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: Computer Graphics **LEVEL:** III

AIM OF THE LEARNING UNIT:
The student implements software solutions to problems in the visualization and graphcis treatment based on Computer Graphics techniques.

CONTENTS:

I. Computer graphing theory fundamentals and basic algorithms.
II. Polygon meshes and lighting models.
III. Parametric modeling and graphics cards programming.

TEACHING PRINCIPLES:
The learning unit will be addressed from the project-oriented learning strategy, the teacher apply the heuristic method, with which it carried out learning activities that will guide the development of skills of abstraction, analysis and design of efficient algorithms, using theoretical and practical tools, such is the case for the implementation of computer programs that demonstrate the concepts of the unit. The activities done in class to encourage students some techniques, such as collaborative, participatory, brainstorming, graphic organizers, inquiry documents, worksheets, supplementary statement of issues, discussion and directed the execution of a project software. It is the responsibility of the teacher decide the features of the project and the programs implemented by fixing the time of preparation and delivery.

EVALUATION AND PASSING REQUIREMENTS:

This learning unit will be assessed from the portfolio of evidence, which is made up of: formative assessment, summative and self-assessment and peer assessment rubrics.

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:

- Blinn, J. (1996). *Jim Blinn's Corner: A Trip Down the Graphics Pipeline*. (1a Ed.). San Francisco, Cal.: Morgan Kaufman Publishers. ISBN: 978-1558603875.
- Foley, J.D. (2000). *Computer Graphics: Principles and Practice in C*. (2a Ed.). USA: Addison-Wesley. ISBN: 978-0201848403.
- Hearn, D. Baker, P. (2006). *Gráficos por Computadora con Opengl*. (3a Ed.). Madrid, España: Pearson Educación. ISBN: 978-8420539805.
- Randima, F. Kilgard, M.J. (2003). *The Cg Tutorial: The Definitive Guide to Programmable Real-Time Graphics*. (2a Ed.). Boston, Mass.: Addison-Wesley Professional. ISBN: 978-0321194961.
- Rogers, D.F. Adams, J.A. (1990). Mathematical Elements for Computer Graphics. (2a Ed.). EUA: McGraw-Hill. ISBN-13: 978-0070535305.

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SECRETARÍA ACADÉMICA

DIRECCIÓN DE EDUCACIÓN SUPERIOR

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: Computer Graphics
TYPE OF LEARNING UNIT: Theorical - Practical, Optative.
VALIDITY: August, 2011.
LEVEL: lll.
CREDITS: 7.5 Tepic, 4.39 SATCA

ACADEMIC AIM

This learning unit contributes to the profile of graduates in Computer Systems Engineering, to develop the skills of effective problem solving in complex dynamic systems modeling of practical problems. It also develops strategic thinking, creative thinking, collaborative and participatory and assertive communication.
Requires learning units Computer Animation with the knowledge modeling graphical objects and computational geometry using theoretical tools to characterize the graphical objects.

AIM OF THE LEARNING UNIT:
The student implements software solutions to problems in the visualization and graphcis treatment based on Computer Graphics techniques.

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 Ciencias de la Computación

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

THEMATIC UNIT: I **TITLE:** Computer graphing theory fundamentals and basic algorithms

UNIT OF COMPETENCE

The student applies the basic algorithms for generating graphics primitives based on their performance.

No.	CONTENTS	Teacher led-instruction HOURS		Autonomous Learning HOURS		REFERENCES KEY
		T	P	T	P	
1.1	History.	1.0		2.0		1B,2B,3C
1.1.1	Computer Aided Design.					
1.2	Applications.	1.0		2.0		
1.2.1	Computer art.					
1.2.2	Entertainment.					
1.2.3	Education and training.					
1.2.4	Display					
1.2.5	Image processing.					
1.2.6	Graphical user interfaces.					
1.3	Algorithm to generate lines.	1.0	1.0	2.0	2.0	
1.3.1	DDA algorithm.					
1.3.2	Bresenham line algorithm.					
1.3.3	Lines parallel algorithms.					
1.4	Basic transformations.	1.0	1.0	2.0	2.0	
1.4.1	Representing points in homogeneous coordinates.					
1.4.2	Matrix representation of transformations.					
1.5	Projections.	1.0	1.0	2.0	2.0	
1.5.1	Orthogonal projection.					
1.5.2	Perspective.					
1.6	Animation	1.0		2.0		
	Subtotals:	6.0	3.0	12.0	6.0	

TEACHING PRINCIPLES

This Thematic Unit must begin with a framing of the course and the formation of teams. Will be Projects-Based learning strategy, trough 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:

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

THEMATIC UNIT: II **TITLE:** Polygonal meshes and lighting models.

UNIT OF COMPETENCE

The student applies the representation of polygons for plotting models to the concealment algorithm based on lighting schemes.

No.	CONTENTS	Teacher led-instruction HOURS		Autonomous Learning HOURS		REFERENCES KEY
		T	P	T	P	
2.1 2.1.1 2.1.2	Polygonal meshes. Definition. Representation lists.	1.0		2.0		1B,3C
2.2 2.2.1 2.2.2	Concealment of faces. Calculation of normal Z Buffer	1.0	1.0	2.0	2.0	
2.3	Light sources.	1.0		2.0		
2.4 2.4.1 2.4.2	Basic models of enlightenment. Ambient light. Diffuse reflection.	1.0	1.0	2.0	2.0	
2.5 2.5.1 2.5.2 2.5.3	Lighting models Constant model. Phong model. Gouraud model.	2.0	1.0	4.0	2.0	
	Subtotals:	6.0	3.0	12.0	6.0	

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

Project Portfolio:

Technical data	5%
Charts	5%
Computer programs w/report	10%
Cooperative Presentation	10%
Project Proposal	30%
Report of Practicals	10%
Self-Evaluation Rubrics	5%
Cooperative Evaluation Rubrics	5%
Written Learning Evidence	20%

THEMATIC UNIT: III **TITLE:** Parametric modeling and graphics cards programming.

UNIT OF COMPETENCE

The student designs parametric models of curves and surfaces based on the use of programming techniques in graphics cards.

No.	CONTENTS	Teacher led-instruction HOURS		Autonomous Learning HOURS		REFERENCES KEY
		T	P	T	P	
3.1 3.1.1 3.1.2 3.1.3	Parametric Curves Hermite curves. Bezier curves. B-spline curves.	2.0	1.0	4.0	2.0	2B, 4C 1B, 3C
3.2 3.2.1 3.2.2 3.2.3	Parametric Surfaces Hermite surfaces. Bezier surfaces. B-spline surfaces.	2.0	1.0	4.0	2.0	
3.3 3.3.1 3.3.2	Introduction to programming of graphics cards. Vertex programs. Fragment programs.	2.0	1.0	4.0	2.0	
	Subtotals:	6.0	3.0	12.0	6.0	

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:

Technical data	5%
Charts	5%
Computer programs w/report	10%
Cooperative Presentation	10%
Project Report	50%
Report of Practicals	10%
Self-Evaluation Rubrics	5%
Cooperative Evaluation Rubrics	5%

RECORD OF PRACTICALS

No.	NAME OF THE PRACTICAL	THEMATIC UNITS	DURATION	ACCOMPLISHMENT LOCATION
1	An algorithm for drawing lines.	I	3.0	Computer Labs.
2	An algorithm for transforming and projecting vertices.	I	3.0	
3	An algorithm for animation.	I	3.0	
4	Programming with dynamic lists the algorithm to implement a polygon mesh.	II	1.5	
5	A face-hiding algorithm.	II	1.5	
6	Programming the model of constant illumination.	II	3.0	
7	Set the Phong lighting model.	II	1.5	
8	Gouraud lighting model.	II	1.5	
9	An algorithm that plot parametric curves.	III	3.0	
10	A parametric surface plot algorithm.	III	3.0	
11	A graphing algorithm for a graphics card.	III	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 thematic unit I.
The practicals worth 10% in thematic unit II.
The practicals worth 10% in thematic unit III.

PERIOD	UNIT	EVALUATION TERMS
1 2 3	I II III	Continuous evaluation 70% and written learning evidence 30% Continuous evaluation 80% and written learning evidence 20% Continuous evaluation 100% The learning unit I is 30% worth of the final score The learning unit II is 30% worth of the final score The learning unit III is 40% worth of the final score Other means to pass this Learning Unit: • 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.

KEY	B	C	REFERENCES
1	X		Blinn, J. (1996). *Jim Blinn's Corner: A Trip Down the Graphics Pipeline*. (1a Ed.). San Francisco, Cal.: Morgan Kaufman Publishers. ISBN: 978-1558603875.
2	X		Foley, J.D. (2000). *Computer Graphics: Principles and Practice in C*. (2a Ed.). USA: Addison-Wesley. ISBN: 978-0201848403.
3		X	Hearn, D. Baker, P. (2006). *Gráficos por Computadora con Opengl*. (3a Ed.). Madrid, España: Pearson Educación. ISBN: 978-8420539805.
4		X	Randima, F. Kilgard, M.J. (2003). *The Cg Tutorial: The Definitive Guide to Programmable Real-Time Graphics*. (2a Ed.). Boston, Mass.: Addison-Wesley Professional. ISBN: 978-0321194961.
5	X		Rogers, D.F. Adams, J.A. (1990). Mathematical Elements for Computer Graphics. (2a Ed.). EUA: McGraw-Hill. ISBN-13: 978-0070535305.

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DIRECCIÓN DE EDUCACIÓN SUPERIOR

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

ACADEMY: Ciencias de la Computación **LEARNING UNIT:** Computer Graphics

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

2. **AIM OF THE LEARNING UNIT**:
The student implements software solutions to problems in the visualization and graphcis treatment based on Computer Graphics techniques.

3. PROFFESSOR EDUCATIONAL PROFILE:

KNOWLEDGE	PROFESSIONAL EXPERIENCE	ABILITIES	APTITUDES
• Methods of analysis of algorithms. • Algorithm design techniques. • Computer Graphics • Programming languages. • MEI. • English Language	• One year experience in the analysis of algorithms. • One year experience in the use of algorithm design techniques. • Two years experience in handling groups and collaborative work. • One year experience as a Professor of Higher Education.	• Analysis and synthesis. • Problems resolution. • Cooperative. • Leadership. • Applications of Institutional Educational Model. • Decision making.	• Responsible. • Tolerant. • Honest. • Respectful. • Collaborative. • Participative. • Assertive.

DESIGNED BY	REVISED BY	AUTHORIZED BY
Rosaura Palma Orozco COORDINATING PROFESOR	Dr. Flavio Arturo Sánchez Garfias Subdirector Académico	Ing. Apolinar Francisco Cruz Lázaro Director

Date: 2011