



Course Specification

(Postgraduate Programs)

Course Title: Image Processing and Computer Vision

Course Code: CE6021

Program: Master of Science in Computer Engineering

Department: Computer and Network Engineering

College: College of Computing

Institution: Umm Al-Qura University

Version: 2.0

Last Revision Date: 12/4/2025



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A. General information about the course:

1. Course Identification:

1. Credit hours: (3)			
2. Course type			
A.	<input type="checkbox"/> University	<input type="checkbox"/> College	<input checked="" type="checkbox"/> Department <input type="checkbox"/> Track
B.	<input type="checkbox"/> Required		<input checked="" type="checkbox"/> Elective
3. Level/year at which this course is offered: (Level 3 or 4)			
4. Course General Description:			
<p>This course covers advanced topics in image processing and computer vision, focusing on techniques for image enhancement, segmentation, feature extraction, and object recognition. Topics include light and perception, digital image formation, image enhancement and feature extraction, unitary transformations, color and texture, image segmentation, motion extraction and tracking, 3D data extraction, invariant features, specific object recognition and object class recognition, and machine learning methods for vision tasks.</p>			
5. Pre-requirements for this course (if any):			
Fundamentals of signals; an ability to use a programming language			
6. Co-requisites for this course (if any):			
None			
7. Course Main Objective(s):			
Develop advanced knowledge and skills to analyze, process, and interpret digital images and videos, applying techniques in filtering, feature extraction, object recognition, and computer vision for real-world applications.			

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100
2	E-learning		
3	Hybrid <ul style="list-style-type: none"> Traditional classroom 		



No	Mode of Instruction	Contact Hours	Percentage
	• E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	45
2.	Laboratory/Studio	
3.	Field	
4.	Tutorial	
5.	Others (specify).....	
Total		45

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

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Explain the basic concepts of digital image representation, image acquisition, and color spaces.	K2	Lectures	Written Exams
1.2	Critically assess recent advancements and challenges in image processing and computer vision and present your findings.	K1	Research papers	Project, Report and Presentation
2.0	Skills			
2.1	Implement and evaluate techniques for image enhancement, restoration, and filtering in spatial and frequency domains and extract and analyze image features such as edges, corners, and textures for object detection and recognition.	S1 and S4	Lectures, and project	Written Exams, and Project
2.2	Apply image transformation techniques for image compression and analysis, apply image segmentation techniques, including thresholding, region-based, and clustering methods, to partition images, and apply machine learning and deep learning methods to	S2	Lectures, and project	Written Exams, and Project



Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	solve classification, object detection, and segmentation problems.			
2.3	Analyze 3D vision tasks, including stereo vision, structure from motion, and depth estimation.	S4	Lectures, and project	Written Exams, and Project
2.4	Communicate effectively through a written report embodying the design, implementation, evaluation of a project in image processing and/or computer vision	S3	Project	Project, Report and Presentation
3.0	Values, autonomy, and responsibility			
3.1	Critically assess recent advancements and challenges in image processing and computer vision and present your findings.	V1	Research papers	Project, Report and Presentation
3.2	Work in a team to implement a project in image processing and computer vision	V2	Group assignments and project	Group assignments and project

C. Course Content:

No	List of Topics	Contact Hours
1.	Light and perception. Digital image formation	3
2.	Image enhancement and feature extraction. Unitary transformations.	7
3.	Color and texture. Image segmentation.	7
4.	Motion extraction and tracking. 3D data extraction.	8
5.	Invariant features. Specific object recognition and object class recognition.	6
6.	Machine learning in image processing and computer vision	8
7.	Emerging Trends in Image Processing and Computer Vision	6
Total		45



D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm Exam	7	20
2.	Assignments	Throughout the semester	20
3.	Project	13	30
4.	Presentation and report on scientific article(s)	13-14	10
5.	Final Exam	15	20

*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	Computer Vision: Algorithms and Applications by Richard Szeliski, 2nd Edition, 2022
Supportive References	Research papers in the field of image processing and computer vision Digital Image Processing by Rafael C. Gonzalez and Richard E. Woods, 4th Edition, 2017
Electronic Materials	
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
Facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms
Technology equipment (Projector, smart board, software)	Projector
Other equipment (Depending on the nature of the specialty)	



F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Program Leaders	Indirect
Effectiveness of students' assessment	Program Leaders	Direct
Quality of learning resources	Students, Faculty	Indirect
The extent to which CLOs have been achieved	Students, Faculty, Program Leaders	Direct and Indirect
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	Computer and Network Engineering Department Council
REFERENCE NO.	The 18 th Session Of The Academic Year 1446
DATE	15/4/2025

