SUBJECT TEACHING GUIDE

G685 - Computer Graphics and Virtual Reality

Degree in Computer Systems Engineering

Academic year 2019-2020

1. IDENTIFYING DATA					
Degree	Degree in Computer Systems Engineering			Type and Year	Optional. Year 4
Faculty	Faculty of Sciences				
Discipline	Subject Area: Computing Mention in Computing				
Course unit title and code	G685 - Computer Graphics and Virtual Reality				
Number of ECTS credits allocated	6	Term		Semester based (1)	
Web					
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. MATEMATICA APLICADA Y CIENCIAS DE LA COMPUTACION
Name of lecturer	ANDRES IGLESIAS PRIETO
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Other lecturers	

3.1 LEARNING OUTCOMES
- Acquisition of knowledge and skills necessary for the student to deepen computer graphics autonomously.
- Understanding the basics of the main methods of computer graphics, and possible ways of implementation and their effects on the virtual scenes.
- Knowledge about how do the main graphics packages actually work, their advantages and limitations, as well as their possible applications in the professional arena.
- Knowledge of what is the purpose of computer graphics and what are the pillars on which this discipline is settled.
- Knowledge of different techniques to achieve realism in three-dimensional images.
- Knowledge about virtual and augmented reality, their uses and applications, as well as the main technologies used in these fields.

4. OBJECTIVES
Learning and understanding the basic concepts and techniques in computer graphics.
Knowing the major graphical formats and industry standards of computer graphics, their scope and main advantages and disadvantages.
Understanding the basics of computer graphics, the graphics pipeline and use of the software and hardware applied to this field.
Knowing the history of computer graphics since its inception, as well as the historical evolution of the different methods in this field depending on the software and hardware available at any time.
Knowing and understanding the most common methods of rendering, lighting, texturing and advanced effects of computer graphics, its foundations, operational scheme and applications.
Understand the use of the Graphical User Interfaces present today in many programs and operating systems from the viewpoint of computer graphics.
Gain enough knowledge to design algorithms for the most common geometric entities in computer graphics and make their implementation in a programming language.
Knowing the world of multimedia environments, virtual reality and augmented reality and their most important uses and applications.

6. COURSE ORGANIZATION	
CONTENTS	
1	Part I. Introduction to Computer Graphics. Basic bibliography. Applications of computer graphics. Relevant examples and scope. History of Computer Graphics. Information sources: magazines, books, CDs, websites. Hardware and Software for Computer Graphics. Free and commercial software. Structure of the course. Basic Algorithms for Computer Graphics. Computer Lab Module 1: Line Algorithms. (I) Slope Intercept (basic and advanced); (II) DDA; (III) Bresenham's Algorithm.
2	Part II. Basic algorithms for 2D graphics. 2D transformations. Transformation matrices. Computer Lab Module 2: 2D Transformations. (IV) 2D basic transformations; (V) application to 2D computer animation. Fractals. IFS. Computer Lab Module 3: Fractals. (VI) recursive fractals; (VII) Julia and Mandelbrot fractal sets; (VIII) IFS; (IX) application of the iterated function systems. L-systems. Simulation of natural phenomena. Computer Lab 4: L-systems. (X) L-systems generation; (XI) applications of L-systems.
3	Part III. 3D transformations. Projections and perspectives. Algorithms for hidden lines and surfaces. Painter's algorithm, Z-buffer. Graphic design. Display systems. Basic and advanced algorithms. Rendering. Lighting models. Basics of rendering. Polygon models: wire-frame, faces and vertices, etc. Basic models of lighting: ambient, diffuse, specular. Distance effects. Basic algorithms. Ray tracing. Radiosity. Basic techniques of texturing. Computer Lab 5: 3D graphics. (XII) 3D operations.
4	Part IV: Virtual and Augmented Reality. Concepts, techniques and devices. Hardware and software for virtual reality. Virtual reality homework assignment.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Project-based evaluation	Work	Yes	Yes	25,00
Classroom activities.	Others	No	Yes	10,00
Computer lab training.	Laboratory evaluation	No	Yes	65,00
TOTAL				100,00

Observations

Attendance to computer lab training is mandatory, except on justified grounds. In such a case, computer lab training can be replaced by assignments providing a similar set of skills and abilities.

The evaluation will comply with the regulations of the University of Cantabria on copyright and plagiarism situations. All material used that is not of own elaboration must be properly identified and cited, with clear mention of the original source of the material.

Observations for part-time students

Part-time students unable to attend the classroom activities can ask for alternative assignments for assessment of such activities.

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

David F. Rogers, J. Alan Adams: "Mathematical Elements for Computer Graphics". MacGrawHill (1995).

A. Rockwood, P. Chambers: "Interactive Curves and Surfaces. A Multimedia Tutorial on CAGD". Morgan Kaufmann, San Francisco (1996).

R.S. Ferguson: "Practical Algorithms for 3D Computer Graphics". AK Peters, Massachussetts (2001).

James D. Foley, Andries van Dam, Steven K. Feiner, John F. Hughes: "Computer Graphics: Principles and Practice" (2nd ed). Addison-Wesley, Reading, Mass (1992).

David F. Rogers: "Procedural Elements for Computer Graphics". MacGrawHill (1998).