	20	20%
3	Final Project	15th	20	20%
	Final-Exam	16th	40	40%

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2- Essential References.

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اللجنة الإشرافية

م.	الاســـم	الصـــــفة	التوقيع
١	أ.م.د. عبد الماجد الخليدي	نائب عميد الكلية للشؤون الأكاديمية	
٢	أ.م.د. احمد مجاهد	نائب عميد مركز التطوير الأكاديمي وضمان الجودة	
٣	د. حسين الأشول	ممثل المركز في الكلية	
٤	أ.د. إبراهيم المطاع	نائب رئيس الجامعة للشؤون الأكاديمية	

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