



A) COURSE

Course Id:	Course			
5721	Image Processing and Computer Vision			
Class Hours per Week	Lab hours per week	Complementary practices	Credits	Total hour course
5	2	5	12	80

B) GENERAL COURSE INFORMATION:

	EE (IEA)	ME (IM)	MME (IMA)	EME (IME)	MTE (IMT)
Level:					X
Course Type (Required/Elective)					Elective
Prerequisite Course:					No course, but 360 credits
CACEI Classification:					IA

C) COURSE OBJECTIVE

At the end of the course, the student will be capable of:

To integrate mathematical knowledge and computing skills about processing images to deal with the manipulation of a digital image. In addition, students will be able to cope with problems about artificial vision.

D) TOPICS (CONTENTS AND METHODOLOGY)

1.- Introducción		5 hrs
Specific Objective:	Students will know the usefulness and the applications of processing images.	
	1.1 Elements of Visual Perception 1.2 Image Acquisition. 1.3 Characterization 1.4 Image Segmentation. 1.5 Image Types. 1.6 Applications	
Readings and other resources	It is recommended to read the topics of the suggested bibliography.	
Teaching Methodologies	The topics are presented with traditional and audiovisual exhibitions. The students will do exercises by applying the presented concepts.	
Learning Activities	Homework and investigations.	



2.- Digital Image Fundamentals		6 hrs.
Specific Objective:	Students will understand the principles lying on a digital image.	
2.1 Image Sampling and Quantization. 2.2 Relationships between pixels. 2.3 Image Geometry.		
Readings and other resources	It is recommended to read the topics of the suggested bibliography.	
Teaching Methodologies	The topics are presented with traditional and audiovisual exhibitions. The students will do exercises by applying the presented concepts.	
Learning Activities	Homework and investigations.	
3.- Digital Image representation and enhancement		18 hrs.
Specific Objective:	Students will know how to design and apply filters to an image for improvement.	
3.1 Processing by Pixel. 3.2 The Fourier Transform. 3.3 Image Enhancement in the Spatial Domain. 3.4 Image Enhancement in the Frequency Domain. 3.5 The Wavelet Transform. 3.6 Smoothing and Enhanced.		
Readings and other resources	It is recommended to read the topics of the suggested bibliography.	
Teaching Methodologies	The topics are presented with traditional and audiovisual exhibitions. The students will do exercises by applying the presented concepts.	
Learning Activities	Homework and investigations.	
4.- Image Segmentation		12 hrs.
Specific Objective:	Students will understand and apply the principles of segmentation and the extraction of issues of an image by developing programs	
4.1. Applications. 4.2 Edge Extracting. 4.3 Region Extracting.		
Readings and other resources	It is recommended to read the topics of the suggested bibliography.	
Teaching Methodologies	The topics are presented with traditional and audiovisual exhibitions. The students will do exercises by applying the presented concepts.	
Learning Activities	Homework and investigations.	
5.- Computer Vision Systems		28 hrs.
Specific Objective:	Students will know concepts and methods related to artificial vision and its application to robotics to control position, quality and inspection.	



5.1 Introduction.	
5.2 Sensors.	
5.3 Tracking and Motion.	
5.3.1 Tracking basis.	
5.3.2 Optical Flow.	
5.3.3 Motion Templates	
5.3.4 Estimators.	
5.4 Camera Models and Calibration.	
5.4.1 Orthographic Cameras	
5.4.2 Calibration.	
5.5 Extracting Information of an Image	
5.6 Projection and 3D Vision.	
5.6.1 Projections.	
5.6.2 Stereo Vision.	
5.6.3 Structure from Motion.	
5.6.4 Optical Character Recognition	
Readings and other resources	It is recommended to read the topics of the suggested bibliography.
Teaching Methodologies	The topics are presented with traditional and audiovisual exhibitions. The students will do exercises by applying the presented concepts.
Learning Activities	Homework and investigations.

6.- Color Image Processing		11 hrs.
Specific Objective:	Students will know color patterns used by main applications and the conversions among different models.	
6.1 Color Fundamentals.		
6.2 Color Models.		
6.3 Pseudo color Image Processing.		
6.4 Full-Color Image Processing.		
6.5 Color Transformation.		
Readings and other resources	It is recommended to read the topics of the suggested bibliography.	
Teaching Methodologies	The topics are presented with traditional and audiovisual exhibitions. The students will do exercises by applying the presented concepts.	
Learning Activities	Homework and investigations.	

E) TEACHING AND LEARNING METHODOLOGIES

- a) Exercises of application
- b) Exposition of teacher
- c) Projects

F) EVALUATION CRITERIA:

Evaluation:	Schedule	Suggested Form of Evaluation and weighing	Topics
1st Term	Session 16	Exam 60%, Homework 40%	Units 1 and 2
2nd Term	Session 32	Exam 60%, Homework 40%	Unit 3
3rd Term	Session 48	Exam 60%, Homework 40%	Units 4 and 5
4th Term	Session 64	Exam 60%, Homework 40%	Unit 5



5th Term	Session 80	Exam 60%, Homework 40%	Units 5 and 6
Project	Session 80	100 %	Units 1 to 6
Final evaluation		70% (Average of the partial evaluations) 30% project	
Other activity:		Corresponding laboratory	
Extraordinary Exam	According to schedule	100% Exam	100% of topics
Title Exam	According to schedule	100% Exam	100% of topics
Regularization Exam	According to schedule	100% Exam	100% of topics

G) BIBLIOGRAPHY AND ELECTRONIC RESOURCES

Main Books

Visión por Computadora, Gonzalo Pajares, Jesús M. de la Cruz. Alfaomega, 2002.

Digital Image Processing. Jahne B. Springer 4th Edition, 1997.

Tratamiento Digital de Imágenes, Gonzalez R.C., Woods R.E. Adison-Wealwey Publishing Co. 1996.

Digital Image Processing Using MATLAB, Gonzalez, Woods, and Eddins. Prentice Hall. 2004.

Learning OpenCV, Gary Bradski and Adrian Kaehler. O'Reilly. 2008.

Robot Modeling and Control, Spong, M.W., Hutchinson S., Vidyasagar, M. Wiley, 2005.

Robot Vision, Horn, B.K.P. Mc Graw Hill, 1986.

Robótica: control, detección, visión e inteligencia, Fu, K.S., Gonzalez, R.C., Lee C.S.C. Mc Graw Hill, México, 1988.

Manual de prácticas de visión artificial. Software: Sherlock.

Complementary Books

Internet Links