



INSTITUTO POLITÉCNICO NACIONAL

SECRETARÍA ACADÉMICA

DIRECCIÓN DE EDUCACIÓN SUPERIOR

SYNTHESIZED SCHOOL PROGRAM



ACADEMIC UNIT: Escuela Superior de Cómputo

ACADEMIC PROGRAM: Ingeniería en Sistemas Computacionales.

LEARNING UNIT: Digital processing of Voice and Image **LEVEL:** III

AIM OF THE LEARNING UNIT:

The student optimizes the sonorous information and digital images through the algorithms of digital processing of voice and image.

CONTENTS:

- I. Signal Processing.
- II. Acoustic Phonetics and Treatment of Voice.
- III. Foundations of Image Processing.
- IV. Image Extraction and Segmentation.

TEACHING PRINCIPLES:

The teacher will apply a Projects-Based learning process, through inductive and heuristic methods using analysis techniques, technical data, charts, cooperative presentation, exercise-solving and the production of the learning evidences. Moreover, an autonomous learning will be encouraged by the development of a final project.

EVALUATION AND PASSING REQUIREMENTS:

The program will evaluate the students in a continuous formative and summative way, which will lead into the completion of project portfolio. Some other assessing methods will be used, such as revisions, practical's, class participation, exercises, learning evidences and a final project.

Other means to pass this Unit of Learning:

- Evaluation of acknowledges previously acquired, with base in the issues defined by the academy.
- Official recognition by either another IPN Academic Unit of the IPN or by a national or international external academic institution besides IPN.

REFERENCES:

- De la Escalera, A. (2001). *"Visión por Computador. Fundamentos y Métodos"*, Spain: Ed. Prentice-Hall. ISBN: 842-05-3098-0
- Faúdez Zanuy, M. (2001). *"Tratamiento Digital de Voz e Imágenes y Aplicación a la Multimedia"*, Spain: Ed. Alfaomega Marcombo. ISBN-13: 97-8842-671-244-8
- González, R. (2008). *"Digital Image Processing"*, Unites States: 3rd ed., Ed. Prentice Hall. ISBN: 97-8013-168-728-8
- Jiménez, J. (2008). *"Matemáticas para la Computación"*, Spain: Ed. Alfaomega. ISBN: 978-970-15-1401-6
- Proakis, J. and Manolakis, D. (2007). *"Tratamiento Digital de Señales"*, Spain: 4th ed., Ed. Prentice-Hall. ISBN: 97-8848-322-347-5



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ACADEMIC UNIT: Escuela Superior de Cómputo.
ACADEMIC PROGRAM: Ingeniería en Sistemas Computacionales
LATERAL OUTPUT: Analista Programador de Sistemas de Información.
FORMATION AREA: Professional.
MODALITY: Presence.

LEARNING UNIT: Digital processing of Voice and Image.
TYPE OF LEARNING UNIT: Theoretical - Practical, Optative.
VALIDITY: August, 2011.
LEVEL: III.
CREDITS: 7.5 Tepic, 4.39 SATCA

ACADEMIC AIM

Furthermore, this program to provide the knowledge on the optimization of the digital processing of voice and image, being caused the independent learning by means of the use of tools and methods; developing abilities to use different algorithms in the analysis, design, improvement and implementation of voice systems and image of efficient form, for the solution of computer problems related to this area. It contributes to the debit profile reinforcing it integration of the knowledge of other Units of Learning to plan, to negotiate and to foment the analysis skills; designing and coordinating projects in the context of systems and digital processing of voice and image. It dominates the practical and methodological principles, aspects for the construction of systems. Decision making, solution of problems, assertive communication, and creative, strategic thought.

This unit has the units Algorithm and Structured Programming, Object-Oriented Programming and Compilers as antecedents. The consequent units are Terminal Work I and II.

AIM OF THE LEARNING UNIT:

The student optimizes the sonorous information and digital images through the algorithms of digital processing of voice and image.

CREDITS HOURS

THEORETICAL CREDITS / WEEK: 3.0
PRACTICAL CREDITS / WEEK: 1.5
THEORETICAL HOURS / SEMESTER: 54
PRACTICAL HOURS / SEMESTER: 27
AUTONOMOUS LEARNING HOURS: 54
CREDITS HOURS / SEMESTER: 81

LEARNING UNIT DESIGNED BY:
Academia de Sistemas Distribuidos.

REVISED BY:
Dr. Flavio Arturo Sánchez Garfias.
Subdirección Académica

APPROVED BY:
Ing. Apolinar Francisco Cruz Lázaro.
Presidente del CTCE

AUTHORIZED BY: Comisión de Programas Académicos del Consejo General Consultivo del IPN

Ing. Rodrigo de Jesús Serrano Domínguez
Secretario Técnico de la Comisión de Programas Académicos



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LEARNING UNIT: Digital processing of Voice and Image

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THEMATIC UNIT: I **TITLE:** Signal Processing

UNIT OF COMPETENCE

The student categorizes the basic terms of the signal processing treatment by the techniques and mathematical tools.

No.	CONTENTS	Teacher led-instruction HOURS		Autonomous Learning HOURS		REFERENCES KEY
		T	P	T	P	
1.1	Signals, systems and signal processing.	1.0	0.5		2.0	3B, 10B, 7B, 6C
1.1.1	Basic elements.					
1.2	Signals Classification.			1.0		
1.3	Digital conversions analogical/digital and digital/analogical.		0.5	1.0	1.0	
1.4	Spatial processing.	1.0		1.0		
1.5	Arithmetical logics and geometrical operations.		1.0	1.0	1.0	
Subtotals:		2.0	2.0	4.0	4.0	

TEACHING PRINCIPLES

This Thematic Unit must begin with a framing of the course and the formation of teams. Will be Projects-Based learning strategy, through inductive method, with the techniques of elaboration of charts, technical data and exercise-solving, exhibition in team, practical and production of learning evidence and the accomplishment of a project proposal.

LEARNING EVALUATION

Diagnostic Test

Project Portfolio:

Proposal of project	5%
Charts	5%
Technical data	5%
Exercise-solving	10%
Cooperative Presentation	15%
Report of Practicals	20%
Self-Evaluation Rubrics	5%
Cooperative Evaluation Rubrics	5%
Written Learning Evidence	30%

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THEMATIC UNIT: II		TITLE: Acoustic Phonetics and Treatment of Voice				
UNIT OF COMPETENCE						
The student Processes signals through computing means of sound, by mathematical calculations and acoustic patterns.						
No.	CONTENTS	Teacher led-instruction HOURS		Autonomous Learning HOURS		REFERENCES KEY
		T	P	T	P	
2.1	Introduction.	0.5	3.0	1.0	3.5	1C, 3B, 6C, 10B
2.2	Bidimensional classifications.	0.5		1.0		
2.3	Spectral estimation by linear prediction.	1.0		1.0		
2.4	Captures of the Sound.	0.5		1.0		
2.5	Sound Formats (MP3, WAV).	0.5		1.0		
2.6	Calculations on Voice Archives.	1.0		2.0		
2.6.1	Modification of the modulation, addition of sounds, echo, fading, change of the number of bits and change of the number of channels.					
2.7	Calculations in the Dominion of the Time.	1.0		2.0	2.0	
2.7.1	Magnitude, average, energy, crossings by zero and maximum ones.					
2.8	Calculations in the Dominion of the Frequency.	1.0		2.0	2.0	
2.8.1	Fast Fourier Transform and Cosine Transform.					
	Subtotals:	6.0	3.0	11.0	7.5	
TEACHING PRINCIPLES						
Will be projects-Based learning strategy, trough heuristic method, with the techniques of charts, exercise-solving, cooperative presentation, advance of the project, practical and the production of the learning evidences.						
LEARNING EVALUATION						
Proyct Portfolio:						
Charts		5%				
Exercise-solving		20%				
Cooperative Presentation		10%				
Report of Practicals		20%				
Advance of the Project		5%				
Self-Evaluation Rubrics		5%				
Rubric of Co-Evaluation		5%				
Written Learning Evidence		30%				



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THEMATIC UNIT: III **TITLE:** Foundations of Image Processing

UNIT OF COMPETENCE

The student implements a system of enhancement of edges, with base in the methods of treatment of images.

No.	CONTENTS	Teacher led- instruction HOURS		Autonomous Learning HOURS		REFERENCES KEY
		T	P	T	P	
3.1	Processing of Digital Images and Formats (BMP, GIF, JPG...).	2.0	1.5	2.0		2B, 4B, 5B, 8C, 9C
3.2	Manipulation of Contrast.	2.0		2.0	1.5	
3.2.1	Amplitude of the scale, modification of the resistance, equalization histogram and list of consultation tables.					
3.3	Filters.					
3.3.1	Spatial linear filters filters nonlinear and filters in the dominion of the frequency.	2.0		3.0	1.5	
3.4	Applications of Filters.	2.0		4.0	1.5	
3.4.1	Enhancement of Edges.					
3.4.2	Linear filters in the dominion of the space.					
Subtotals:		8.0	1.5	11.0	4.5	

TEACHING PRINCIPLES

Will be projects-Based learning strategy, trough inductive and heuristic methods, with the techniques of elaboration of exercise-solving, cooperative presentation, practical and learning evidence, the production of the learning evidences and advance of the project.

LEARNING EVALUATION

Project Portfolio:

Exercise-solving	10%
Cooperative Presentation	15%
Report of Practicals	20%
Self-Evaluation Rubrics	5%
Cooperative Evaluation Rubrics	5%
Advance of the Project	25%
Written Learning Evidence	20%

LEARNING UNIT:

Digital processing of Voice and Image

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THEMATIC UNIT: IV		TITLE: Image Extraction and Segmentation				
UNIT OF COMPETENCE						
The student optimizes the image processing systems through mathematical calculations and object detection.						
No.	CONTENTS	Teacher led- instruction HOURS		Autonomous Learning HOURS		REFERENCES KEY
		T	P	T	P	
4.1	Detection of Edges.	1.0		2.0	3.0	2B, 4B, 5C, 8C, 9C
4.1.1	Techniques based on gradient.					
4.1.2	Operators of second order (Laplacian).					
4.1.3	Gaussian derived based Methods.					
4.1.4	Detection of lines and corners.					
4.2	Textures.	0.5		2.0		
4.2.1	Statistic analyses of textures.					
4.2.2	Frequency analysis in textures.					
4.3	Detection of Motion.	1.0	1.5	3.0		
4.4	Segmentation of images.	0.5		2.0		
4.4.1	Segmentation by detection of edges.					
4.4.2	Segmentation by detection of regions.					
	Subtotals:	3.0	1.5	9.0	3.0	
TEACHING PRINCIPLES						
Will be projects-Based learning strategy, trough inductive and heuristic methods, with the techniques of cooperative presentation, practical, the production of the learning evidences and the presentation of the final project.						
LEARNING EVALUATION						
Project Portfolio: Cooperative Presentation 10% Report of Practical 10% Self-Evaluation Rubrics 5% Cooperative Evaluation Rubrics 5% Final Project 50% Written Learning Evidence 10%						



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RECORD OF PRACTICALS

No.	NAME OF THE PRACTICAL	THEMATIC UNITS	DURATION	ACCOMPLISHMENT LOCATION
1.	Signal processing.	I	2.0	Computer Labs.
2.	Space processing.	I	2.0	
3.	Conversions Analogical/Digital.	I	2.0	
4.	Classification of Sounds in Spanish.	II	3.0	
5.	Handling of sounds by means of a calculation system.	II	3.5	
6.	Spectrum of Sound.	II	4.0	
7.	Presentation of images.	III	3.0	
8.	Manipulation of the image.	III	3.0	
9.	Detection of Edges.	IV	1.5	
10.	Detection of Movement.	IV	3.0	
		TOTAL OF HOURS	27.0	

EVALUATION AND PASSING REQUIREMENTS:

The practicals are considered mandatory to pass this learning unit.
The practicals worth 20% in each thematic unit.



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PERIOD	UNIT	EVALUATION TERMS
1	I y II	Continuous evaluation 70% and written learning evidence 30%
2	III	Continuous evaluation 80% and written learning evidence 20%
3	IV	Continuous evaluation 90% and written learning evidence 10%
		<p>The learning unit I and II is 30% worth of the final score The learning unit III is 30% worth of the final score The learning unit IV is 40% worth of the final score</p> <p>Other means to pass this Unit of Learning:</p> <ul style="list-style-type: none">• Evaluation of acknowledges previously acquired, with base in the issues defined by the academy.• Official recognition by either another IPN Academic Unit of the IPN or by a national or international external academic institution besides IPN. <p>If accredited by Special Assessment or a certificate of proficiency, this will be based on guidelines established by the academy on a previous meeting for this purpose.</p>



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KEY	B	C	REFERENCES
1		X	Bernal Bermúdez, J. and Bobadilla Sancho, J. (2000). " <i>Reconocimiento de Voz y Fonética Acústica</i> ". Mexico: Ed. Alfaomega Ra-Ma. ISBN: 970-15-0541-7
2	X		De la Escalera, A. (2001). " <i>Visión por Computador. Fundamentos y Métodos</i> ", Spain: Ed. Prentice-Hall. ISBN: 842-05-3098-0
3	X		Faúdez Zanuy, M. (2001). " <i>Tratamiento Digital de Voz e Imágenes y Aplicación a la Multimedia</i> ", Spain: Ed. Alfaomega Marcombo. ISBN-13: 97-8842-671-244-8
4	X		González, R. (2008). " <i>Digital Image Processing</i> ", United States: 3rd ed., Ed. Prentice Hall. ISBN: 97-8013-168-728-8
5		X	González, R. and Woods R. (2009). " <i>Digital Image Processing Using MATLAB</i> ", United States: 2nd ed., Ed. Gatesmark. ISBN: 97-8098-208-540-0
6		X	Iglesias, P. (2002). " <i>Postproducción Digital de Sonido por Computadora</i> ", Spain: Ed. Alfaomega-Ra-Ma. ISBN: 970-15-0826-2
7	X		Jiménez, J. (2008). " <i>Matemáticas para la Computación</i> ", Spain: Ed. Alfaomega. ISBN: 978-970-15-1401-6
8		X	Pajares, G. and De la Cruz, J. (2008). " <i>Visión por Computador - Imágenes Digitales y Aplicaciones</i> ", Spain: 2nd ed., Ed. Alfaomega. Ra-Ma, ISBN: 978-970-15-1356-9
9		X	Pajares, M. and Sanz, G. (2007). " <i>Ejercicios Resueltos de Visión por Computador</i> ", Spain: Ed. Alfaomega-Ra-Ma. ISBN: 978-847-89-7828-1
10	X		Proakis, J. and Manolakis, D. (2007). " <i>Tratamiento Digital de Señales</i> ", Spain: 4th ed., Ed. Prentice-Hall. ISBN: 97-8848-322-347-5



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TEACHER EDUCATIONAL PROFILE PER LEARNING UNIT

1. GENERAL INFORMATION

ACADEMIC UNIT: Escuela Superior de Cómputo.

ACADEMIC PROGRAM: Ingeniería en Sistemas Computacionales.

LEVEL III

FORMATION AREA:

Institutional	Basic Scientific	Professional	Terminal and Integration
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ACADEMY: Sistemas Distribuidos.

LEARNING UNIT: Digital processing of Voice and Image.

SPECIALTY AND ACADEMIC REQUIRED LEVEL: Masters Degree or Doctor in Computer Science.

2. AIM OF THE LEARNING UNIT: The student optimizes the sonorous information and digital images through the algorithms of digital processing of voice and image.

3. PROFESSOR EDUCATIONAL PROFILE:

KNOWLEDGE	PROFESSIONAL EXPERIENCE	ABILITIES	APTITUDES
<ul style="list-style-type: none">• Programming visual languages.• Handling of the Operating Systems.• Mathematics for analysis of signals.• Algorithmic complexity.• Knowledge of the Institutional Educational Model.• English.	<ul style="list-style-type: none">• A year in voice and image programming• Actual in educational as facilitator of the knowledge of six months.• Six months in the handling of equipment of calculation.• A year experience in the Institutional Educational Model.	<ul style="list-style-type: none">• Analysis and synthesis.• Problems resolution.• Cooperative.• Leadership.• Applications of Institutional Educational Model.• Decision making.	<ul style="list-style-type: none">• Responsible.• Tolerant.• Honest.• Respectful.• Collaborative.• Participative.• Interested to learning.• Assertive.

DESIGNED BY

REVISED BY

AUTHORIZED BY

M. en C. David Araujo Díaz
COORDINATING PROFESOR

Dr. Flavio Arturo Sánchez Garfías
Subdirector Académico

Ing. Apolinar Francisco Cruz Lázaro
Director

M. en C. Laura Méndez Segundo.
M. en C. Juan Jesús Gutiérrez García.
M. en C. Jesús Alfredo Martínez Nuño.
COLLABORATING PROFESSORS

Date: 2011